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VOL. XXXIX, No. 1. FRIDAY, JULY 7, 1905.

Good reputations are often ruined in a night, as they are often won in a day, but good character is stable. Those who have known Mr. John F. Wallace well—and there are thousands who have a more or less intimate acquaintance with his high qualities—cannot reconcile this knowledge with the intemperate scoring in which Mr. Secretary Taft has indulged. Surely all his admirers will agree with the remark of one who knows him best, made immediately after reading the Secretary's statement: "William Taft has not described John Wallace." The situation is pitiful. Here is a man of great accomplishment who has spent a long life in doing good work with distinguished ability, beyond criticism both as to motive and results. He is honored with an appointment that was rightly regarded as one of the highest rewards of a great engineer. After a brief service he comes to his superior officer to give his reasons for resigning and finds that officer in a rage, not at all interested in the reasons for the resignation, but indignant at the fact, and with a prepared libelous address to him which is at once given to the press. It is easy for a Cabinet officer, one of unusual power and repute, to break the heart of a subordinate, but, lacking a previous careful investigation of the facts and deliberate judgment, it was an unwise and brutal use of power. Mr. Wallace is a cruelly wounded man, and his loyal friends will need to know that he has done wrong before they believe it. Nevertheless, it seems clear that he made a mistake in the specific manner in which he managed his resignation. It was too abrupt, and the order in which the facts came to the public indicated a primary consideration for his own interest rather than patriotism. The chief engineer of the Panama Canal Commission is not a general at the front, and he has a right, which should be unquestioned, to sever his connection with the enterprise of which he is the operating head. But it is undoubtedly true that his work has a governmental—a national—character, which carries certain implied obligations not specified by contract, and not present in ordinary corporate positions. Not only the President and his cabinet, but the whole American people, feel keenly the responsibility of the task at Panama, and the importance to the national reputation of succeeding where another nation has failed. Mr. Wallace doubtless saw that the principal part of the work could be carried on without him; he doubtless failed to appreciate the moral effect of a precipitate resignation; of placing private duty above public duty, on everyone of his associates and fellow workers. It is easy to say that the necessary resignation of a chief engineer should not be made in a way that would damage the *esprit de corps*, yet at least in the early stages of the work Mr. Wallace had no more important task than to maintain the *morale* of his forces.

A suggestion about creosoted ties: They have, in the past, cost too much, and attention has been given to the possibility of using the cheaper woods found in the United States. We do not need to limit ourselves to the United States in the search for available material. Those learned in forestry tell us that before the middle of the present century our forests will be denuded by the present increasing rate of use. Canada has unmeasured forests of coniferous trees, whose logs will float and come to market cheaply. Most of these forests are doing no good in the world except to protect the soil. Their trees have arrived at the limit of natural production, for death and decay keep even pace with the natural growth. Virgin forest is benefited, not injured, by cutting out the big trees. Broadly, therefore, for the benefit of mankind, as well as for individual railroad interests, the Canadian forests will bear looking into. Specifically, a variety of Norway pine, known locally as "Princess pine," is found in quantities described as "inexhaustible," near enough to the border to cost little for transportation here. It is a comparatively dwarfed Norway, slower of growth and heavier. These Princess pine ties, 7 in. x 9 in. x 8 ft., can be delivered at a profit to railroads in the northern, easterly, states for something less than 50 cents each, and this includes the rather onerous ad valorem duty on importation. The wood "looks" as if it might be the best soft wood, spike-holding, tie known. This is not a scientific statement, and the subject needs further careful examination. Effective creosoting can now be done for within 20 cents per tie, so that this 70-cent tie may be expected to be protected permanently against decay, while its fibre gives promise of a life of more than fourteen years under heavy traffic. The cost of a Georgia pine tie is 60 cents—more or less—and it is not commonly expected to last more than nine years. It usually costs as much as 15 cents to transport and substitute a new tie. Anyone can figure out the rest of this arithmetic, so that it need only to be learned whether or not the Princess pine ties may have some practical defects.

Russian newspapers intimate that some of the state railroads may be sold to corporations or pledged for loans to the state. About 12 years ago the government began acquiring railroads, and has now built up a great state system, though the policy followed did not indicate that an exclusively state system was aimed at, at least not at present. Most of the railroads built by companies had dividends guaranteed by the government, and its experience with them seemed in many respects highly unsatisfactory. That the railroads worked by the state have been less or more so is not easy to decide, as many of them have been such as private enterprise would be least likely to undertake without a guarantee. From the accounts published, it would seem that very great advantage might result from a businesslike administration; but Americans and western Europeans are not likely to appreciate the difficulties in the way. In one respect Russia has avoided dangers which have wrecked hundreds of millions of capital in this country: it has not permitted the building of too many railroads in the same territory. Its railroads do not crowd each other even in the most productive districts. Thus they have, on the average, what we would call large earnings, though fares and freight rates are among the lowest

in the world. European Russia south of the latitude of St. Petersburg ought to be able to support three times as much railroad as it has now. The very long hauls from farm to station must require a large part of the time of men and teams, and offset the low freight rates. But the American capitalists who may be tempted by the prospects there must bear in mind that Russia and Russians are very different from America and Americans. A new railroad here with fertile country for 15 or 20 miles on each side for which it serves as almost the sole outlet is sure to have its traffic grow with very great rapidity. There, the country, though so far from cheap transportation to market, is likely to have been occupied and cultivated after a fashion for a century at least, and the production will be changed comparatively little and very slowly when it becomes more profitable.

TROLLEY FARES AND EARNINGS

In one of the International Railway Congress issues of the *Railroad Gazette* a paper was printed tabulating the rates of fare charged on certain through trolley runs. Since that time this inquiry has been carried further and returns have been tabulated from a number of other interurban lines (58 in all) representing every part of the country. The average fare per mile on these 58 through services is 1.38 cents. The list purposely excluded the rate of fare on the purely urban services of city lines. The passenger who travels the full distance possible for a five-cent fare in New York or Chicago, by making use of all the transfer privileges that are allowed him, will bring his average rate per mile to a figure considerably less than half this average. The additional fact that city lines do so large an amount of business in furnishing rapid transit as a convenience to persons wishing to travel only a short distance, paying a minimum fare of five cents, makes it quite impossible to reduce purely urban fares to any mileage basis for consideration, but the returns from these 58 interurban roads would certainly seem to indicate that there is a living profit in carrying passengers by trolley at a rate well under a cent and a half a mile.

The arrangement of the principal trolley companies in the United States in order of their gross earnings, which appears in the recent issue of *American Street Railway Investments*, adds some interesting data about the operating profits of electric lines, although no effort is made to separate city from interurban roads. In 1904, according to these figures, there were 43 companies with gross receipts of over one million dollars; the New York City Railway Company heading the list with gross earnings of $21,894,004, and the Philadelphia Rapid Transit Company coming second with gross earnings of $16,096,362. In 1903 there were 42 companies which earned over one million dollars; thus only one additional company has come into this class during the year; but the aggregate gross earnings of those included amounted in 1904 to $198,644,802, as against $169,394,001 in 1903. There were 30 companies in 1904 that earned between $500,000 and $1,000,000, as against 26 companies in this same class in 1903, and the gross earnings were $21,483,088, as compared with $18,019,575. The companies having gross receipts between $100,000 and $500,000 numbered 144 in 1904 and 100 in 1903, and earned $31,783,234 in 1904 and $22,875,139 in 1903. There were 106 companies that earned between $50,000 and $100,000 gross in 1904, as against 91 companies in 1903, and they earned $7,661,972 as against $6,428,530. The last classification is that of companies with gross receipts between $25,000 and $50,000. Of these there were 82 in 1904 and 51 in 1903, and the gross earnings were $3,183,982 as against $1,871,719. These figures are unfortunately not accurate. The 1903 figures were apparently revised for the current year, as they do not tally with the 1903 figures given in last year's collaboration; but it is impossible to use the new compilation of the results for 1903 because the companies which have passed the boundaries of a new class during the past year are not included in the returns for the previous year of the class they have left. Therefore, it has been possible to use only the new totals of the 1904 volume as compared with the new totals of the 1903 volume. In spite of this defect, the returns possess sufficient value to be very interesting.

Of the 43 companies compared in the first class (those earning one million dollars or over), only four showed decreases from 1903, and these decreases were not important in any case. Of the 30 companies in the next class, only two showed apparent decreases. Of the 144 companies earning between $100,000 and $500,000 in 1904, all increased over the year previous except 17; while taking the last two classes on the list together—representing 188 companies total—151 increased in gross and 37 decreased. The total earnings of the companies listed in 1904 amounted to $262,712,078. The total earnings of the trolley roads in these same classifications two years ago (in 1902) amounted to $201,593,401.

No good figures are obtainable to show the expenses of these same roads in the aggregate. Certain prominent lines made a bad showing. For example, the Massachusetts Electric Companies came out last year with a deficit, after paying reduced dividends, in place of a small profit balance in 1903 and a handsome profit in 1902. Other companies, such as the United Traction Company, of Albany, have been able to keep down both operating expenses and interest charges so as to show handsome increases in net income and surplus, year by year. It is unfortunate that the form of returns made by the trolley roads throughout the country is not uniform, so that careful aggregate statistics of anything except gross earnings are very hard to obtain.

An interesting commentary on the prevailing low fares on interurban lines has recently been made in the form of an agreement between the lines covering a considerable portion of Ohio to raise their minimum rate to two cents a mile. Twenty-one lines came into this agreement and proposed to sell interchangeable mileage tickets which are to be good throughout Ohio, Indiana and Michigan (*Railroad Gazette*, May 12, 1905). With the Ohio agreement in mind, together with the record of gross earnings and of fares charged, the figures at hand suggest some interesting questions, though they do not answer them. It is apparent that prevalent trolley fares are regularly made on a considerably lower basis than is thought possible by steam railroads; also that gross earnings have been increasing very rapidly on the electric properties throughout the country. The thing which is perhaps most necessary to know in forecasting the financial future of these roads is whether the properties, viewed as a whole, are being sufficiently well maintained out of earnings so that increased capital expenditure will not be necessary except where it may be expected to bring in new earnings. If they are not—and there is reason to fear that in many instances this is the case—another interesting thing to know is whether their earnings can be substantially increased by increases in fares, or whether low cost of transportation is their chief source of business. The recent action of the Cleveland lines will go a long way to help determine this. It seems quite safe to hazard a guess that the interurban lines have made themselves such a modern necessity by reason of their convenience, that they will be able to hold their business with a considerable increase in fares charged.

RAILROAD MOTOR CARS.

European practice and progress in the use of rail motor cars has been described and discussed frequently in these columns in the past year, and the field existing for their extended use in this country and some of the advantages to accrue therefrom have been pointed out. The general awakening of American roads to an increasing appreciation of the possibilities attending a proper development of this matter is evidenced by the many efforts being made to produce serviceable designs of autocars for steam road service. In recent issues brief descriptions have been presented of two American designs of cars, which represent two of the three available types, namely, steam, gasolene and gasolene-electric. Several designs of the second type—gasolene—are already well developed, the most notable being the Union Pacific car, described in this week's paper. Although these three designs will each be used on a different road, and the different conditions of working will preclude making any but general comparisons, the results from the trial of each in service will be awaited with considerable interest. The Union Pacific car has been working for about three months, but up to the present no systematic tests have been made to determine accurately its cost of operation in the service for which it is intended. However, the results of such trials as have been made thus far with it, prior to, and during a leisurely trip from Omaha to Portland, Ore., where it will go into reguar service, have satisfied the Union Pacific officers so well that six more cars are being built of larger capacity and containing such improvements as have thus far shown themselves to be desirable. Unofficial reports credit the car with a gasolene consumption averaging 3 quarts per car mile; the car has capacity for twenty-five passengers. The gasolene-electric car built for the St. Joseph Valley Traction Company by F. M. Hicks & Co., described April 21st, is now making 22 miles a day, hauling a 45 ft. trailer and some freight cars, on a gasolene consumption per car mile also of 3 quarts. The gasolene engine is 70 h. p., and in factory tests showed a consumption of one pint of gasolene per horsepower hour.

In discussions of the merits of the three types of motor cars,

it is not surprising to find that many motive power officers lean toward the steam car, expressing a belief that in the end it will be found more practical and satisfactory from the operating and maintenance standpoints than either of the other two types. It has been suggested by some that in a steam car burning crude oil would probably be found the ultimate solution of the rail motor car problem. They point to the good results in locomotive practice with crude oil in boilers not designed for its use, and argue that with a boiler scientifically designed to burn the oil to the best advantage, a chief present difficulty of the steam cars would be overcome. On a horsepower hour basis the cost of operation by crude oil is considerably greater than with coal, but less than with gasolene, at present prices for these fuels. The steam car is evidently the preferred type in England at present, despite the fact that they use a fireman, and a petrol car can, therefore, be operated with one man less, or only two in the crew. But the production of steam designs which enable the services of a fireman to be dispensed with causes this disadvantage of difference of crews to disappear, the Ohio River & Columbus car, described June 16th, being of that sort. Two-men crews, are, of course, out of the question with steam roads where the motor car service supplements the regular train service, three men, at least, being necessary to meet train rule requirements. The Chicago & Alton gasolene-electric car will carry a third man in the capacity of flagman. For a steam car in such service, this third man would have to be a fireman, as the need of keeping constant lookout ahead would make it unsafe to require the engineman to give any attention to the fire.

May Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of May, printed in another column, contains accounts of 12 collisions, 25 derailments, and two other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
6th	Harrisburg, Tex.	2	0
11th	Lochiel, Pa.	23	109
11th	Warren, Pa.	2	2
12th	Weatherford, Tex.	0	20
19th	Kosoma, Ind. Ter.	0	15

The Harrisburg (Pa.) disaster, the second in the above list, has already been reported in the *Railroad Gazette* (May 19, page 163, General News Section, and June 2, page 594). No additional facts of importance have come out since except that (1) the train was composed of 68 cars, exactly one-half of which were air-braked; (2) the engineman applied the air-brakes only moderately (5-lb. reduction of pressure), and (3) the grade was slightly descending. Whether or not the car that buckled was weaker than those behind it is a point on which no information is vouchsafed. Since the accident the Pennsylvania has issued revised regulations for the transportation of explosives. Such shipments must be carried only in perfect cars, in trains of not over 30 cars, two-thirds air-braked; near the middle of the train but not within 10 cars of the engine.

The derailment at Harrisburg, Texas, on the 6th, was of a kind which has become rather familiar in the accident records of the Southwest—that in which a furious fire, fed by a tender-full of oil, quickly destroys the wrecked cars. The Warren (Pa.) collision illustrates once more the weak and ineffective way in which we carry out the principle of having two men of equal authority—a conductor and engineman—look out for the safety of trains.

The number of electric car accidents reported in the newspapers as occurring in the month of May was 23, in which eight persons were killed and 184 injured. There was the usual variety of causes, including the failure of power while cars were standing on railroad crossings and brakes failing on steep grades. Among the electric-car accidents was a collision, near Clearwater, S. C., which vividly illustrates the way in which the movement of heavy cars on steep grades is entrusted, on electric roads, to men who by reason of limited experience, or lack of experience, are unfit for such a delicate duty. In this case two men were killed and six were injured, two of them fatally. An Augusta paper thus reports the circumstances:

"Last night shortly after dark a special crew, composed of Motorman A. A. Whitmore, Conductor Gay and a negro brakeman, left the power house and proceeded to Clearwater, after a car of coal, to pull back to the power house. The trip out was successfully made, and the coal car, a heavy affair of the Louisville & Nashville railroad, was attached to the express car, which the special crew was operating. The trip back to the power house was about successfully made when the coal car started on its runaway career. The brakeman was down and opening the switch on to which the car was to be run. The switch had to be backed on to, and evidently in going over it, the coupling broke loose. The heavy coal car started down the hill, increasing its momentum at every turn of the wheels. The crew were unable to catch the car. They jumped to another and lighter power car and attempted to overhaul the runaway, but were unsuccessful. . . . Those left to tell the tale of the collision can only say that it occurred. The first they knew of their danger was when they felt the shock of the collision. There was no other warning. They do remember that the brakes were suddenly applied. The number of seriously injured was limited only by the fact that but few were on board. All in the car were caught like rats in a trap. There was no escape."

The *Journal*, of Atlanta, Georgia, says: "The state legislature should, at the coming session, take up the question of popular election of the railroad commissioners. These offices should be held directly from the people. It should not be possible to use them as political assets. The office of railroad commissioner is one of the most important in the state. The commission may exercise great power over the commercial and industrial destinies of the commonwealth. If the board is elected by the people it will be more responsive to the popular demand and more zealous in its advocacy of the popular interest, while if it is composed of men selected for the payment of political debts its members may feel inclined to let the public interest go and cleave to the political elements to whom they owe their tenure of office. If the railroad interests are able to dominate the politics of the state so far as to control a number of the chief executive offices, the railroad commission, which holds its office by appointment, will likely be a great deal more zealous in looking after the railroad interests than in protecting the popular interests. It may even become a sort of adjunct of the railroads. With a commission of this sort in power it is obviously harder for the people of the state to get a "square deal" than if there were no such thing as a commission. It may do more harm than it does good. Its chief function may be to block action." We fear that the *Journal's* remedy would be as bad as the disease. A commission that is appointed by a Governor who is favorable to the railroads is likely to "block action"; but how about one elected by the people? It will be likely to go as far in the other direction; to take such radical action that it will need blocking itself—by the courts. It will, perhaps, have a better heart for giving the people what they ought to have, but not so good a head. The people are prone to elect men who promise to be good advocates, rather than those who are of judicial mind; and advocates usually do nothing with the railroads but dispute with them. If a Governor uses railroad commissionerships to pay political debts, the Governor himself needs to be reformed. Does the Governor use judgeships for that discreditable purpose? If the people of a state cannot elect an independent Governor, what likelihood is there that they can elect strong men for railroad commissioners? That is the real need in making up any railroad commission—strong men. Whether or not that is the trouble in Georgia we shall not undertake to say; but as the Commission in that state has lately refused to comply with the request of Atlanta people for certain radical reductions in freight rates, one naturally queries whether the *Journal's* complaint may not be due to the presence of too much strong-mindedness in the Commission rather than too little.

All the old box cars, fences and things unsightly in any degree on the Baltimore & Ohio line between Pittsburg and Chicago, where it is double-tracked, are to be removed, the right of way to be made a thing of beauty, with flower beds around stations, and hillsides (cuts) graded and sodded.

The foregoing, clipped from an Ohio paper, conveys most pleasing intelligence. Would that it could be said of a hundred other railroads! Whether or not the statement must be taken with the grain of salt which sometimes needs to be taken with advertising agents' announcements we do not know; but we will assume that it does not. That double-track proviso is a bad enough grain of salt. What is the matter with beautifying a single-track division now and then? Why are old box cars named first in the list of unsightly things? We do not know. How an old box car looks under the genial suns of Ohio we cannot accurately state. But on a certain large road in another state this disfigurement would naturally be put first on the list, because it *is* first by its nature. And two box cars, one atop of the other, making a two-story shanty, may fairly be termed "the limit," especially when the combination is freshly painted a glaring salmon. The most encouraging words in this B. & O. item are "all" and "any," in the first two lines. Next to a constant succession of slovenly grounds along a railroad, is a road with just enough flower-beds to emphasize the disagreeable sights by contrast. A roundhouse or a watchman's hut, which is so dingy and neglected as to cause ladies in the parlor cars to look the other way, often becomes actually worse by putting too smart a face on a few square yards of the grounds around it. There is too strong an impression that the bosses of different departments of the railroad do not "consist."

Mr. George Rice is dead; but the soul of his fight against the Standard Oil Company goes marching on. The Gulf Refining Company, a dealer in Texas oils, has complained to the Interstate Commerce Commission that the Illinois Central, the Louisville &

Nashville, and the C., N. O. & T. P., carry petroleum oils from Louisville southward to New Orleans, for 18 cents per 100 lbs., while from New Orleans northward to Louisville the rate is 35 cents; and Cincinnati, Chicago and other places are favored in the same way. At the same time cottonseed oil is carried northward at about the same rates as petroleum oils southward; and the roads are accused of acting in concert to unlawfully prevent complainant from selling Texas oil in the north, although the northern cities want it. This case will furnish the material for an interesting study. The cheap rates for petroleum south and cottonseed oil north have been made, undoubtedly, to develop business; but why should not the Texas oil business be developed with equal assiduity? It would be worse than carrying coals to Newcastle to carry oil a thousand miles northward and other oil a thousand miles southward over the same line and in the same cars; and yet such ideally perfect use of cars appears to be one of the reasons why, according to the complainants' statement, their oil ought to be carried more cheaply than it is. Certainly it ought to be good for the railroads to thus exchange commodities, for to exchange commodities is a chief reason why they have been built. But is there really such a difference between northern oil and Texas oil as to justify this costly transportation? To the ordinary man, to whom all oils look alike, it would seem as though the territory ought to be divided, giving the southern half to the Texas people and the northern half to the northern producers. But that proposition would introduce the question of volume of traffic, the personal preference of purchasers, and intangible differences in the qualities of different oils. Evidently nothing less than an investigation by Commissioner Prouty will serve to illuminate this illuminant.

Riding in a runaway trolley car down a steep hill is quite likely to be injurious to one's health, for a cracked skull or a crushed leg or foot may cause insanity or blood poisoning; but we should hardly have thought of asking the public health authorities to prevent runaways. That, however, is just what has been done in Yonkers, N. Y., as appears from the following press despatch: "While traffic on the trolley cars was at flood tide yesterday afternoon, the cars being jammed with passengers going to the automobile races, Police Captain Woodruff and Health Officer Mulligan held up fifteen trolley cars at Getty Square and ordered them back to the depot. No heed was paid to the protests of the passengers, and the cars went back. Dr. Mulligan said that some time ago the Board of Health passed an ordinance requiring all cars to have sandboxes in good working order, and filled. The cars sent back were not equipped with sand, and were therefore dangerous to the crowds being carried. Yonkers is a hilly city, and on wet or rainy days it is dangerous to run the cars without sand." The acts of health officers frequently seem extreme, and even unnecessary or oppressive; and some of the laws under which they act are ill-judged; but we shall not quarrel with this one, illogical as it may seem. It is good that the Yonkers Board had the "sand" to enforce their rule.

TRADE CATALOGUES.

Brake-beam Stresses.—The Damascus Brake-Beam Co., St. Louis, Mo., publishes a pamphlet on this subject under the title of "Transverse Strain." It is a copy of a report made several years ago by Mr. H. M. Perry to a beam manufacturer, after investigating a large number of brake-beams on cars. The report is accompanied by diagrams and photographs, which are reproduced. The pamphlet also illustrates the "Waycott" trussed beam, and shows a sample beam in the testing machine at Purdue University.

Pinch-Bar or Car Propeller.—H. J. Gehr, Waynesboro, Pa., sends a folder which illustrates and describes an ingenious tool known as the "Gehr" car propeller. This tool is designed for moving cars by hand and is provided with a device which automatically clamps it to the rail head and thus prevents it from slipping while under pressure.

Spray Nozzles, Injectors, Etc.—The Schutte & Koerting Co., Philadelphia, Pa., sends several folders which illustrate and describe its spray nozzles, which are used for cooling condensing water; its Universal double-tube injector and the Schutte-Koerting educator condenser.

Oil Engines.—The De La Vergne Machine Co., New York, sends a folder descriptive of its "Hornsby Akroyd" oil engines. It contains figures regarding the cost of operation as well as illustrations of the engines which are made in sizes ranging from 1½ h.p. to 125 h.p.

Valves.—The Crane Co., Chicago, sends its special railroad number of *The Valve World*, in which is described the power plant of the Railway Exchange Building, Chicago. It also contains an illustrated article by O. F. Bell entitled "Illinois and Chicago's First Railroad." It also contains illustrations and brief descriptions of some modern locomotives, as well as its usual amount of light reading matter.

CONTRIBUTIONS

The First Steel Car.

New York, June 29, 1905.

To the Editor of the Railroad Gazette:

In your issue of June 16 last, considerable space is devoted to a description of steel passenger cars. In the interest of historical accuracy I am venturing to correct a statement in your editorial upon the subject, which reads to the effect that the first "all-steel passenger cars" put in actual service were the side-entrance suburban cars on the Illinois Central, which you state antedate some months the Gibbs type of car used on the New York Subway.

The Illinois Central cars are of the steel frame type, but cannot be called an all-steel car in the same sense that the New York Subway cars can. The Illinois Central car uses a steel upper frame for structural reasons, but uses wooden sheathing and inside trim. The Subway cars are all-steel and of fireproof construction throughout. The outside sheathing is of steel and forms an integral part of the frame; the inside treatment is of metal backed with asbestos; the floor is of steel and plastic cement, to be proof against both fire and electric arcs.

My first all-steel fireproof passenger car was designed in 1902, and constitutes, I believe, the first attempt to reduce to a practical proposition this form of construction. At the present date even, I believe my cars on the New York Subway are the only metal and fireproof passenger-carrying vehicles in regular service anywhere. Since the first order for these cars was given by the Subway, my design has been adopted for electrical service on the Long Island Railroad, the New York Central Railroad, and on one of the London underground roads. That the use of strictly all-metal passenger cars will become general in electric service I have no hesitation in predicting, and I further believe this form of construction will quickly demonstrate its advantages over wood framing for passenger-carrying vehicles on steam roads generally.

I do not wish to detract in the least from the credit due Messrs. Sullivan and Renshaw in successfully developing what is probably the first practical steel frame passenger car, but I believe to the Interborough Rapid Transit Company of New York City should be given the credit in an historical record of being the first railroad company to adopt and place in service a successful all-steel, fire and electric arc-proof passenger car.

George Gibbs.

Cast-Iron Wheels.

New York, July 5, 1905.

To the Editor of the Railroad Gazette:

The writer has read with interest the paper on "Cast-Iron Wheels," by Mr. J. E. Muhlfeld, which was printed in the *Railroad Gazette*, May 5, 1905. Also, the cast-iron wheel-makers' petition to the Master Car Builders' Association at the convention held last month. The question is one of grave importance. Perhaps nothing relating to railroad equipment is of so much importance as this at the present moment.

While a wheel of cast-iron, properly made, of good material and design, might be considered economical and comparatively safe for freight equipment, where such equipment did not exceed 60,000 lbs. capacity, it is obvious that if it is barely strong enough for that service, it is wholly inadequate for a 100,000-lb. car, or else it is unnecessarily strong for the 60,000-lb. car, which all railroad men know is not the case. The experience of all railroads with cars of 100,000 lbs. capacity is, that their wheel mileage for this class of car has been greatly reduced, which means inevitably an increase of accidents from wheel breakage, and, consequently, a greatly increased mileage cost due to this decreased mileage and accident expense. All of this has occurred and is occurring, notwithstanding the fact that the weight of the cast-iron wheel has been increased, nor does it seem reasonable that the increase of weight of the cast-iron wheel will remedy the difficulty, for the reason that the heating of the wheel by brake-shoe friction and rail contact causes seams and cracks to develop in the throat and across the rim, resulting in broken flanges, rims and plates. This being true, a wheel for this heavy service should be made of a material that is intrinsically stronger and consequently safer than cast-iron. Mr. Muhlfeld's argument is in favor of trying to improve the cast-iron wheel by making some changes in designs, but the fact is that the best that can be done in this regard will not produce a wheel of more than about one-fifth the strength of a steel wheel, in so far as its ability to resist breakage or cracks is concerned.

Specifications, guarantees, inspections and tests, such as Mr. Muhlfeld recommends, are proper and in the main have been in existence a great many years, but it does not alter the fact, nor

can it, that in the case of cast-iron, the tensile strength, without any elongation, is probably 25,000 lbs. per square inch, and in the case of a pressed and rolled steel wheel, from 110,000 to 125,000 lbs. The margin of safety in the latter is so great that the absence of liability of breakage is apparent. As a proof, however, of the enormous differences between the pressed and rolled steel wheel and cast-iron wheel, both with regard to its ability to resist shock and to resist the detrimental effects of the heat action, I give below the result of, first, a thermal test, and, second, a drop test, both of which were suggested by Mr. Muhlfeld:

Thermal Test.

2-in. of molten metal poured around the rim.

33-in. wheel from heat No. 80.		33-in. wheel from heat No. 86.	
Pouring	12 sec.	Pouring	11 sec.
Ring broke in	2 min.	Ring broke in	3 min.
Ring taken off in	3 min.	Ring taken off in	4½ min.
Pouring	10 sec.	Pouring	11 sec.
Ring broke in	3 min.	Ring broke in	2½ min.
Ring taken off in	4 min.	Ring taken off in	3½ min.
Pouring	9 sec.	Pouring	9 sec.
Ring broke in	2½ min.	Ring broke in	3 min.
Ring taken off in	3½ min.	Ring taken off in	4 min.
Pouring	10 sec.	Pouring	10 sec.
Ring broke in	2 min.	Ring broke in	2 min.
Ring taken off in	3¼ min.	Ring taken off in	3½ min.
Pouring	15 sec.	Pouring	14 sec.
Ring broke in	3 min.	Ring broke in	3 min.
Ring taken off in	4 min.	Ring taken off in	4 min.
Pouring	10 sec.	Pouring	10 sec.
Ring broke in	3½ min.	Ring broke in	3 min.
Ring taken off in	5 min.	Ring taken off in	5 min.

Measurement after cooling revealed no difference in dimensions in any of the tests. An interval of 24 hours elapsed between each test, to allow the wheels to cool. It will be noted, also, that double the quantity of molten metal was used as compared with ordinary cast-iron practice, as well as six applications as compared with one in cast-iron wheel tests.

The analyses of these wheels are as follows:

Wheel No. 1, from heat No. 80.	Per cent.	Wheel No. 2, from heat No. 86.	Per cent.
Carbon	.70	Carbon	.65
Phosphorus	.026	Phosphorus	.018
Manganese	.67	Manganese	.75
Sulphur	.036	Sulphur	.039
Silicon	.220	Silicon	.165

Drop Test.

A 36-in. wheel was placed in an upright and running position, under a drop weight of 2,200 lbs., the distance traveled by the weight in descending being 8 ft. It was given 12 blows in this position, and, turning the wheel partially around, but still in an upright position, subjected to 12 more blows, and after a third partial turning was given an additional 12 blows. This treatment produced absolutely no effect on the wheel, aside from some insignificant local displacements of metal where the drop came in contact with the wheel.

The wheel was then placed flat and given 12 blows, without injuring it in any way. It was then turned over and given 12 more blows. This was the extent of the test. Measurement of the wheel after taking it from the drop failed to discover injury in any way. Its roundness had not been affected and the coning remained identically the same as when it was placed under the drop.

It does not appear to be a debatable question as to which type of wheel should be used, both for economical purposes as well as safety. The latter should always take precedence where life as well as property is at stake. Railroads, however, have not been to blame in this matter, because steel wheels, such as the writer refers to, have not been produced in quantities which would supply the wheels for 100,000-lb. capacity cars.

The wheel manufacturers committee in their petition to the Master Car Builders' Association make the following statement:

Comparison of car wheels, past and present, and their construction and requirements of service as presented at the Cleveland meeting:

Capacity of car.	M. C. B. standard finished wheel fit.		Weight of wheel in common use.
Pounds.	Inches.	Cubical area.	Pounds.
24,000	4½ x 7	13,364	525
28,000	4⅝ x 7	13,364	550
40,000	4⅞ x 7	18,665	580
50,000	5⅛ x 7	20,629	500
60,000	5⅝ x 7	22,690	600
80,000	6⅜ x 7	31,909	625
100,000	6⅞ x 7	37,122	650

Comparison of 12-ton capacity equipment with 50-ton capacity equipment:

Increase in cubic area, finished wheel fit	177 per cent.
Increase weight of rails	100 " "
Increase weight of wheels	23 " "
Increase:	
Load capacity; formerly 24,000 lbs., now 100,000 lbs.	76,000 lbs.
Tare weight of car; formerly 18,000 lbs., now 28,000 lbs.	10,000 "
Permitted excess load (10 per cent.); formerly 2,400 lbs., now 10,000 lbs.	7,600 "
Total, additional load	93,600 lbs.
Or, 375 per cent.	
Increase in time guarantee (2 yrs. to 4 and 5 yrs.)	125 " "
Increase in annual mileage of cars	100 " "
Total increased requirements of our wheels	600 per cent.

Six hundred per cent. increased requirements for a cast-iron wheel with only an increase in weight of 23 per cent. has put a burden on cast-iron wheel makers too much for them to bear, and it is not at all certain that the 23 per cent. additional weight gives 23 per cent. additional strength, because of the difficulty of putting the weight in the proper place. It is, therefore, no wonder that they are petitioning the Association to have the guarantee reduced to a fraction of what they are willing to guarantee a wheel for 60,000-lb. cars.

In brief, the cast-iron wheel makers might just as well have said "we cannot make a cast-iron wheel to safely carry a 100,000-lb. load," for when they refuse to guarantee the wheel for that service, they have in fact said they cannot make it.

The following table of tests of cast-iron wheels for flange breakage, which the cast-iron wheel makers committee submitted, is most significant as showing the unreliability of the combination of chilled and soft iron in the wheel tread and flange:

Results of Flange Tests.

No. of test.	Breaking load.	No. of wheel.	Point of application of load on flange.
1	52,850	H. 19,413	Between brackets.
2	47,750	H. 19,413	Opposite bracket.
3	49,350	H. 19,413	Between brackets.
4	53,400	H. 19,413	Opposite bracket.
4a	105,000	H. 19,413	Load applied on rim; no fracture.
5	62,850	H. 19,410	Between brackets.
6	48,700	H. 19,410	Opposite bracket.
7	58,250	H. 19,410	Between brackets.
8	58,000	H. 19,410	Opposite bracket.
9	74,850	H. 19,254	Between brackets.
10	72,200	H. 19,254	Opposite bracket.
11	87,000	H. 19,254	Between brackets.
12	68,550	H. 19,254	Opposite bracket.
13	99,300	A. C. & F. Co., wheel 650	Between brackets.
14	100,000	A. C. & F. Co., wheel 650	Opposite bracket.
15	105,000	A. C. & F. Co., wheel 650	Between brackets.
16	68,200	A. C. & F. Co., wheel 650	Opposite bracket.
17	79,350	A. C. & F. Co., wheel 650	Opposite bracket.
18	52,300	H. 19,558	Between brackets.
19	111,600	1904 M. C. B. pattern (tape 1) 700.	Opposite bracket.
20	87,000	1904 M. C. B. pattern (tape 1) 700.	Between brackets.
21	109,900	1904 M. C. B. pattern (tape 1) 700.	Opposite bracket.
22	98,900	A. C. & F. Co., wheel (tape 2) 700.	Between brackets.

From the above it will be seen the average strength to resist flange breakage is 80,000 lbs., but the significant point shown by this exhaustive test is the variation in the strength, ranging all the way from 47,750 to 111,000 lbs. More than 55 per cent. difference in the strength of wheels is undoubtedly a grave defect. A test for flange breakage of a Schoen pressed and rolled steel wheel was made by Mr. Geo. L. Fowler, M.E., under similar conditions to those used in the cast-iron wheel tests referred to above, with the result that it took 554,000 lbs. pressure to break it.

The specifications, inspections and tests of cast-iron wheels are about as severe as it is possible to make them, and the cast-iron wheel makers were compelled to make the confession in their petition to the Master Car Builders' Association that they cannot make a better wheel, and that it is not good enough for the 100,000-lb. capacity cars is conclusive from the fact that they refuse to guarantee them for more than one-third of the mileage that they guaranteed for the 60,000-lb. car wheel.

The question is, what is to be done about it? To my mind there is but one solution, and that is, to make wheels of steel. The extra expense involved is more imaginary than real, because, as a matter of fact, on a mileage basis a pressed and rolled steel wheel can be produced, and is being produced, that can be sold at a price that would make the wheel cost per thousand miles about equal to that of cast-iron, and in addition be safe.

With regard to the use of cast-iron wheels for passenger service, the practice is wholly indefensible. Certainly from a point of safety there can be no comparison between a cast-iron and a steel wheel, and as to the question of expense, there is absolutely no difference. If anything, the steel wheel can make the mileage of a cast-iron wheel for less expense.

Mr. Muhlfeld's statement that it would make a difference of $200,000,000 in investment if steel wheels were used is somewhat misleading, for the reason that the necessity for equipping cars of 60,000 lbs. capacity and under, apparently does not exist, and is applicable only to 80,000 and 100,000 lbs. capacity cars. There are probably 200,000, or say, 250,000 cars of this capacity in use, and the additional investment for steel wheels over the cast-iron wheels with which they are equipped, would probably not exceed $15,000,000 to $20,000,000, all of which would be more than saved in increased mileage, and in addition there would be safety against wrecks.

Mr. P. H. Griffin points out the fact that by using over and over again the old cast-iron wheels for making new ones, the metal in the new wheels is continually retrograding in quality, and consequently the new wheels must be getting poorer in quality from year to year. Comment on this point is unnecessary. It speaks for itself.

The writer was the first to develop and exploit the substitution of steel freight cars of 100,000 lbs. capacity, in a substantial way, and through that experience learned quickly that to build a 100,000-lb. capacity car entirely of steel and leave the very foundation (the wheel) of cast-iron, was immediately demonstrated by excessive failures of the cast-iron wheel to be radically wrong. Furthermore, it is a fact that the full earning capacity of 100,000-lb. steel cars is not obtained under present wheel practice.

My faith in the rolled-steel wheel as an economic proposition for railroads is so great that, single-handed and alone, I have spent nearly three-quarters of a million dollars in developing the enter-

prise, and with reasonable support from railroad officers, the old system of making car wheels for large capacity cars, fast freight service, and passenger equipment, will in the near future be entirely revolutionized.

CHAS. T. SCHOEN.

Locomotive Valves and Valve-Gears.*

1. What the human heart is to the body, the valves are to the locomotive. It is their function to control the circulation of the energizing vapors throughout the organism of the machine. When they perform well their functions, the locomotive is prompt and precise; if they are faulty, it limps on its course, or allows its energies to run to waste. From the early days of locomotive operation, valves and their gears have challenged alike the skill of practical mechanics and of the professional engineers. Most men who have had to do with the operation of locomotives and whose abilities have been such as to make them responsive to their surroundings, have at some time in their life, been interested in the introduction of some new type of valve or valve-gear. It goes without saying that much of this effort has been misdirected and it has not infrequently happened that proposed improvements have involved misconceptions concerning fundamental principles. In view of this fact, and because of a very common interest which attaches to the problem, it will be profitable to discuss briefly the present state of valve practice and to inquire as to its tendencies.

The valve-gear of a modern locomotive contends with conditions which are difficult to meet. It is designed to so move the valve it drives as to open the port by an amount which at running cut-off, usually does not exceed three-eighths of an inch, and at speed, the entire interval during which any port is open is less than a twentieth of a second. If normal steam distribution is to be maintained, the valve must move with great precision, since even a slight change in the extent of its travel, or in the time of its action, becomes relatively large when measured by the small port opening and the brief interval during which the port is open. Moreover, a valve of a modern locomotive weighing with its yoke 150 lbs. or more, requires the application of forces of considerable magnitude to give it motion, and its action involves more than ten reversals in its motion each second. It is necessary that the gear which actuates such a valve be free from lost motion, and that it be so stiff as to admit of no deformation of its parts. With this understanding of the requirement, we shall do well first to examine that type of valve-gear which is common in American practice, and to review briefly its merits and defects.

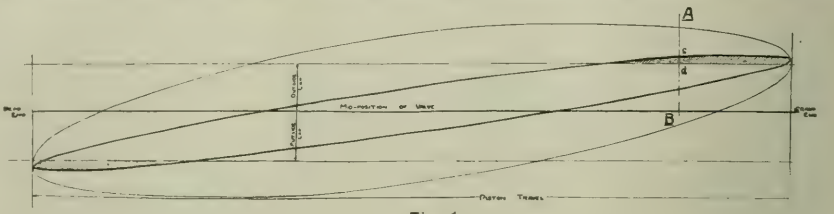


Fig. 1.

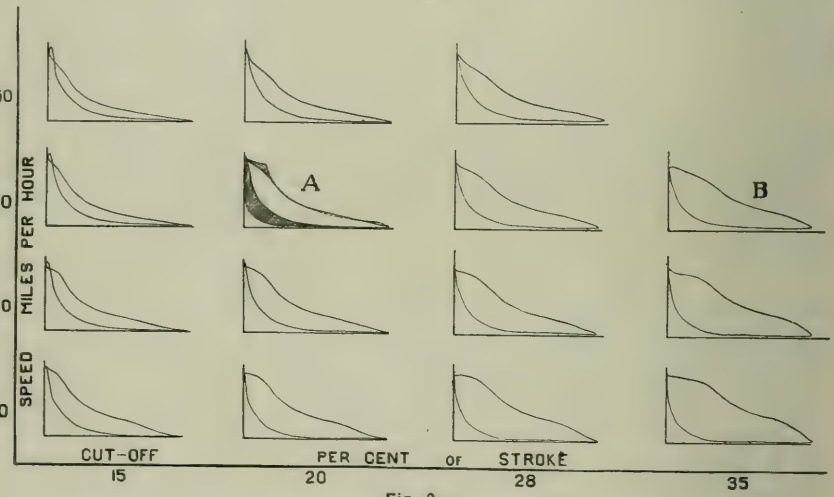


Fig. 2.

THE STEPHENSON VALVE-GEAR.

This gear, which is so familiar to all that I have no need to illustrate it, as designed to drive a flat valve, contains ten joints between the axle and the valve-yoke, having motion when the gear is in action. Lost motion in any of these will modify the valve action. Accurate fitting and the use of case-hardened parts have, however, made the joint of the link-motion reasonably satisfactory, but the average gear leaves much to be desired, in the way of stiffness. It is true that great progress has been made in this latter respect. The modern engine does not slow down on the hill, when the throttle opening is increased, as used sometimes to be the case with locomotives having bent and limber eccentric blades, but even in the modern locomotive the spring of parts has not been entirely eliminated. The principal defect at present is in the link and its support. The heavy valves now in use, in combination with the angular position with reference to the motion of the link-block, occupied by the link when the cut-off is short, impose heavy stress upon the link hanger. The fact that this is attached to one side of the link leads to the introduction of twisting strains which affect the whole system. The remedy is to be found in a more general adoption of the marine type of link, with double hangers, giving support to the link upon both sides, and having connection with a very heavy reverse shaft and arms.

The motion communicated to the valve by the Stephenson gear is one which, beginning from rest, increases to maximum and then gradually diminishes until at the end of its travel, it comes to rest again. The fact that it approaches its point of rest, and upon reversal recedes therefrom with a relatively slow motion, permits the valve to be controlled in its course more easily than would be the case if its changes in velocity were in obedience to a more complicated law. The gradual change in its rate of motion may well be seen in a curve representing the relative movement of valve and piston. Figure 1.

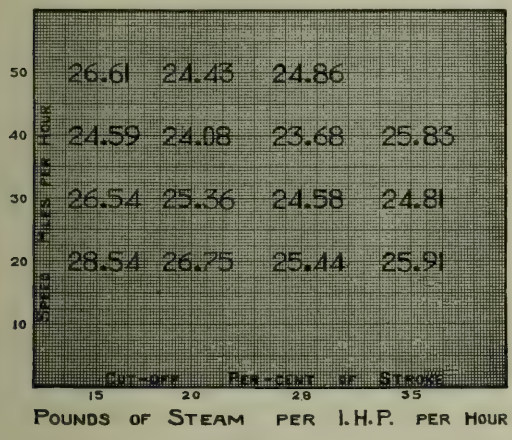
In the diagram of this figure, which is usually referred to as a valve ellipse, horizontal distances represent piston displacement, and vertical distances valve displacement. The figure shows two ellipses corresponding with two different positions of the reverse lever. Distance between the heavy horizontal center line and the upper portion of either curve indicates the distance which the valve is removed from its central position, and distances along the center line represent piston displacement; thus, in the original diagram from which Figure 1 was made the distance along the line A B from the center line to the heavier lined curve, is one and three-fourths inches. If we subtract the outside lap of the valve from this distance, the result will be the port opening. Thus, in the present case, the outside lap is one and one-half inches, so that the port opening on the line A B C D is one-fourth inch. In the particular case in question, the shaded area represents both the time and extent of the port opening. As many valve ellipses can be made as there are notches in the quadrant holding the reverse lever. Again, while I have referred only to the steam port opening, it should be evident since the displacement of both valve and piston are shown, that the time and extent of the exhaust-port opening can be determined as well as that for the steam port.

The present purpose is less concerned with questions of port opening than with the form of the curve representing the motion of the valve, for I wish at this point to discuss briefly a modification of existing gears designed to accelerate the valve motion when the piston is at the end of its stroke. It is the purpose of the class of devices to which I refer, to secure a quick and liberal opening of the port to hold the valve nearly stationary during admission, and

*A paper read before the Southern and Southwestern Railway Club, by Prof. W. F. M. Goss.

to close the port promptly at cut-off. The mechanical arrangements for securing these results usually consist of the addition of mechanism to existing valve-gears. A number of different gears have from time to time been proposed and used. While the means employed vary greatly in different gears, the form of the valve diagram will be much the same for all. In contrast with that shown by Figure 1, it will be a figure having the same total length and the same total width, but with ends much flatter, indicating the higher velocities of the valve on either side of its points of reversal. It is evident that increased acceleration requires a gear which is stiffer than that which is usually employed. This fact, together with a knowledge of the care which must be exercised in the construction and maintenance of normal gears, suggests some of the difficulties to be met in designing and maintaining any of these accelerating devices. The conception underlying the accelerated device is good, but the locomotive is an extremely difficult type of engine upon which to employ it. The fact that in locomotive service the valve travel is considerable and the speeds are ofttimes enormously high, makes it difficult to say just how far a design may be carried to secure such stiffness of gear, and increase of wearing surfaces as may be required to perform the work imposed by any of the devices in question.

Another point to be emphasized in connection with the valve ellipse is the small extent of port opening. The smaller of the two ellipses shown represents a cut-off of 20 per cent. of stroke. The greatest width of the shaded portion on a full-sized diagram in one-fourth inch, which is the maximum steam-port opening at this cut-off. With longer cut-offs the travel of the valve is increased,



POUNDS OF STEAM PER I.H.P. PER HOUR

Table 1.

and the port openings become greater, but the fact remains that at running cut-offs, the opening is small.

The effect of small port-openings upon the form of the card will be seen by reference to Figure 2. The several cards of this figure are plotted in terms of speed and cut-off. Referring to them first by horizontal lines, those which are lowest, were made at a speed of 20 miles an hour; the next highest 30 miles, the next 40 miles, and the highest 50 miles. Viewing them in vertical lines, those at the extreme left represent a cut-off of 15 per cent. stroke, the next 20 per cent., the next 28 per cent., and the last 35 per cent. The wire-drawing effect may, for the purposes of illustration, best be seen from the four cards at 20 per cent. At the slow speed of 20 miles an hour, the events of the stroke are well marked, but as the speed increased, the points representing change of pressure are less clearly marked, and at 50 miles, as shown by the highest card, the events of the stroke cannot be located. Similar results appear in the cards for 28 per cent. stroke and for those at 35 per cent. stroke. All this is the effect of wire drawing, and is typical of the Stephenson link motion. It is an indication that as the velocity both of the piston and valve increases the changes of pressure within the cylinder lag behind, the form of the card approaching a smooth curve and its area diminishing.

The fact that with a given cut-off, the cards must diminish in size, as the speed is increased in the manner shown by the diagram, Figure 2, may be made apparent from several points of view. Thus, it may be said that with each increment of speed, the duration of each stroke is shortened, and hence the amount of steam which can enter a given opening of port becomes less. Again, it may be made apparent by considering that with a given cut-off the fraction of the whole time which the port is opened is independent of speed. In an hour's run, there will be a certain definite number of minutes that each port will be open, whatever may be the speed; hence the volume of steam passing a port in a given time is constant except in so far as the flow may be modified by the conditions of pressure existing within the cylinder. With the total volume passing, approaching a constant, it is evident that when the number of strokes increase, the amount admitted per stroke must diminish. It is, therefore, entirely clear that any valve actuated by a Stephenson link motion, unless designed to give port openings which will be excessive for slow speeds, must give rise to wire-drawing at higher speed.

It is commonly assumed that all wire-drawing in locomotive service is objectionable; whereas, there is one very useful service which it renders. It is that of assisting in the maintenance of uniform conditions upon the boiler while the engine is operating under widely varying conditions of speed. The significance of this statement will appear if we assume an engine at a speed of 20 miles an hour with reverse lever and throttle set to make the demand for steam such as to put a fair working load on the boiler. If, now, by a change in grade, the load is diminished sufficiently to permit the speed to increase to 40, 50 or even 60 miles an hour, it will generally not be necessary to change the reverse lever or the throttle, the wire-drawing action coming into play to prevent the cylinder from taking from the boiler more steam than it can supply, the engine meanwhile continuing at all speeds, to work at or near its maximum capacity. This automatic regulation of power through wire-drawing is, I believe, one which means much both as a matter of convenience in the operation of the locomotive and as a factor affecting boiler repairs. In seeking to improve valve-gear practice, it will always be well to remember the fact that it is the wire-drawing action which permits a locomotive to run without any change in the adjustment of throttle or reverse lever at widely varying speeds, developing all the time a close approach to its maximum power.

But there are objections to wire-drawing which are real and sometimes serious. These arise from the fact that as the process proceeds, the cylinder action becomes less efficient. While the loss on this account is smaller than is generally supposed, it is well that the facts be understood. These may best be apprehended by comparing the steam used per horse-power hour for different speeds. Values as obtained in the tests represented by the cards, Figure 2, are shown by Table 1.

Accepting for purposes of comparison, the results corresponding with a cut-off of 28 per cent., the values are as follows:

Speed 50, Steam per I. H. P. H., 24.9.
Speed 40, Steam per I. H. P. H., 23.7.
Speed 30, Steam per I. H. P. H., 24.6.
Speed 20, Steam per I. H. P. H., 25.4.

Results for other cut-offs are substantially the same. At 60 miles an hour, were the data available, the consumption would probably rise to 27 lbs. It is a principle in steam engineering that, other things remaining the same, the steam consumption should diminish with increase of speed. This principle would apply in locomotive service were it not for the fact that with each increment of speed there is a change in the distribution of steam. The result is that while the steam consumption diminishes until a speed of 35 or 40 miles an hour is reached, after this point it increases, the losses through wire-drawing being greater than the thermodynamic gain due to the increase of piston speed. Referring to the figures above, there can be no doubt but that the change from 23.7 lbs. to 24.9 lbs. is due to wire-drawing. If for this series of tests the steam consumption had been obtained for a speed of 60 miles, it would have shown an increase in steam consumption of 2 lbs, or, say 10 per cent. above the minimum.

In conclusion, therefore, with reference to wire-drawing, with increase of speed, it may be said that its presence is a necessary accompaniment of valves and gears now common; that is, serves a useful purpose in regulating the demands which the cylinders make upon the boiler, but that, at the highest speeds, is is responsible for some increase in steam consumption.

IMPROVED VALVE GEARS

From the beginning of locomotive valve-gears, countless devices have been proposed affecting either the valve or the gear which gives it motion, whereby the card may be made larger than that which results from the normal link-driven plain valve. A typical improved card is shown at A, Figure 2. Concerning such devices, I would note that it is usually assumed, though the assumption is erroneous, that anything which increases the area of an indicator card is desirable. For example, in Figure 2, for 20 per cent. cut-off and a speed of 40 miles an hour (card A), the plain outline is the normal card around which has been drawn a so-called improved card. The difference is the shaded area, and is presumably the result of the adoption of some new form of gear. Obviously, the shaded area represents increase of power. The first mistake that is made concerning the change is that the increase in power results in no expense. Again, while the truth of the preceding statement may be admitted, it is often urged that one may measure pressure and volume represented by two indicator cards, such as are shown by Figure 2, and derive therefrom an estimate of the relative amount

of steam used per horse power per hour under conditions which each represent. Such estimates are in fact fairly reliable when made between cards agreeing closely in form, and when all conditions of running are the same, but as a general proposition, nothing is more misleading. If there are differences in speed, or in initial or final pressure, or in the number of expansions, the percentage of the total amount of steam used which is shown by the indicator will change. Anything which may produce a change in the temperature of the metal of the cylinder at any one point in its cycle is likely to produce changes in the whole cycle. As is well known, a considerable percentage of the steam drawn from the boiler for each stroke of the engine, condenses on entering the cylinder. While the interchange of heat causes some change in the amount of water in the cylinder as the piston proceeds on its course, by far the larger part of the initial condensation continues in the cylinder until the exhaust port is open, when it flashes into steam and disappears with the exhaust. While the process is a complicated one, and cannot within the limits of the present paper be accurately defined, the fact is that any change in the form of any line bounding an indicator card has its effect upon the amount of steam which must be admitted to make up the loss due to initial condensation. A change in the cycle remote from the period of admission may have as pronounced an effect on the quantity of steam required, as a change in the period of admission itself. There is, in fact, no way to measure performance of a steam engine, but by weighing of the feed or the exhaust. Again, a further illustration of the fact that the mere increase in the area of an indicator card is not significant, is to be found in the ease with which such increase of area may be secured. In locomotive practice, it is quite unnecessary to adopt a new gear. If, under the conditions prescribed, the normal card (Figure 2), is not large enough for the work, the reverse lever may be advanced on its quadrant until the cut-off is 35 per cent. of the stroke instead of 20, whereupon, in this particular case, the normal card becomes equal in size with the card representing an assumed improved gear. The

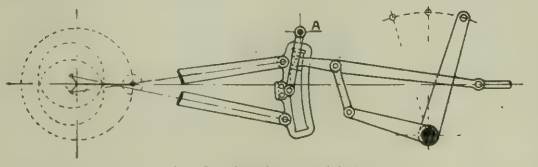


Fig. 3—Stationary Link.

real question, therefore, may generally be stated as follows: Is the improved card at 20 per cent. a better card than the normal card of equal area at 35 per cent. cut-off? Will the former yield a horse-power upon the expenditure of less steam than the latter? It is upon this latter statement that the argument rests. No device which seeks to improve the steam distribution in a locomotive can succeed which does not save steam when compared with devices now in use. In proportion as it saves steam, it both increases the efficiency of the engines and increases their maximum power, for since the boiler capacity is limited, a pound of steam saved is a pound of steam available for additional services.

Turning now to a consideration of the margin upon which those who would improve valve gears have to work, it must be admitted that it is not large. Results have already been quoted (Table 1), which prove that the locomotive with all its wire-drawing, gives a horse-power on less than 24 lbs. of steam per hour. This is near the minimum. From this performance of a simple locomotive having normal valve gear with its narrow port openings and wire-drawing effects, we may turn to the Corliss engine, the action of which is generally accepted by all improvers of locomotive valve gears as a standard of perfection. Such an engine, with its large port opening, its prompt movement of the valves, can in fact be relied upon to give as good a performance as engines having any other type of valve gear operating under similar conditions of speed and pressure. Corliss engines having cylinders which are comparable in size with those of locomotives and which work under a similar range of pressure are, however, not common, and hence, it is not easy to command data for the proposed comparison. Generally simple Corliss engines work under a lower pressure than locomotives. The best performance of which I have been able to find record of a simple Corliss engine exhausting into the atmosphere, is that of an 18 x 48 Harris-Corliss engine, for which the steam consumption was 23.9 lbs. per hour.* The steam pressure supplied this engine was only 96 lbs. by a gage. On the basis given, the engine should, when supplied with steam at 180 lbs., which is the pressure under which the locomotive data were obtained, require less than 23 lbs. of steam per horse-power per hour. Straining the facts applying to the two classes of engines as widely apart as a knowledge of existing data will possibly permit, we may assume that a Corliss engine, if given the advantage of the high steam pressure and high piston speed common in locomotive service may give a horse-power hour, or approximately 8 per cent. less on the consumption and 2 lbs. less of steam than the locomotive. This, then, is the margin upon which those who seek to improve the locomotive valve gear must expect to work. While it is well worth attention, it cannot revolutionize practice.

I am aware that this statement is in conflict with the experi-

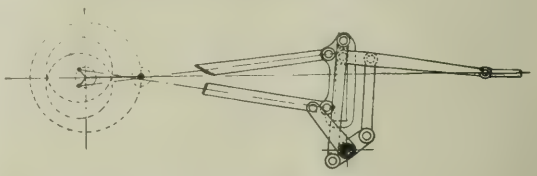


Fig. 4—Allen Link.

ences of many men who, having been interested in special gear, have found them to be 10, 20 and even 30 per cent. more efficient than the link motion they have displaced. A careful examination of such cases, however, will not fail to disclose the fact that the normal gear, which is made the basis of comparison, was either poorly designed, or in poor condition, and hence the results are misleading. Obviously, where two systems are involved, comparison should be based upon the best type which can be selected of each.

VALVE-SETTING.

While somewhat apart from the purpose of my discussion, I cannot refrain from making brief reference to the matter of valve-setting, for which Fig. 2 furnishes a most admirable text. Experience both upon the testing plant and upon the road has shown that in setting valves care should be taken to avoid excessive lead at running cut-offs. Whenever the setting is such as to give a loop in the top of the card such as that which appears in the cards of the left-hand column (Fig. 2), it is safe to conclude that there is too much lead. Its reduction will increase the economy with which the engine will work at the cut-off in question. Experience also has shown that it is profitable so to reduce the lead as to avoid the loop at running cut-offs, even though there is negative lead for the longer valve travels. An examination of Fig. 2 is of interest in this connection. The cards at 15 per cent. cut-off already referred to, present too much lead, but the cut-off in question is really shorter than that at which any locomotive should be operated, and if it be assumed that these cards represent conditions which, if not impracticable, are undesirable, which is the fact, the next column of cards at 20 per cent. cut-off may be accepted as those of shortest cut-off. Here the loop has disappeared and the form of these cards may be accepted as that which attends a satisfactory degree of efficiency. With the valves thus set, it is interesting to note that at the longest cut-off of the series, namely, that of 45 per cent. stroke the lead is insufficient to sharpen the initial corner of the card, which, upon the diagram appears rounded. This, however, should create no concern, since the cards which are here presented, were obtained under conditions which have been proven to be highly efficient.

FOREIGN VALVE-GEARS.

Having now considered the frailties and virtues of the link motion, we may inquire concerning other forms of gears which in foreign countries at least are in common use. In England one occasionally sees the stationary link as shown by Fig. 3, the link hanger of which is suspended from a fixed pin, A, while the reverse shaft is connected with a radius rod which communicates the motion of the link to the valve spindle. A modification of this gear is found

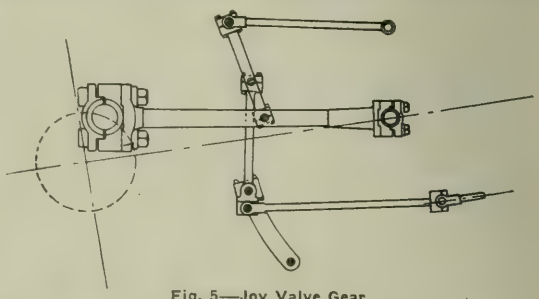


Fig. 5—Joy Valve Gear.

in the straight or Allen link, shown by Fig. 4, in which both the link and the radius rod have connection with the reverse shaft which in reversing causes them to move in opposite directions.

The Joy gear (Fig. 5), which has been, and still is, extensively used in English practice, requires no eccentric, but receives its motion directly from the main rod. The reversal of the engine

*Peabody's Thermodynamics.

and changes in the travel of the valve are, in this gear, accomplished by varying the inclination of the curved guide along which a block is forced to travel with each reciprocation of the main rod. The guide remains stationary, except as acted upon by the reverse lever.

As a last example from foreign practice, is presented the typical gear of Continental Europe, namely, the Walschaert gear (Fig. 6). In this gear, motion is derived from the crosshead and from a single eccentric, or, where the gear is outside of the frame, from a return crank. These motions are so combined by means of a system of connected rods and a link as to give the usual motion to the valve. A radius-rod connecting with the link-block receives motion from the reverse shaft in reversing, and in changing the travel of the valve.

The fact concerning these foreign gears which I most wish to emphasize is, that they all give a motion to the valve which may be represented by a valve ellipse such as that shown by Fig. 1. There are minor differences in the character of the resultant motion which my present purpose will not permit me to discuss, the important fact being that the mechanisms in question are not to be regarded as reform gears. They are not to be contrasted with the Stephenson link motion, but compared with it. They do not exist because they give a better steam distribution than is obtained from the link-motion of this country, and except as may be hereinafter suggested, they are not superior to the gears common in this country. With this understanding of the matter, we may now examine the several gears referred to, and seek to find a reason for their existence, in the conditions under which they are used.

From that which has already been stated, it may be surmised that the Stephenson link-motion as used upon American locomotives, constitutes a convenient and acceptable gear. There are at least four good reasons why this is so, which may be enumerated as follows:

1. The gear gives a satisfactory distribution of steam.

2. Its design readily adapts itself to conditions involving the use of a rocker between the axle and the valve, and the rocker has

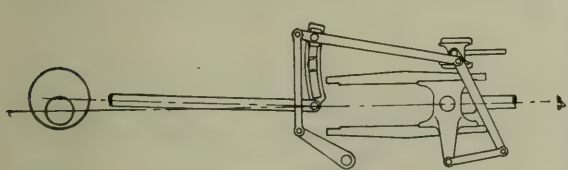


Fig. 6—Walschaert Valve Gear.

until recently been regarded as an essential element in the design of the American locomotive.

3. The accessibility of the forward driving axle and the unoccupied space between the frames in American locomotives as a point of attachment for eccentric, has supplied ideal conditions under which to develop the link motion.

4. Other forms of gear which have been used elsewhere have been thought impracticable in American service because, owing to the small diameter of driving wheels, which, until recently, have prevailed in this country, the mechanism of such gears often extending too near the roadbed for safety.

The stationary link (Fig. 3) has proven attractive to the designers of many English engines, because it involves the use of a single eccentric, room for which is more easily found upon the inside connected engines common to English practice where the greater part of the forward axle is occupied by cranks.

The Allen link responds to conditions similar to those which are met by the stationary link, but is a better design, since by it the lines of motion are kept much nearer the lines of force.

The Joy valve-gear is distinctively English in its design, and in the extent of its use upon locomotives. With the increased size of the inside connected locomotive, the inside crank of the forward axle gradually developed proportions which made it difficult to find room even for a single eccentric.

Confronted with these conditions, the Joy gear naturally makes a strong appeal to the designer. This gear takes its motion from a connecting rod and leaves the forward driving axle to be occupied wholly by the cranks. For locomotive service the Joy gear is perhaps inferior to either of the other motions described, since irregularities in the track materially affect the distribution of steam. For example, when a low joint permits the wheel to drop, the connecting rod partakes of its motion and carries it on to the valve-gear and to the valve.

The Walschaert gear, which is extensively used in Continental Europe, may be either inside or outside of the frames of the engine. In European practice, where inside cylinders have been much employed, it has generally been outside of the frames. Its design makes a strong appeal to the designer who is forced to go outside of the frame with his valve motion. For this reason, its use is likely to increase in American practice. If, as many engineers believe, some form of balanced compound is to gain ascendency in this country, there will be greater difficulty in retaining the valve-gear between frames. As an illustration of this, it is of interest to note that the Mallet compound, built by the American Locomotive Company for the Baltimore & Ohio Railroad, and exhibited at St. Louis, is designed with Walschaert valve gears. The gear is one in which the metal for the parts may be well distributed to transmit the stresses which are brought upon them, and for this reason it may constitute a very stiff gear, though its individual parts are relatively very light. A most admirable type of this gear, with some special adaptation to meet the requirements of the compound principle, is illustrated in the von Borries balanced compound locomotive, which was on exhibition during the summer at St. Louis.

The conclusion to be drawn from the foregoing discussion should not be one of discouragement for those who are interested in improving the locomotive valve gears. In so far as I may have commended forms of gears now common, I have had no wish to imply that better ones may not be devised. The force of my argument is, however, that real and lasting improvement is to be looked for more along mechanical lines than in attempts to improve the character of the motion imparted to the valve. While there is a chance for slight saving in fuel, the real economy which may result from the adoption of a better gear is to be found in its lower maintenance cost, and in the greater certainty of its action, rather than in pounds of coal saved. What is most desired in a valve gear is a mechanism which under the adverse conditions of actual locomotive service, will give to the valve that precision of movement it is designed to have. Along these lines there is ample opportunity to improve the present practice.

Train Dispatchers' Convention.

The 18th Annual Convention of the Train Dispatchers' Association of America opened on Tuesday, June 20, at the Brown Palace Hotel, Denver. The Credentials Committee reported 46 members present. The President's address was then read. The election of new members was the next business in order and the convention balloted upon 43 candidates, electing 40. The report of the Executive Committee was read, congratulating the Association upon its continued prosperity. There is a balance of $373, in addition to railroad bonds to the amount of $2,000, an increase of $360 over the previous year in assets. The net increase in membership during the year was 34, and the total present membership of the Association is 884. The Committee on Topics reported the following five questions:

1. How can forms of orders be shortened or improved, and how much, if any, deviation from prescribed forms may be permitted in the interest of brevity? Give instances or conditions where improvement might be made.

2. Can the use of the "19" order be extended beyond the usual practice, i. e., giving it only to inferior trains? If so, how? Can a safe method be adopted for using it in every case for all trains?

3. What form of dispatchers' transfer do you consider best, and why?

4. Do you favor a printed form for train order books for dispatchers' use? If so, what are the advantages?

5. To what extent may a train crew continue to use orders after having changed their identity, i. e., assumed a train of another number or designation? Consider: First: Kinds of orders: (a) Annulment. (b) "Run late" orders (Form E), (c) Extra with right over other trains (Form G, example 3).

Second: Manner of changing identity: (a) Running a regular train to terminal and returning on another. (b) Running a regular train but change to extra in order to exceed schedule time. (c) From an extra to a work extra, or vice versa. (d) "Short run" extras, i. e., running orders over part of the district only, another order being issued to complete run. (e) From one section number to another.

In response to these questions papers were submitted by Messrs. F. H. Hadley (Pennsylvania), of Media, Pa.; J. W. Cuineen (Lehigh Valley), Auburn, N. Y.; E. R. Gassman (L. S. & M. S), Toledo, O.; T. D. Dillmin (L. S. & M. S.), Youngstown, O.; D. B. Fleming (N. Y. C. & H. R.), Jersey Shore, Pa., and W. J. Choapman (Southern Railway), Greensboro, N. C. Mr. Dillmin's paper will be found in another column.

A paper on Rule 4B, standard code, by Mr. H. A. Dalby, was also read. The Train Rules Committee submitted a number of suggestions for amendment for the standard code covering definitions and the following standard code rules:

Rule 4 (A), 4 (B), 20, 93 and 218, and forms of orders A, B and K. Also a rule providing for the "X" response as a substitute for repetition of the order by the operator at the meeting point, in case of "meet" and "wait" orders.

Two sessions of the convention were fully occupied in discussing these topics and the reports of the Train Rules Committee.

The election of officers resulted in the election of F. X. Meyers (Texas & Pacific), Marshall, Tex, for President; L. H. Phetteplace (N. & W.), Williamson, W. Va., for Vice-President; J. F. Mackie

[illegible] and Messrs. C. D. Richards, T. D. Dillman, C. W. Fisher and J. [illegible], members of the Executive Committee.

The next meeting will be held at Buffalo, N. Y., in June, 1906.

The convention held three sessions each on Tuesday and Wednesday, and the members devoted the remainder of the week to enjoying the hospitalities of the Colorado railroads, Thursday being occupied in a trip over the new Moffat road, whose present terminus is Arrowhead, at the entrance to the famous Middle Park which will be traversed by this road in its progress towards Ogden. The unsurpassed scenery along this route will at some future time undoubtedly form one of the chief attractions of Colorado to tourists. No section of Colorado embraces within such a limited distance the same variety of mountain scenery that is afforded by this road. Friday was devoted to a trip over the Colorado Southern to Silver Plume and return. This trip embraces the famous Georgetown Loop. Saturday was occupied with a trip to Cripple Creek over the Colorado Springs & Cripple Creek District Railway and to Pike's Peak. The convention was one of the most interesting and pleasurable in the entire history of the association.

The Cost of Locomotive Operation.

VII.

BY GEORGE B. HENDERSON.

(Continued from Vol. xxxviii., Page 577.)

WATER TREATMENT.

When locomotives were small and had a comparatively easy time, little attention was paid to the material in the water, but as they became larger and were forced to work more continuously, the trouble increased. In desperation over leaky flues and cracked fire-box sheets, the method of introducing soda-ash, or carbonate of soda, into the tender, and so to the boiler, became quite general, and is still used at many places. In time, however, it came to be recognized that the boiler of a locomotive was hardly the place to do this work of freeing the water from impurities, as the sludge filled the lower part of the boiler, necessitating very frequent blowing off and washing out, and the more logical method of preparing the water before it was delivered to the tender became popular. There are quite a number of treating plants at present in use; in some the apparatus is patented and in others it is home-made. All, however, depend upon chemical action for their success. The soft scaling waters, containing carbonate of lime or magnesia, held in solution because the water itself is charged with carbonic acid gas, are simply treated with slaked lime, which unites with the free carbonic acid, forming carbonate of lime. This, being insoluble in water free from carbonic acid, settles as a white precipitate, accompanied by the carbonate previously in the water in solution. The clear water is drawn off above the sediment, and thus none of the carbonates get into the boiler, but practically pure water is delivered. As quick lime (from which the slaked lime is made) is a cheap substance, the cost of chemicals for such treatment is small. As one pound of carbonate of lime requires a little more than half a pound of quick lime for its precipitation, we may say roughly, that for each grain of carbonates in a gallon of water, we should need one-tenth pound of lime for treating 1,000 gallons, this referring, of course, to the incrusting carbonates of lime and magnesia. With lime at 50 cents per barrel of 200 pounds, a water containing 40 grains of carbonates of lime and magnesia, would cost but one cent for the necessary amount of quick lime; the cost of labor would depend mostly upon the size of the plant, as a large one would require no more attention, perhaps, than a small one. The hard scaling waters are more costly to treat by six or eight times. Sulphate of magnesia alone, does not form boiler scale, but when present with carbonate of lime, a reaction takes place, and sulphate of lime is formed. When 300 degrees temperature is reached, this is precipitated, making a hard, cement-like coating on the flues and sheets. In order to remove these sulphates from the water before it is supplied to the tender, it is treated with carbonate of soda, or soda ash, as it is commonly called. The chemical reaction produces carbonate of lime and sulphate of soda, so that the carbonate of lime will settle, as before. As one pound of sulphate of lime requires .85 pound of 58 per cent. soda ash for its precipitation, it will require one-eighth of a pound for each 1,000 gallons containing one grain of the sulphate per gallon, and as soda ash is worth about one cent a pound, we could treat only eight grains per gallon for one cent per thousand gallons. The cost of treatment will thus be seen to depend entirely upon the ingredients in the water.

Corroding materials, such as acids and chloride of magnesium, may be neutralized with quicklime or soda ash, chloride of magnesium requiring about the same amount of soda ash as sulphate of lime.

Many of the large railroads in this country have now gone very extensively into water treatment. The Southern Pacific has made, by Mr. Howard Stillman, a very complete organization for this work, and reports are constantly issued on this subject. From some at hand it appears that the cost of chemicals varies from one to five cents per 1,000 gallons. They grade the waters as follows, according to the grains of incrusting matter per gallon:

Good, less than 12 grains per gallon.
Fair, 12 to 20 grains per gallon.
Poor, 20 to 30 grains per gallon.
Bad, over 30 grains per gallon.

Mr. G. M. Davidson, of the Chicago & North-Western, has taken the matter up actively, and states the cost at from 1 to 10 cents per 1,000 gallons. The Union Pacific costs have been stated by Mr. J. B. Berry from one-third cent to 3½ cents per 1,000 gallons for chemicals only. On the Sante Fe, while the majority of waters would need for chemicals, from 1 to 5 cents' worth per 1,000 gallons, some waters ran higher, in one case reaching 21 cents. This latter, however, it was not practicable to treat, and it was abandoned as a water station.

While carbonate waters can be easily and cheaply treated, and a comparatively pure water supplied to the boilers, it is not so with sulphates of lime and magnesia. After the reaction, the carbonate of lime formed, settles to the bottom of the tank, and can be blown off as "sludge," but the sulphate of soda, the soluble result of the chemical change, goes into the boiler and, if in large quantities, or allowed to become concentrated by evaporation, causes foaming. Soluble matter of over 30 grains per gallon will be likely to give trouble on a locomotive, on account of the constant agitation, although 50 or 60 grains can be endured in a stationary boiler. This is illustrated by the analyses before and after treatment of a water from a driven well, in the middle west:

	Grains, per gallon— Before treatment.	After treatment.
Carbonate of lime	24.39	2.26
Carbonate of magnesia	1.18	.88
Sulphate of lime	6.22	...
Sulphate of magnesia	13.33	...
Chloride of sodium	1.21	1.27
Sulphate of soda	5.58	26.32
Incrusting solids	46.88	3.54
Soluble salts	6.79	27.81

Here we notice after treatment, an increase of 21 grains per gallon in the soluble salts—slightly greater than the sulphates of lime and magnesia (which total 19½ grains in the raw water), but the carbonates have practically disappeared. If we take a water such as the following, which is found in the southeastern part of Colorado, we are sure to have trouble after treatment:

	Per gallon.		Per gallon.
Carbonate of lime	10.67 grains.	Sulphate of magnesia	13.52 grains.
Sulphate of lime	19.01 "	Sulphate of soda	17.82 "
Carbonate of magnesia	1.13 "	Chloride of sodium	1.17 "

This water untreated, will form a hard scale on account of the sulphate of lime; if treated with lime and soda ash, the carbonates can be settled and drawn off, but there will remain in solution from the sulphates of lime and magnesia about 33 grains of sulphate of soda, in addition to the 17.82 grains already in the water, making a total of about 50 grains, which would certainly give trouble from foaming.

The Southern Pacific does not think it advisable to treat water if the soluble alkalies exceed thirty grain per gallon (whether naturally contained or introduced by chemical reaction), as troubles from foaming in road service with losses included may largely exceed the cost of boiler repairs due to incrustation. As an example of this, one of their California waters which analyzes as follows:

	Per gallon.		Per gallon.
Carbonate of lime	12.42 grains.	Sulphate of magnesia	10.67 grains.
Sulphate of lime	2.39 "	Sulphate of soda	11.32 "
Carbonate of magnesia	2.97 "	Chloride of sodium	9.62 "

is considered by them as untreatable, for the reasons given above, viz., that if the sulphates of lime and magnesia were changed to carbonates and sulphate of soda, the soluble salts as a total would amount to over 30 grains per gallon. Another California water contains but 12 grains of carbonates and practically no incrusting sulphates, but has 45 grains of salt to the gallon, and is considered untreatable also. Under such cases, it seems that nothing but distillation will get rid of the matter in solution. Tannic acid and boiler compounds have been tried, but they are only partly successful.

DISTILLATION.

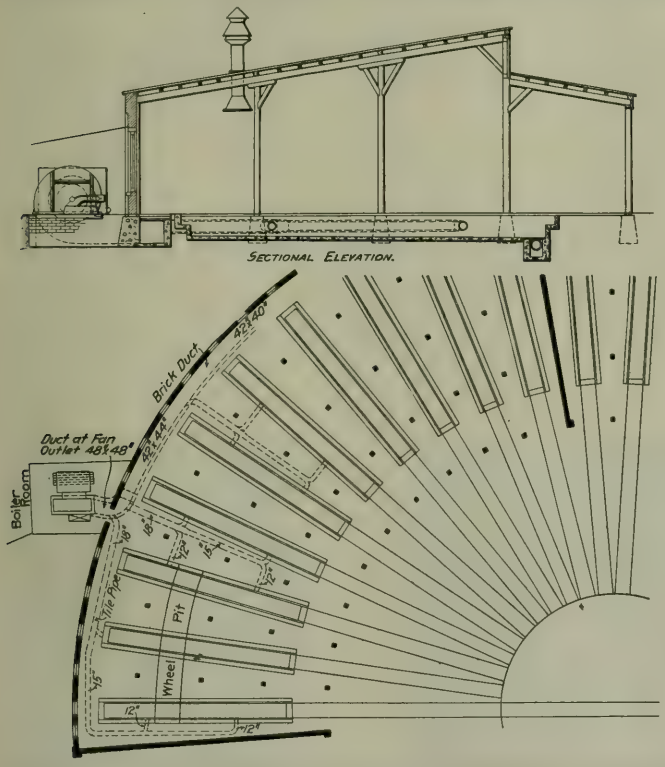
Under ordinary conditions, the cost of this method of purification would be prohibitive, as can be plainly seen by a few simple calculations. Good coal should evaporate 10 lbs. of water for each pound burned, from and at 212 deg. Fah., at atmospheric pressure. 1,000 gallons, weighing about 8,000 lbs., would therefore require 800 lbs. of coal, and at $1.00 a ton, this would mean 40 cents a thousand gallons for fuel alone. Multiple effect stills, however, can be procured, which will reduce the fuel consumption. The Yargan apparatus will distil water at the rate of about 40 lbs. per pound of coal, and the Goss still will double this. Under these latter conditions, 1,000 gallons of water would require but $\frac{8000}{80} = 100$ lbs. of coal, and at $1.00 per ton, the cost for fuel would be 5 cents. As in the treating plants, the labor would depend upon the size of the plant.

and as there are many railroads that obtain their coal at less than $1.00 a ton, it is apparent that conditions may exist where the cost of distillation will not exceed that for chemical treatment, and the latter is not available for foaming waters. Such a still was experimented with in the California desert on water containing over 350 grains of soluble alkali per gallon, and this was readily reduced to a workable strength, that is, less than 30 grains per gallon. At this point it was customary to haul water nearly 60 miles, making it cost fully 30 cents per thousand gallons. Fuel could be supplied at this point at the rate of $1.00 a ton, and allowing for labor and repairs, the cost of distilled water would run about 13 cents per 1,000 gallons, a reduction of 17 cents under the cost by hauling in trains. There are many places in the west where the combination of cheap fuel and foaming water naturally suggests this method of purification, but for the ordinary carbonates of lime and magnesia, the chemical treatment is the proper course to pursue. The cost in any case, can be estimated as above outlined.

(To be continued.)

Heating and Ventilation System for a 20-Stall Roundhouse.

The accompanying illustration clearly shows the heating and ventilating equipment as installed in the 20-stall roundhouse of the N. Y., O. & W. R. R. at Middletown, N. Y. The equipment as shown consists of a Sturtevant blast wheel 7 ft. in diameter by 4 ft. in width. This is inclosed in a ¾-in. steel plate housing, the lower portion of which extends beneath the floor and contains the outlet through which the air is discharged into an underground duct. The



Heating and Ventilating Equipment as Applied to the Middletown Roundhouse of the N. Y., O. & W. R. R.

fan is driven by a 7 in. x 10½ in. direct-connected engine, and draws the air through a Sturtevant heater containing 6,900 ft. of 1-in. pipe. This equipment was installed to maintain a minimum temperature of 65 deg. in the building with a temperature of zero outside. It is stated that during the last winter the steam was furnished from an old engine located outside of the roundhouse, as the new boiler could not be arranged and put in place at the time. The figures upon which the apparatus operated last winter are therefore subject to change under altered conditions of equipment. It is stated that with a steam pressure of 130 lbs. on the old engine and with nights during the winter when the thermometer was from 5 deg. to 20 deg. below zero, engines came into the house completely covered with snow and were thawed out in from one to two hours. It would have taken from five to six hours to have thawed these engines out in the old roundhouse, which was equipped with steam pipes in the pits. Steam pipes in the pit are also more or less undesirable, as the men are liable to be burned aud the pipes are apt to be injured by heavy castings or other material falling on them. For the above information we are indebted to Mr. C. E. Knickerbocker, Engr. M. of W., and others.

Car Accountants' Annual Meeting.

The second annual meeting of the Association of Transportation and Car Accounting Officers was held at the King Edward Hotel, Toronto, Canada, June 20 and 21. The attendance of members was all that could be desired, very few being absent. It will be recalled that this organization was started under the new name a year ago, at the twenty-ninth annual convention of the car accountants, and the eleventh of the Transportation Association, held at Washington when both these united to form one strong body; the present gathering, therefore, may also be rightly described as the thirtieth successive annual meeting of the society.

The report of the executive committee showed 168 roads had joined the organization—holding 193 active memberships, with a road mileage of 200,259 miles, and owning 1,811,917 cars; there were 84 associate members—20 representing car service bureaus, and 64 fast freight and private car lines; there are also 39 honorary members. The treasurer reported all accounts paid and a balance on hand.

No amendments were suggested to the code of per diem rules, the various points discussed under this head having relation only to the proper application and interpretation of the rules. In the operation of Rules 1, 2 and 9, it was stated that considerable amounts of per diem have been found uncollectible, or have to be held outstanding from month to month, owing to differences or errors occurring in reported dates of car movement between delivering and receiving roads; and that instead of taking prompt action to determine which of the two is responsible for payment, these roads usually throw upon the distant owning road the almost hopeless task of settling the quarrel, and of obtaining the per diem justly due. After discussion, the question was referred to the per diem committee for recommendation, the general opinion being that the delivering road should be held responsible for adjusting all such cases with the receiving road, and of reporting the result to the car owner.

The penalty rule (3) having been rendered inoperative in many cases, through errors in reports of movement of cars, the following resolution was brought forward and referred to the committee for action:

"That any road failing to report to the owner the delivery of a car to connecting road, or failing to give correct information in reporting delivery of a car, shall be held responsible to the owner for all penalty which could have been obtained had proper information been supplied."

Differences of opinion having developed as to the meaning of the reconsigning clause in Rule 6, as to what constitutes a reconsignment of a car at destination to a non-per diem road—for unloading, especially in cases where such road is not mentioned in the way bill—the per diem committee was authorized to obtain particulars of a case, and to submit it to the arbitration committee of the American Railway Association for decision.

The car service committee, in emphasizing the necessity for improved methods for the economical movement of L. C. L. freight, referred—as an object lesson—to the clearing platform and transfer facilities for consolidation of loads, installed at Elizabethport on the Central of New Jersey, describing it in detail; the record of one month's work was 4,645 car loads received, and 4,430 forwarded, a saving of 215 cars or 4.6 per cent., the average loading having been brought up to 9,400 lbs. per car.

The representative of a western road also gave the result of adopting similar methods at various points, supplemented by meetings of agents for instruction; the movement of 28,000 cars having been saved in ten months' operations, greatly increasing the average load per car, and reducing the cost of movement, as well as releasing 28,000 cars for other business.

The committee's recommendations on the following subjects were adopted:

1. When a car is offered for return trip to a road over which it moved in the opposite direction one year or more previously, the

offering road shall at the same time give data of the previous movement.

2. For the purpose of establishing uniform practice in the handling of embargo notices, the transportation officer in charge of distribution of equipment as shown in columns of *The Official Railway Equipment Register*, shall be designated as the proper party to issue, and with whom to place embargo notices.

3. Baggage cars with theatrical scenery.—It is the sense of this Association that it is desirable that a card way-bill or car ticket should accompany each car of passenger equipment moved over the road in other than regular service, whether loaded or empty.

The committee on office methods and accounting, reported progress on several important subjects, as under:

1. Measures for preventing duplication of initials and numbers in marking freight equipment on the various roads.

2. The tracing of car load shipments in interline business.

3. Measures for securing accurate reports of cars placed on industrial tracks, accessible to two or more per diem roads.

4. The formulation of a concise method for computing the average miles run per car per day on home lines, the adoption of which will secure uniformity in these statistics on all roads, for comparative purposes.

In order that due consideration may be given to subjects immediately connected with transportation, it was revolved that a committee on "transportation topics" be appointed, to which all matters under that head shall be referred.

On the subject of car demurrage and car service associations, the movement for antagonistic legislation in the shape of extended time and reciprocal demurrage, was touched upon, and the fact was stated that such legislation had been enacted in three states. It was the general view that such action would injure the users of cars more than the owners, as the demurrage rules were more protective of the interests of the traders than of the railroads; and if users of cars were allowed more time to load and unload, the effect would be to reduce the number of cars available for load, and for the trade of the country. In the matter of car supply the interests of both railroad and trade were identical, also the same principle obtained as regards the prompt movement of loaded cars, so that legislation to compel the roads to do what they are bending their best energies to accomplish, seems unnecessary and anomalous.

Mr. A. J. Elliott, of the Peoria Car Service Association, addressed the convention by request, on this subject, and his remarks were enthusiastically endorsed.

The election of officers resulted as follows:

For President, H. L. Hunter, M., St. P. & S. S. M. Ry., Minneapolis, Minn.

For First Vice-President, D. E. Spangler, Norfolk & Western Ry., Roanoke, Va.

For Second Vice-President, T. S. Bell, Pennsylvania R. R., Philadelphia, Pa.

For Secretary, G. P. Conard, Official Ry. Equipment Register, New York.

For Treasurer, F. M. Luce, C. & N. W. Ry., Chicago, Ill.

For Executive Committee, I. N. Seale, Southern Ry., Washington, D. C.; H. G. Sleight, Vandalia Ry., Terre Haute, Ind.

New Orleans was chosen as the place of the semi-annual meeting in November next, and Denver for the annual meeting in May or June, 1906.

The Vienna "rapid transit" city railroad is not yet a mine of gold, though it is several years old. In 1904 its gross earnings were $1,031,608 and its working expenses $1,185,796, which is $109,400 more than the year before. When the lines were built the city was almost like New York before the first elevated railroad; but about the time it was finished the street railroads were transformed into electric lines, and served better than the rapid transit lines for most people. The number of passengers on the latter was 6 per cent. less in 1904 than in 1903.

Some Causes of Failure of Rails in Service.*

BY ROBERT JOB,
Chemist, Philadelphia & Reading Railway Co.

For a number of years a careful study of causes of rail failures has been made by the Philadelphia & Reading Railway. The method followed has been in the case of each failure to forward a portion of the rail showing the defective condition to the test department with a form giving information regarding the manufacture and service of the rail. An investigation then followed to determine the cause of the failure. In a general way it may be said that when failure occurs owing to fracture, excessively rapid rate of wear under given conditions, or crushing down in track, the poor service is generally due to one or more of the following causes, viz.: (1) Pipes in the steel; (2) presence of a considerable proportion of blow-holes; (3) excessive segregation; (4) coarse granular structure; (5) rough handling. In the first case the defect is readily shown by the appearance of the fractured end with its unwelded surfaces, and upon buffing off a section of the rail, the extent of the pipe is generally clearly shown, even without etching, as in Fig. 1. In such case the steel is in a seamy condition, and the layers readily split apart or crush down upon comparatively slight pressure, and indication of the unsoundness is usually given after a very short service. This general type is caused by failure at the mill to crop ingots down to sound steel, and such a rail is nearly always derived from metal from the top of an ingot, and almost invariably fails when tested under the drop test. When the mill inspection is watched closely and when it is seen that the test butt for the drop test is always taken from the top of the ingot, failures due to such pipes are relatively rare. A defect of this character is one of the most dangerous which can be present, since it is liable to result in sudden crushing under light pressure, and consequently it should be guarded against most carefully at the inspection.

The second cause of failure, viz., presence of considerable proportion of blowholes in the steel is probably the most common defect under present mill practice, and the one which causes the largest number of failures in service to-day.

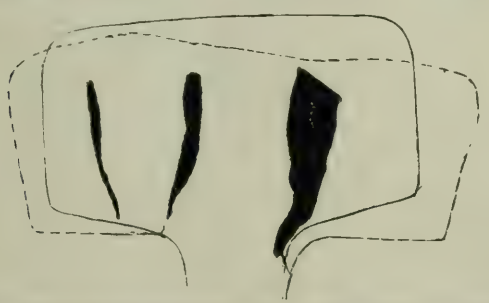


Fig. 3—Contour of Rail Shown in Fig. 4 After Service of Five Months.

Fig. 5—Contour of Fig. 6 After Two Months' Service.

Such rails usually do not fracture after a very short service unless the extent of the blowholes is very pronounced, but the defects are generally noticed by the gradual mashing down of portions of the rail, accompanied generally by flowing over at the sides of the head, and the track men are apt to complain that the rail in question is "too soft," or that it has numerous "soft spots." Analysis proves, however, that the metal is not softer than that in other rails adjoining the defective one, but upon polishing and etching the section lightly with iodine or other medium it will be found that the steel is unsound, or in other words, that blowholes, slag and other foreign matter have prevented thorough welding of the steel and have resulted in a number of seams which break up the solidity of the metal and permit a slipping apart of the unwelded surfaces under moderate pressure, causing final fracture or crushing. In some cases this condition is caused by presence of slag and of oxides in the steel, but in the greater number of instances it is simply due to blowholes, and relatively little slag or oxide is present.

Fig. 2 represents the heel of a wing rail of a frog, of the following analysis:

Carbon	0.63	Sulphur	0.078
Phosphorus	.137	Manganese	.874

This rail crushed down in service upon another road into the condition shown, in less than five weeks. Figures 3 and 4 represent a batch of rails which mashed down in a few months upon another road to the contour represented by the dotted line. The unbroken line represents the template, and the large black areas indicate holes in the steel which were formed by the elongation of the metal upon the top of the rail when the failure began. When this section was polished there was no indication of an actual pipe, but upon light etching the cause of the weakness is very evident, showing that the

*From a paper read at the Atlantic City meeting of The American Society for Testing Materials, June 29-July 1, 1905.

steel is so thoroughly unsound and porous that rapid crushing was possible.

The composition of this rail was:

Carbon	0.82	Manganese	0.88
Phosphorus	.102	Sulphur.	.053

and the heat average was:

Carbon	0.59	Sulphur.	0.074
Phosphorus	.075	Manganese	1.06

It is thus seen that a marked segregation was present as well as great unsoundness, and it is evident that the cropping at the mill had been insufficient to get to sound and reasonably homogeneous metal. These rails were furnished under the mill's own specifications and guarantee.

The tendency of some rails to flow over and form a "lip" has been referred to and this frequently is attributed to mere softness of the steel. Our experience has been that a rail with carbon as low as even 0.33 per cent. will not flow over under exceedingly heavy traffic, provided sound steel is present, with granular form fine enough to render the metal tough and strong, and in every instance of flowing over or of breaking down of the side or corner of the head, we have found presence of blowholes or other unsoundness near the surface or corners of the head of the rail, generally within one-eighth or one-quarter of an inch of the surface, whereas in the cases in which the rails have sustained long and heavy traffic we have found comparative freedom from such defects. A case of this kind which was investigated a couple of years ago will illustrate the point. A number of rails from a single rolling had mashed down in track after two months' wear to the general form represented by Fig. 5, the broken line representing the template. These defective rails were upon curves and upon tangent, and were from various heats throughout the rolling, but rails from the same heats and immediately adjoining the defective rails were unaffected by the traffic.

It was found that composition had nothing to do with the failures, but upon polishing and etching the sections we found in the cases in which flowing and splitting occurred that the steel was unsound, as indicated in Fig. 6, while the rails adjoining were in good condition were of sound steel, as indicated in Fig. 7. We have also investigated a considerable number of rails to determine whether or not the form of section exerted an influence upon the tendency to crush in service, and it has been clearly proved that ability to withstand crushing under heavy service is due not so much to any particular form of section as to the relative freedom from unsoundness in the metal. In connection with this question an examination was made about a year ago upon a lot of rails which were removed from main track and relaid in branch lines. The section had a rather deep head with contour approximating that of a wheel flange. Practically no flowing and no crushing was found in these rails after 15 years' service, while a number of rails of the A. S. C. E. section laid in adjoining parts of the same track had crushed and otherwise failed in a very few years. The composition of the different lots showed comparatively little variation, but in the case of the rails which crushed in service we invariably found unsoundness, of the general type indicated by Fig. 6, whereas in the good rails the steel was practically sound within ½ in. of the surface of the top and sides of the head. In other words, the good service was due mainly to the greater care exercised in the manufacture of the earlier rails and their consequent relative freedom from unsoundness.

Up to this point we have made little mention of granular structure of the metal, and it may be inferred that this has little influence upon the permanency of the rail in track. On the contrary we have reason to regard a uniform fine granular structure of high importance both in reducing rate of wear and in cutting down liability of fracture, but it is an unfortunate fact that the very best of steel as regards granular form or composition may be completely and quickly ruined, from the standpoint of efficiency in track, or in other words, as to its value as a rail, by failure in manufacture to ensure reasonable freedom from unsoundness. This to our mind is an integral point in the manufacture of rails, for if any material degree of unsoundness exists in the rail within a distance, say, of ¼ or ½ in. from the head or sides, and more particularly near the upper corners, unsatisfactory service under heavy traffic is almost certain to result regardless of the composition or method of rolling. Such at least has been our invariable experience. As to injurious segregation, we find that relatively few failures in track are due to this condition. If ingots are not properly cropped, or if they are allowed to remain in the furnace with the interior of the ingot in

Fig. 1—Pipe in Steel. Section Polished, But Not Etched.

Fig. 2—Wing-Rail, Unsound Steel. Service Five Weeks.

Fig. 4—Unsound Steel, Five Months' Service.

Fig. 6—Unsound Steel, Service Two Months. Crushed Down as Shown in Fig. 5.

Fig. 7—Sound Steel, Service Two Months. Rail Next in Track to Fig. 6.

Fig. 8—Segregated Rail. Broke Under Drop Test.

a liquid condition for an excessive time, segregation, of course, results, and if the test butt from each heat is taken, as should invariably be done, from the top of the ingot, badly segregated rails will fail, and consequently under such conditions careful guarding against segregation is as much to the interest of the manufacturer as to that of the consumer. Fig. 8 represents one such rail which failed under the drop test, and the extent of the segregation is shown by the fact that the proportion of carbon at the outside averaged 0.49 per cent., while at the center of head borings taken with a ¼ in. drill averaged 0.76 per cent.

Also it will be noted that blowholes extend all along the top of the head. Such cases as this are, however, rare.

Under "failures due to rough handling" we have found a considerable number from time to time. The initial fracture may, of course, occur either at the mill at straightening presses or in loading into high side cars and letting fall upon other rails 5 ft. or more below, or in letting the rails fall from the loader 6 or 7 ft. upon the ground, and the same thing, of course, may occur after receipt of the rails in unloading unless they are skidded out or otherwise gotten to the ground without any considerable shock. Careful inspection will remedy this condition. A fracture of this type is characteristic. It begins generally across the base of the rail and extends up a short distance into the web, then it works along the web sometimes for a distance of 6 ft. or more, with the face of the fracture in a plane at right angles to a vertical line down through the rail, and the steel finally snaps off up through the head. A fracture due to this cause can generally be identified at a glance and can be distinguished from a fracture caused by pipes, since the latter extend with the unwelded faces more or less parallel with the contour of the rail. To sum up, the results of our investigation indicate that the greater part of the difficulty which occurs to-day with rails under heavy traffic is due to unsound condition of the steel, a condition which existed in comparatively slight degree in the earlier rails. There has been a marked improvement in practice at some of the mills over that generally prevalent a decade or two ago, and this has resulted at such mills in producing a much finer granular form throughout the section and hence a tougher and better wearing rail if only the metal were sound, but unfortunately in the essential element of soundness of the steel there has been direct retrogression, making it appear that the main attention in the manufacture has been fixed upon quantity and not quality of the output.

The Union Pacific Gasolene Motor Car.

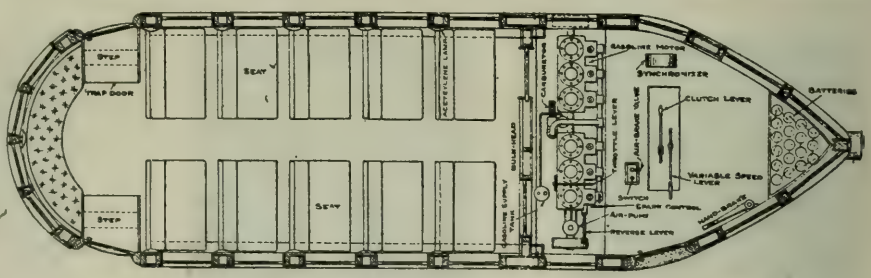
Union Pacific gasolene motor car No. 1 was described in the *Railroad Gazette* March 10th. The road has issued a pamphlet concerning this car showing a floor diagram, which is reproduced herewith, giving the following information not contained in the description above mentioned.

The motive power is a six-cylinder gasolene engine of 100 h.p. The cylinders are 8 in. x 10 in., of the upright type, placed at right angles to the center line of the car. The six cylinders are arranged and connected up in opposed sets of three each, resulting in three power-giving pulsations at each revolution of the crank-shaft.

The engine speed has a wide range of control, thus affording great economy under variation of load. A synchronizer facilitates and simplifies the changing of speeds. A reverse throttle and spark levers are all conveniently located and in easy reach of the operator. Immediately in front of him is the air-brake valve lever and the emergency spark cut-out, which enable the operator to stop the engine and apply the full brake power in less than half a second. Spark current is furnished by eight cells of battery, with a "make and break" spark device.

The clutches and controlling devices are all mechanical and of the simplest design. Special effort has been made to do away with the complicated machinery ordinarily used in utilizing gasolene power for propelling cars of this kind. By means of a special chain, the engine crank shaft drives direct on to the driving axle.

The car is intended for service on 4 per cent. grades, with frequent stops, and is therefore at present geared to a maximum speed of about 35 m. p. h., but with slight changes, if desired, it could be very easily speeded to 60 m. p. h. The acceleration of the car from standstill to 300 f. p. m. is superior to any electric car of the same horse-power. The acceleration for the first 50 ft. is much slower than the electric car (there is no uncomfortable jerk in starting); from 100 ft. on, however, the acceleration is very rapid. On a level or ½ of one per cent. grade the car starts readily on high speed, direct connected, without the use of gears; although on anything over a ½ of one per cent. grade, or with a heavy trailer, it is necessary to use the gear speeds.



Plan of Union Pacific Gasolene Motor Car.

The car is easily controlled by one operator and can be stopped and backed up at will, although it is designed to run in one direction. The vibration and noise of the engine have been almost entirely eliminated; in fact, when the car is in motion neither of these can be distinguished. The exhaust of the engine is destroyed in a muffler, the burnt gases escaping at the rear of the car without inconvenience from same.

The car was completed and turned out of the shops during the last week in March, 1905. Before being tested in actual road service it was operated and thoroughly broken in around the Omaha shops and vicinity. During these tests it was coupled to two passenger cars —a standard mail car weighing 52,100 lbs. and a standard coach weighing 60,000 lbs. These cars were successfully started and accelerated, both on a descending grade and on a 1-3 of one per cent. ascending grade, the motor thus starting a total load of 152,100 lbs.

Pulling the standard mail car weighing 52,100 lbs., a trip was made to South Omaha and return. This is up a 1.6 per cent. grade, which was ascended at the rate of 11 m. p. h., the total load pulled being 94,000 lbs. In another test the motor car successfully ascended a sharp grade of 7.8 per cent., or about 400 ft. to the mile, the car being stopped and started repeatedly on the grade.

Itinerary of Runs.—On April 2, 1905, the car was given its initial long distance run. Leaving Omaha at 10 A. M., the run was made west to Valley on the main line of the Union Pacific, a distance of 34.8 miles, and the performance of the car was most satisfactory, especially on the return trip, when the schedule for passenger trains was easily maintained.

April 10th a second test trip to Valley and return was made, the entire run—both eastbound and westbound—being practically made on high speed.

April 16th the car was sent to Grand Island, Neb., and made the entire run of 154 miles in a most satisfactory manner.

April 17th to 22nd, inclusive, the motor car was in regular service on the branch line between Grand Island and St. Paul, Neb., making two round trips, or 89 miles, each day.

April 23rd, the car made the run from Grand Island to North Platte, a distance of 137 miles.

April 24th the run was made from North Platte to Denver, 278 miles, without delay other than meeting trains, delays for orders, etc.

April 26th car made a trip from Denver to Brighton and return, distance 42 miles.

April 27th to 29th, the car was in regular service between Denver and Greeley, making one round trip of 107 miles each day.

April 30th the car ran from Denver, Col., to Laramie, Wyo., distance 164 miles. Leaving Cheyenne, the ascent of Sherman Hill, the summit of the Rocky Mountains, was made, the 27 miles of steep grade being accomplished without difficulty.

May 1st the car left Laramie for Salt Lake City. It arrived at Salt Lake City on the morning of May 4th. Since leaving Omaha April 16th it has made, entirely under its own power, a distance of 2,095 miles, and the performance of the car has been most satisfactory in every respect. May 19th it arrived at Portland, Ore., its destination, to go into regular service.

It should be stated that the car has required but slight running repairs and has not been out of commission since starting on its journey.

Certain members of councils of departments in France, and also corresponding officials of arrondissements, which are sub-divisions of departments, intimated to the cabinet that it would be well if they were provided with free passes. Their request was denied; it was looked upon as the thin edge of a wedge.

New Chief Engineer for Panama.

Mr. John F. Stevens has been appointed Chief Engineer of the Panama Canal, succeeding Mr. John F. Wallace. Mr. Stevens had been selected by the government as Government Railway Expert in the service of the Philippine Commission, under whose supervision about 1,000 miles of railroads in the Philippines were to be built with government aid. He was to have accompanied Secretary Taft on his trip recently begun to the Philippines. Mr. Stevens was born at Gardiner, Me., April 25, 1853. From 1875 to 1876 he was Assistant Engineer of the city of Minneapolis. In the latter year he took up railroad work and was Assistant Engineer on the Sabine Pass & Northwestern, the Denver & Rio Grande, the Chicago, Milwaukee & St. Paul, the Canadian Pacific, the Duluth, South Shore & Atlantic, and the Spokane Falls & Northern. He was appointed Principal Assistant Engineer of the Great Northern in 1890, and in 1895 was promoted to be Chief Engineer of that company. While in charge of the location and building of the western end of the Great Northern, he was personally engaged in engineering work of the most pioneer sort, necessitating long and dangerous trips into the mountain wildernesses. Stevens Pass, in the Cascade Mountains, was named after him. Mr. Stevens also laid out the famous "Switchback," rebuilt important sections of the road in Dakota, Montana and eastern Washington, and built the Cascade tunnel, 2½ miles long. In March, 1903, Mr. Stevens was appointed Chief Engineer of the Chicago, Rock Island & Pacific, and a few months later was elected Fourth Vice-President. In 1904 he was again promoted from Fourth-Vice-President to succeed Mr. Mather, now General Counsel and Chairman of the executive committee, as Second Vice-President. His record is clearly that of a successful engineer and manager, and there is every hope that under his leadership the work on the canal will be successfully carried on. Mr. Stevens's salary is to be $30,000, and it is reported that one of the terms on which he was appointed to the position was a pledge that he would stay in the position under all reasonable circumstances. In the official announcement of his appointment, Secretary Taft stated that the duties of Chief Engineer especially related to the practical work of construction and operation of the canal, and it was for this definite service that Mr. Stevens was selected. The technical plans for the waterway are to be determined by the Commission as a body in conjunction with the Advisory Board of Engineers recently appointed by the President. The plans thus decided from time to time will be executed on the Isthmus by the Chief Engineer. The government believes that the canal work will be more actively prosecuted under this arrangement, by which the Chief Engineer confines himself to the actual work on the Isthmus.

John F. Stevens.

Using "19" Orders for all Trains.*

On the Franklin Division of the L. S. & M. S. (single track line) trains are being operated by using the "19" order in all cases for both the superior and inferior trains, with perfect safety. The operator receiving the order displays the stop signal as per Rule 221-B (Standard Code) and delivers the order with a clearance card.

When an operator has orders or clearance cards to deliver to a train which it is not desired or necessary to have stop, he leaves his train order signal in the stop position, and when the train is approaching he goes out upon the track and gives the engineman a "Proceed" hand signal, using a white flag by day and a white light by night. The engineman will then approach and pass the operator at such a rate of speed as to enable him to hand on (by use of the hoop) the orders and cards to both the engineman and conductor. When delivering orders, the operator must note plainly by figure, upon the last order received, the total number of orders for delivery to the train. Conductors and enginemen use the number as a check to know that they receive all orders for them. In case the engineman or conductor should muff the orders, or if there is anything wrong with an order, they must stop the train and must not proceed until the orders have been received and understood.

We also use the middle order.

By using the "19" order for all trains, the dispatcher can handle a greater number of trains on his division and do better work, than he can by using the "31" order, and I consider it can be done with perfect safety. The "19" order can be used as a hold order, the same as a "31" order, by using the X response. In handling trains by "31" order, a despatcher will usually place the orders for a train at a watering station or some other favorable place, where trains can start without trouble, and thus a train will sometimes receive several orders at one station. It is not well for trainmen to receive too many orders at one time. Train orders should be as short as possible. Sending a long or complicated order, or putting orders in the hands of the trainmen two or three hours before they are fulfilled is apt to cause misunderstanding and to lead to orders being overlooked. By using the "19" order the despatcher can place the order for the superior train one or two stations in advance of the meeting point, and deliver it without stopping the train. The order is then kept in mind by the trainman, and at the same time the train is not being delayed waiting for the conductor to walk 60 to 100 car lengths to sign orders, and you do not have to run the chance of enginemen breaking a knuckle or pulling out a draw bar while starting a 3,500 or 4,500 ton train.

*A paper by T. D. Dillmin, of the Lake Shore & Michigan Southern Ry., Youngstown, Ohio., presented at the 18th Annual Convention of the Train Dispatchers' Association, at Denver, June 20.

American Society for Testing Materials.

The eighth annual meeting of this society was held in Atlantic City, June 29 to July 1. About 200 members attended. The society now has 677 members, an increase of 177 members over the number reported at the last meeting. The Secretary said that he hoped the society would continue to increase and that by the next meeting he would be able to announce its membership at one thousand. The following officers held over for another year: President, Charles B. Dudley; Vice-President, R. W. Lesley; Secretary and Treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia. W. A. Boswick and Mr. McLeod were elected members of the Executive Committee. Aside from a number of committee reports, papers were read as follows: Address by the President, Charles B. Dudley, on The Testing Engineer; A Course of Laboratory Instruction in Testing Materials, W. K. Hatt; A Course in Properties of Materials, G. L. Christensen; Plan and Scope of the Proposed Investigation of Structural Materials Under the Auspices of the U. S. Geological Survey, J. A. Holmes and Richard L. Humphrey; The Collective Portland Cement Exhibition and the Results of the Tests Made at the World's Fair, St. Louis, Richard L. Humphrey; Normal Consistency Tests of Neat Cement, Topical Discussion introduced by R. S. Greenman; Economical Mold for Forming Compressive Test Pieces for Concrete, Clifford Richardson and C. N. Forrest; Slow-Pulling, Early-stage Rotary Portland Cement vs. the Ordinary Early-strength-developing Product, W. A. Aiken; British Standard Specifications for Cement, with Introduction by R. W. Lesley; Impact Tests of Asphalt Paving Mixtures, Clifford Richardson and C. N. Forrest; Standard Specifications for Preservative Coatings for Steel, Topical Discussion by C. B. Dudley, Robert Job, A. H. Sabin, Maximilian Toch and Cyril de Wyrall; Proper Methods in Conducting Painting Tests, G. W. Thompson; Protection of Iron and Steel Structures by Means of Paper and Paint, Louis H. Barker; What is the Best Method of Painting Steel Cars? Topical Discussion introduced by F. P. Cheesman, G. W. Thompson and S. M. Evans; Some Causes of Failure of Rails in Service, Robert Job; Influence of Methods of Piling Staybolt Iron on Vibratory Tests, H. V. Wille; A Preliminary Report on Tests of Nickel Steel and

Carbon Steel Under Combined Stresses, E. L. Hancock; A Comparison of Standard Methods of Testing Cast Iron, Richard Moldenke; Hard Cast Iron: The Theory of One of its Causes, Henry Souther; The Thermite Process in American Practice, E. Stuetz; A Large Hydraulic Testing Machine for Uniform Loads, Robert A. Cummings; Specifications for Cotton Tapes for Electrical Purposes, R. D. DeWolf; Rail Sections as Engineering Structures, P. H. Dudley.

Papers in the above list which are of particular interest to railroad men will be printed in whole or in part in future issues of the *Railroad Gazette*.

The Use of Superheated Steam on Locomotives.*

(Continued from Vol. xxxviii., Page 757.)

RESULTS.

The results obtained from superheating appear invariably to have shown a decided economy. Starting with the instance previously referred to as reported by Trevethick, in which an economy of 30 per cent. was obtained with an unknown degree of superheat, but in which 7 per cent. of the total coal burned was used in the superheater, all of the various tests show a remarkable agreement in results. A short statement of a number of experiments, which follows, is interesting as showing a general agreement among a number of investigators:

Hirn, in a report issued in 1857, describing the results of various experiments carried out by himself on a simple engine working at a pressure of 55 lbs., obtained economies of from 20 to 45 per cent. with steam superheated to from 410 deg. to 490 deg.

John Penn, before the Institute of Mechanical Engineers in 1859, reports on a condensing marine engine on the S. S. "Valetta," 260 h.p., boiler pressure 20 lbs., boiler heating surface 4950 sq. ft., superheater forty-four 2-in. tubes in smoke-box, superheating surface 720 sq. ft., superheat 100 deg. F. Saving, 20 per cent. in fuel.

John Ryder, in a paper before the Institute of Mechanical Engineers, 1860, reports on a condensing marine engine on the S. S. "Buster," boiler pressure 10 lbs., superheater, two return-pipes over fire, superheat 144 deg. Saving, 25 per cent. in fuel.

Bryan Donkin, article in *Engineering*, 1891, reports on a simple non-condensing horizontal engine, boiler pressure 50 lbs., revolutions 220, superheat 50 deg. F., saving, 15 to 27 per cent., dependent on cut-off (probably water consumption). Higher temperature of cylinder walls noted.

W. H. Patchell, paper before Institute of Mechanical Engineers in 1896, reports on a horizontal tandem compound condensing engine, 300 h.p., cylinders 18 in. and 36 by 48 in., boiler pressure 100 lbs., superheater, Hick, Hargreaves & Co., superheat 42 deg. to 55 deg., economy in water, 9.6 per cent.; in coal, 19 per cent. (indicates part gain due to more efficient boiler results, water evaporated per pound coal, increase 13 per cent).

Other tests on Lancashire boilers show a very similar result, considerable gain being shown in water evaporated per pound of coal.

There are any number of similar instances in stationary practice, and it is significant that such decided gains have invariably been obtained from simple non-condensing engines, and this fact would lead to the expectation of decided benefits in locomotive work.

The tests of the first locomotive equipped, Hanover No. 74, which were reported by Mr. Garbe in his paper of 1902, showed excellent results in comparison with two similar, but compound locomotives Nos. 73 and 49. On a nine days' test from October 16 to 25, 1901, running passenger trains averaging 35 axles and 360 tons from Grunewald to Saumerfauld and back (104 miles), the superheated locomotive consumed per train mile 34.2 lbs. of coal and 206 lbs. of water, with an evaporation of 6.05 lbs. of water per pound of coal. The compound locomotives consumed 37.8 and 38.2 lbs. of coal, respectively, and 279 lbs. of water per train mile, the evaporation in their case being 7.37 and 7.30 lbs. of water per pound of coal. The compound locomotives therefore required 11½ per cent. more coal and 30 per cent. more water than the superheater, but the boiler of the latter was evidently less efficient, as an evaporation of 7.35 lbs. saturated steam would equal 6.60 lbs. superheated 200 deg. Other tests with locomotives 2069 and 2070 showed equally good results, a saving of about 15 per cent. in coal being obtained with a steam temperature of about 520 deg. A large number of indicator diagrams from these tests are shown in Mr. Garbe's paper, and they are exceedingly satisfactory.

In 1901, trials were made by Mr. Von Borries on the Royal Hanover Railway, between a four-cylinder compound, No. 11, a two-cylinder compound, No. 38, and the first engine fitted with the smoke-box superheater, No. 86. These engines were all 2-4-0 passenger engines with driving wheels 78-in. diameter, No. 11 having 13-in. and 20½-in. cylinders, No. 38, 18.1-in. and 26.8-in. cylinders, and No. 86, 18.9-in. The length of run from Hanover to Stendel was 93½ miles. In these tests the consumption of coal and water and evaporation was as follows:

Engine No.	Coal per Mile.	Water per Mile.	Water per Lb. Coal.	Relative Coal.	Consumption Water.
11	38.8	280	7.27	98.0	110
38	37.8	294	7.78	95.5	115
86	39.6	255	6.44	100.	100

The superheater engine, while showing a saving of 10 to 15 per cent. in water as compared with the compounds, showed a loss of 2 to 4½ per cent. in coal, but this test has occasioned a large amount of controversy in Germany, and Mr. Garbe has pointed out that on the run on which these trials were made, the trains were lighter and the line less severe than in the case of the trials of engine No. 74, yet the coal and water consumption in the case of engine No. 86 was considerably greater than that of No. 74. Any one desiring a critical analysis of these tests can be gratified by referring to the Bulletin of the International Railway Congress for February, 1904, in which translated papers by Mr. Teuscher and Otto Berner were published.

In 1902 Mr. Von Borries made further trials between two new four-cylinder compounds, Nos. 17 and 18, two new superheated simples of the Schmidt smoke-box type, Nos. 439 and 440, and one two-cylinder compound, No. 42. The grate area of all these engines was the same, 24.43 sq. ft., and the heating surface of the three types, 1,277, 1,134 and 1,345 sq. ft., respectively. The boiler pressure of Nos. 17 and 18 was 210 lbs. and that of the others was 180 lbs. A large number of runs were made between Stendel and Hanover, the mean speed over a distance of about 75 miles averaging 54 to 56 miles per hour. The drawbar pull for the train was calculated by the formula:

$$T = W\left(0.8 + V\frac{V+80}{17{,}300}\right)$$

that of the locomotive by:

$$T = W\left(1.9 + V\frac{V+48}{5{,}760}\right)$$

where T is tractive force in pounds, W weight in tons (2,000 lbs.), and V, speed in miles per hour. The average temperature of the superheated steam in Nos. 439 and 440 was 527 deg., and the averages of the more important results were as follows:

Description	Nos. 17 and 18	Nos. 439 and 440.	No. 42.
Number of runs	20.	22.	12.
Duration of run, minutes	112.3	108.5	114.7
Net time of trip, minutes	107.3	103.5	109.7
Mean speed for 75 miles	54.8	56.4	54.
Weight of train, tons	315.	302.	284.
Water per round trip, pounds	51,160.	45,780.	50,100.
Coal, per round trip, pounds	6,662.	7,030.	6,472.
Water per mile, pounds	35.7	37.6	34.6
Coal per mile, pounds	274.	245.	268.
Water evaporation by coal	7.67	6.54	7.78
Relative evaporation	117.	100.	119.
Coal per H. P. hour, total pounds	2.08	2.17	2.32
Relative consumption	96.	100.	107.
Coal per H. P. hour at drawbar, lbs.	3.65	3.76	4.46
Coal per square ft. grate per hr., lbs.	76.3	83.3	73.2

In this test the superheater simple obtained results practically equal to the four-cylinder compound and superior to those of the two-cylinder. It was also worked rather harder, the average speed of the runs made by it being 2.9 per cent. greater than those made by Nos. 17 and 18. The boiler performance is again inferior to the engines without superheater, although better than that usually obtained in America, but as the superheat was about 150 deg., had the boiler efficiency been the same as on Nos. 17 and 18, the evaporation would have been 7.1 lbs. of water per pound of coal, and in place of the four-cylinder compound showing a gain in coal per total horse-power hour of 4 per cent., it would have shown a loss of 3 per cent. As a confirmation of this test, Mr. Von Borries states that the consumption of coal per mile for the same engine in regular passenger service was, during six weeks, 39.42, 40.16 and 39.81 lbs. per mile for these types, respectively, figures which agree fairly well with those obtained on trial. In some similar trials on the Halle Railway between the same class of four-cylinder compounds and simple superheaters, the results were as follows:

Description.	4-cyl. compound.	Simple superheater.
Coal, lbs. per mile	38.9	37.9
Relative consumption	103	100
Water, lbs. per mile	270.2	226.5
Relative consumption	119	100
Evaporation	6.96	5.98
Relative evaporation	116.5	100

In this test, the superheater engine has a slight advantage in coal consumption, but there is the same large difference between the water and coal figures, showing a decreased boiler efficiency in the superheater. Some 0-8-0 freight engines were also tested on the Royal Saarbrucken Railway, the superheater engines being simple and weighing 122,000 lbs., the two-cylinder compounds weighing 117,000 lbs., the train loads being practically proportional. The results were stated per 1,000 miles per axle and were as follows:

Description	Compound.	Superheater.
Coal burned, pounds	605.6	567.3
Relative performance	107.	100.
Water used, pounds	4,459.	4,070.
Relative consumption	110.	100.
Evaporation	7.38	7.18
Relative evaporation	103.	100.

It will be noticed that the boiler performance of the superheater in this case is decidedly better and that while the economy in

*Extract from a paper by H. H. Vaughan, Superintendent of Motive Power, Canadian Pacific, read before the American Railway Master Mechanics' Association, June 16, 1905.

water is not as great as in previous trials, yet the coal economy is better. This may be due to the engine not having been worked as hard as in the previous trials, and consequently those gases passing through the superheater would not leave it at so high a temperature. These tests have been presented at some length to show the possibility of a substantial economy in water being neutralized by a loss in boiler efficiency, and by this is not meant the decrease in the evaporation due to the additional amount of heat in the steam delivered to the engine, but a further decrease, which can only be due to one of two causes, the gases that pass through the superheater leaving it at too high a temperature or the reduction in the number of flues used for evaporative purposes increasing the velocity of the gases in those flues so that their temperature, when leaving, is too high. The latter reason does not appear possible and the Schmidt smoke-box superheater is certainly very liable to lead to the first, although it can be avoided by proper adjustment, and it appears probable that the poor boiler results in these trials may be accounted for in this way. It should be noted, therefore, that the superheater simples showed an economy in water of 14 to 15 per cent. over a four-cylinder balanced compound in passenger service which, allowing an average of 150 per cent. of superheat, would permit of an economy in coal of about 7 per cent., and that the average coal consumption in passenger service is actually the same, and in freight service better than the compound engine. An extensive test was carried out by Mr. Strahl, of the Breslau District of the Prussian State Railways, between two 2-4-0 passenger locomotives, No. 9 simple and No. 54 compound, equipped with the Pielock superheater, and two similar engines, No. 4 simple and No. 60 compound, using saturated steam. The results are given in the following table:

Description	No. 4.	No. 9.	No. 60.	No. 54.
Diameter of cylinder	16⁵/₁₆	16⁵/₁₆	18¼ and 26²⁵/₃₂	18¼ and 26²⁵/₃₂
Stroke	23⅝	23⅝	23⅝	23⅝
Diameter of drivers, inches	78	78	78	78
Heating surface, square feet	1,349	1,123	1,270	1,044
Superheater surface, sq. ft.	226	226	226	226
Grate area	24.43	24.43	24.76	24.76
Average weight of train, including engine and tender	283	283	309	309
Distance run, miles	1,193	1,193	2,360	2,360
Working pressure, pounds	170	170	170	170
Temperature of superheated steam in dome	500	500	446	446
Temperature of feed water, deg.	50	50	50	50
Average consumption of steam per hour, pounds	9,568	8,069	11,618	10,459
Average consumption of coal per hour, pounds	1,195	1,047	1,574	1,519
Economy of water, per cent.	16	16	10	10
Economy of coal, per cent.	12.3	12.3	3.5	3.5
Water evaporation per lb. coal	8	7.70	7.70	6.88

In these tests the saving in water was accompanied by a corresponding saving in fuel, although in the compound superheater the boiler performance drops off a little, although the superheat is low and, in fact, the superheat in these trials was only moderate and not as high as that advocated by Schmidt. In an article written by Mr. Strahl giving the results of his experiments, he arrives at the result that the locomotive with the superheater used almost exactly the same volume of steam as the locomotive without, and Mr. Strahl has also advised that this approximation holds very closely for other engines using superheated steam. He states that for several months some 0-8-0 engines with Schmidt smoke-box superheater have been compared with the same class without the superheater, and that the resulting economy in water has been 25.3 per cent., and in coal 15.25 per cent. On the basis of equal volumes with the degree of superheat obtained, the figures would have been 24 and 17 per cent., respectively. An interesting result arrived at by Mr. Strahl is that flat slide valves worked satisfactorily up to 520 deg. F. The German trials described above are remarkably uniform in one respect—the considerable water economy effected by superheating—and they also show that while a falling-off in boiler efficiency must be guarded against, it need not occur, at any rate, beyond 2 to 5 per cent. In the tests made by Mr. Von Borries, it must be remembered that the engine with which the superheater simple was compared is the most efficient type of compound, that the water economy shown in comparison with it is a high recommendation for the superheater, and in view of the probable improvements in boiler performance, it will, no doubt, in the future, be possible to show a corresponding economy in fuel.

Turning from the results obtained abroad to those in America, the only figures so far available are those on the Canadian Pacific, and on this road the records available are those obtained in service over a considerable period. These results, after all, must be the deciding ones, as in view of the influence of the boiler efficiency on the net economy, isolated tests will always be more or less unsatisfactory. It is possible to determine the water consumed per unit of power developed with considerable accuracy, but in determining the water evaporated per pound of coal, a factor must be taken into account that is independent of the boiler, and nearly everything else on the road, in the efficiency of the fireman. It is quite possible, on a test, to obtain an evaporation that is decidedly better than that realized day after day in service, and while no doubt careful tests are desirable, and it is the intention to carry them out as soon as a dynamometer car is available for the purpose, yet the service results are so far satisfactory and are interesting as showing the economy actually obtained.

The records from engine No. 548 extend over a period of 17 months, during which time this engine was compared with similar simple and Vauclain compounds in freight service and with simple and two-cylinder Pittsburg compounds in passenger service. The dimensions of the various engines are as follows:

Engine No.	548	616	595	634	482
Type	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0
Kind	Simple S. H.	Simple	Compound	Simple	Compound
System	Schmidt S'box	.....	2-cylinder Pittsburg	.....	4-cylinder Vauclain.
Cylinders	18 x 24	18 x 24	20 & 30 x 24	18 x 24	13½ & 23 x 24
Drivers, inches	62	62	62	62	62
Heating surface, fire tubes and fire-box, square feet	1,116	1,291	1,291	1,428	1,614
Grate area	23.44	23.44	23.54	28.54	28.54
Boiler pres., lbs.	180	180	180	180	200
Wt. on drivers pounds	96,800	95,400	96,800	94,350	94,100
Total wt., lbs.	124,000	119,250	123,400	119,325	129,225
Superheating-surface, square ft	307	.....	.....	.....	.....

These engines were compared for periods in which they were running in corresponding service to No. 548 between Montreal and Smith Falls, a practically level division with rolling grades with a maximum of 0.5 per cent., and the results were as follows: The column marked "Relative Economy," in each case showing the amount of coal consumed by engine No. 548 as compared to the engine with which it was tested:

	Engine.	Engine, Miles.	Ton-Miles, Thousands.	Coal Tons.	Coal per 1,000 Ton-Miles.	Relative Economy.
May, 1903, to December, 1903, Freight	548	34,493	33,183	1,514¾	93	81.5
	482	31,857	30,457	1,741¾	114	100.
January, 1904, to May, 1904, Freight	548	16,812	14,404	931	129	74.
	616	15,722	13,248	1,167	176	100.
June, 1904, to September, 1904, Passenger	548	15,768	2,451	467¾	382	81.5
	595	16,128	2,560	600	469	100.
	634	16,854	2,750	680¼	495	105.

Noting that Nos. 616 and 634 are simple engines and Nos. 595 and 482 are compounds, these results show satisfactory agreements and would show that this engine consumed about 75 per cent. of the coal required by a simple engine, and 82 per cent. of that required by a compound in similar service. The superheat obtained in this engine is, however, high, running from 550 deg. to 650 deg., according to conditions, and it may be considered as representing the extreme limit to which superheating can be conveniently carried. There is no doubt that the results that have been obtained are exceptionally economical and the engine has been a favorite with the men handling it in any service. The valve and cylinder arrangements of this engine were designed by Mr. Schmidt and have given entire satisfaction at the temperature mentioned above, although when the superheat was raised above 700 deg. a certain amount of trouble was experienced with the lubrication and packings.

The results from engines No. 1000 and No. 1300 extend over a period of nine and eleven months, respectively, during which time these engines were compared with engines identical in every respect except that of not being equipped with a superheater. The dimensions of these engines are as follows:

Engine No.	1000	996 and 997	1300	1319
Type	4-6-0	4-6-0	4-6-0	4-6-0
Kind	Compound S. H.	Compound	Compound S. H.	Compound
System	2-cyl. Schmidt fire tube	Pittsburg 2-cyl.	2-cyl. Schenectady, fire tube	2-cyl. Schenectady.
Cylinders	22 and 35 x 26	22 and 35 x 26	22 and 35 x 30	22 and 35 x 30
Drivers, in.	63	62	62	62
Htg. surf.*.	1,888	2,420	2,492	3,065
Superheating surf., sq. ft.	350	....	390	....
Grate area, square feet	33.02	33.02	44.08	44.08
Boiler pressure, lbs.	210	210	200	200
Weight on drivers, lbs.	129,000	128,000	141,000	141,000
Total weight, pounds	172,000	169,000	192,000	190,000

*Heating surface, fire tubes and firebox, square feet.

Engine No. 1000 was compared with Nos. 996 and 997 for periods in which they were running in corresponding service between Montreal and Smith Falls in freight service. Engine No. 1300 was compared with No. 1319 in corresponding service between Chalk River and North Bay, and North Bay and Cartier; these divisions are very similar, Chalk River to North Bay being an undulating road with several grades four to seven miles long with occasional stretches of 1 per cent., but more generally 0.6 to 0.8 per cent., the total rise on the division being 135 ft. From North Bay to Cartier, the road is undulating, except for one rise of 480 ft. in 16 miles, the limiting grades being 1 per cent. and the total rise 230 ft. The results were as follows, arranged as for engine No. 548:

	Engine No.	Engine, miles.	Ton-miles, thousands.	Coal, tons.	Coal per 1,000 ton-miles.	Relative economy.
Montreal to Smith's Falls:						
January to July, 1904	1,000	21,567	25,321	1,571½	100	72
	997	19,662	23,278	1,499¼	129	100
August to Sept., 1904	1,000	3,740	4,657	188½	81	70
	996	5,666	7,026	409¾	116	100
Chalk River to North Bay:						
Nov.,1903, to Sep.,1904	1,300	22,987	17,075	1,127½	132	90
	1,319	19,983	15,091	1,112½	147	100
North Bay to Cartier:						
Nov.,1903, to Sep.,1904	1,300	10,964	9,887	550¼	111	84
	1,319	10,521	9,249	616½	133	100

These results are rather more favorable to the superheater engines than would have been expected, espcially in the case of engine No. 1000, where it will be seen that this engine gave considerably better comparative results that No. 1300. These engines also being equipped with the smoke-tube type of superheater, did not obtain the same degree of superheat as No. 548, generally running from 500 deg. to 550 deg. There was a certain amount of leakage from the boiler of Nos. 1000, 996 and 997 class during the period, which makes the comparison of less value than those for No. 548 and No. 1300, but in spite of this, the results are evidently satisfactory.

The results from 20 Schmidt smoke-tube superheaters and 21 Schenectady superheaters have been obtained over a period of four months. These engines could not be compared with similar engines, but they are compared with the 1300 class referred to previously and with a class of compound consolidations termed the 1200 class. As will be seen by the table below, these consolidations, although lighter, are a very similar engine in every respect to the superheaters, as they are comparative in their dimensions and have the same grate area and type of boiler. The dimensions of these engines are as follows, the Schmidt superheater being the 1600 class and the Schenectady superheater the 1621 class:

	1200.	1600.	1621
Type	2-8-0	2-8-0	2-8-0
Kind	2 cyl. compound.	Simple superheater.	Simple superheater.
System	Schenectady.	Schmidt smoke-tube.	Schenectady smoke-tube.
Cylinders	22 and 35x28	21x28	21x28
Drivers	57 ins.	57 ins.	57 ins.
Htg. surf.*	2,218 sq. ft.	2,381 sq. ft.	2,870 sq. ft.
Superhg. surf.	.....	375 "	340 "
Grate area	43.64"	42.64"	43.64"
Boiler press.	200 lbs.	200 lbs.	200 lbs.
Wt. on drivers.	143,000 lbs.	164,000 lbs.	164,000 lbs.
Total weight	162,000 lbs.	186,000 lbs.	186,000 lbs.

*Heating surface, fire tubes and firebox.

The results obtained from these engines were as follows, the number of engines working being the actual number of different engines of the class included in the figures each month and the comparative economy being that of the various engines compared with the 1200 class where possible, or if none of those engines were working, with the 1300 class, and in one case with the 1621 class. The column, 1600 to 1621, shows the percentage of economy, or if negative, the loss of the 1600 over the 1621 class:

	Engine.	No. of class running.	Ton-miles thousands.	Total coal, tons.	Coal per 1,000 E. G. ton-miles.	Relative economy.	1600 to 1621.
		Chalk River to North Bay.					
January	1200	12	7,077	7171/2	202	100	21
	1300	1	865	803/4	199	98	
	1600	5	5,111	4101/2	160	79	
	1621	9	10,669	1,075	201	100	
February	1200	1	202	173/4	173	100	14
	1300	1	1,334	1173/4	173	100	
	1600	6	7,542	6123/4	162	93	
	1621	8	8,728	8241/4	188	108	
March	1200	1	316	241/2	155	100	13
	1300	1	770	56	145	93	
	1600	6	6,175	4231/4	137	88	
	1621	6	7,095	5601/4	157	101	
April	1600	5	6,179	3743/4	121	93	7
	1621	6	9,886	6451/4	130	100	
	North Bay to Cartier.						
January	1200	10	6,393	499	156	100	4
	1300	1	713	481/2	136	87	
	1600	4	2,008	146	145	93	
	1621	6	9,397	7081/4	152	97	
February	1200	2	1,590	1371/2	172	100	16
	1300	1	565	441/4	156	91	
	1600	6	6,043	4233/4	140	82	
	1621	8	5,052	429	167	97	
March	1200	3	1,377	1001/4	145	100	14
	1300	1	728	50	137	95	
	1600	5	4,825	294	121	83	
	1621	6	5,360	3781/4	141	97	
April	1200	1	365	26	143	100	8
	1300	1	191	93/4	102	71	
	1600	5	6,322	3671/2	116	81	
	1621	6	5,599	3523/4	126	88	
	Chapleau to White River.						
January	1300	3	3,735	3401/4	181	100	25
	1600	13	13,956	1,2673/4	181	100	
	1621	5	612	741/2	243	132	
February	1300	4	2,696	239	177	100	
	1600	9	13,226	1,0331/4	158	89	
March	1300	3	4,821	4001/4	164	100	
	1600	10	19,106	1,348	141	86	
April	1300	4	2,518	193	153	100	
	1600	9	11,894	7383/4	124	81	
	Cartier to Chapleau.						
January	1300	3	3,373	5223/4	191	100	12
	1600	11	14,547	1,2091/4	166	87	
	1621	7	1,170	1101/2	188	98	
February	1300	3	3,970	3323/4	167	100	
	1600	9	13,176	9963/4	151	90	
March	1300	3	3,305	2461/4	149	100	6
	1600	11	21,942	1,450	136	91	
	1621	1	265	17	128	86	
April	1300	3	2,726	2043/4	150	100	
	1600	9	12,814	7663/4	119	79	
	Megantic to Farnham.						
January	1200	6	759	1243/4	328	100	
	1621	7	13,595	2,1641/2	318	97	
February	1200	4	879	1771/4	403	100	
	1621	7	12,639	2,0601/2	326	81	
March	1200	1	170	32	378	100	
	1621	8	15,481	2,1531/4	278	74	
April	1200	1	1,033	1521/4	295	100	
	1621	8	13,923	1,8201/4	261	89	
	Farnham to Outremont.						
January	1200	8	1,120	1281/4	225	100	
	1621	4	1,800	186	206	92	
February	1200	4	1,754	211	240	100	
	1621	7	891	1051/2	263	109	
March	1200	2	1,228	1121/2	183	100	
	1621	3	821	83	202	110	
April	1200	1	49	51/2	224	100	
	1621	1	52	6	230	102	
	Newport to Farnham.						
January	1200	4	611	1021/4	334	100	
	1621	6	1,807	2611/4	289	87	
February	1200	2	946	137	289	100	
	1621	4	1,184	1773/4	300	104	
March	1200	2	1,036	1483/4	286	100	
	1621	1	282	371/4	264	92	
	Brownville to Megantic.						
January	1200	12	5,364	677	252	100	
	1621	6	12,118	1,4293/4	236	94	
February	1200	12	6,991	9821/2	281	100	
	1621	6	4,686	8013/4	342	122	
March	1200	12	7,907	9491/4	240	100	
	1621	4	9,447	1,064	225	94	
April	1200	14	6,319	7201/4	228	100	
	1621	4	7,837	9231/2	235	103	

Reference has already been made to the nature of the divisions, Chalk River to North Bay, and North Bay to Cartier, shown in the above table; Cartier to Chapleau and Chapleau to White River are practically similar, having undulating grades with 1 per cent. limit, and a maximum rise or fall of 200 ft.; both divisions are, very largely, short grades, with very little level track, but the net rise is only 110 ft. in the latter case, and the former is practically level. Farnham to Megantic is a very heavy division in the direction of traffic, rising 750 ft. in 33 miles, with grades of 0.7 to 1.0 per cent., undulating seven miles with a drop of 10 ft., limiting grades 1 per cent., falling 135 ft. in five miles, limit 1 per cent., undulating with short 0.6 and 1 per cent. grades 22 miles with a drop of 200 ft., rising 330 ft. in six miles, limit 1.3 per cent., down 330 ft. in six miles, limit 1.3 per cent., rising 640 ft. in 47 miles, with limiting grades of 1.3 per cent. and drops of 232 and 400 ft., besides smaller ones.

Farnham to Outremont is undulating with short grades of 0.6 and 0.75 per cent. Farnham to Newport is heavy in direction of traffic, rising 236 ft. in 20 miles, limiting grade 1 per cent., 119 ft. in four miles with grades 1.4 and 1.66 per cent., dropping 162 ft. in seven miles, 1 per cent. grades, undulating 18 miles, rising 422 ft. in 11 miles, 1.5 per cent. grades and dropping 255 ft. in four miles, 1.5 per cent. grades. Brownville to Megantic in direction of traffic, rising 640 ft. in 15 miles with limit of 1.2 per cent., dropping 700 ft. in 13 miles, grades up to 1.2 per cent., undulating 58 miles with grades up to 1½ miles long of 1.0 per cent., dropping 480 ft. in 13 miles, 1 per cent., undulating 11 miles, dropping 370 ft. in seven miles, grade 1 per cent.

From an inspection of this statement, which is simply an analysis of the regular road records for five months, it will be seen that the results obtained from the 1600 class are decidedly superior to those obtained from the 1621 class. This is due to the higher superheat in the former engine, which is about 100 deg. as against 50 deg. in the case of the latter; in neither is as much obtained as is desirable, but still good results have been obtained. The only case in which No. 1621 shows the better results is for a round trip in March, and it is not reasonable to place reliance in coal figures for one trip on account of no proper allowance being made for the coal on the tender. There is, however, a very general agreement that the 1621 class are equally as economical as the compounds and the 1600 class about 10 per cent. better, and while it is impossible to say definitely that this is due to the superheat, yet the fact remains that the 1200 and 1300 class engine were previously the most economical on fuel on the road, and yet, as shown, the 1600 class engines have given superior results. No doubt, the experience so far gained is hardly sufficient for a definite conclusion, but it certainly can be said that the results to date are exceedingly satisfactory.

GENERAL CONCLUSIONS.

The use of superheated steam does not entail the multitude of practical difficulties that so generally accompany any invention or improvement that is introduced to improve the economic results obtained from a locomotive, and indeed, it is probable that as experience with its application develops, some of the expenses that are incurred in the locomotive of to-day will be diminished rather than increased. There would only appear to be two possible sources of additional cost, the wear of valves and cylinders due to defective lubrication, and the cost of maintaining the superheater itself. So far as has been learned at present, the lubrication of superheater engines is not different from that of other engines, with the exception that the lubrication must be accomplished, and it is not sufficient to hope that the oil gets to the designed spot. For this purpose a positive feed lubricator is required, and this should preferably be provided with six feeds, so that pipes may be led to each end of the valve and to the cylinder. It should also be possible to vary considerably the amount of oil fed per minute, as superheater engines, even more than those of the ordinary type, require more oil when working slowly at long cut-offs than at other times, on account of the high temperature of the steam being maintained throughout the stroke. This can be effected either by supplementary oiling or by an easy adjustment of the lubricator allowing a large amount of oil to be fed at low speed, but the latter will be preferable if obtained without complication. With proper lubrication there appears to be no additional wear of valves or pistons,

and while a special mixture of metallic packing must be used, it has given, if anything, less trouble on the superheaters than on the other engines. On engine 548, in which the steam was superheated as high as 700 deg., it was found that the ordinary valve oil was not suitable and that the rod packings would melt out, but by reducing this from 550 deg. to 600 deg., these troubles were not experienced, and no difference is noticed between an operation of this and an ordinary engine. The valves used on No. 548 are Mr. Schmidt's design, but with split ring packing in place of the solid ring used in Germany, so that they are practically similar to the piston valves in general use, except in their being of smaller diameter, 6 in. for an 18-in. cylinder, and double ported. The packing rings, in place of being narrow, are comparatively wide, and on the surface there are several water grooves. These rings have given exceedingly good service, but in view of the successful use of split rings it is difficult to see any reason why valves of the ordinary design should not be entirely suitable for superheated steam, the only point to consider being whether small double ported valves would not be preferable to the large single ported valves at present in use, and whether wide rings with water grooves would not give better results than narrow plain rings. It is natural that, on account of the reduced weight of the superheated steam, a smaller admission area can be used than that required for saturated steam, but for equal flows under equal heads, the rate is only 10 to 9 and 8, for steam superheated 100 deg. and 200 deg., respectively, so that the dimensions adopted by Mr. Schmidt must be entirely ascribed to the use of double ported valves. Those engines on the Canadian Pacific having smoke-tube superheaters which have not developed the same degree of superheat as engine 548, have given, so far, no trouble with their valves, pistons and packing, when properly lubricated, and while there is room for considerable improvement in positive feed lubricators before an entirely suitable design is obtained, it is safe to say that with proper lubrication there will be no greater expense in maintaining the engine on account of using superheated steam.

The repairs to the superheater proper are at present difficult to determine; the smoke-box superheater certainly entails an additional expense when flues are renewed, as it has to be entirely dismantled in order to get at the tube sheet, but while it is said to have given some trouble in service in Germany, such has not been the case in three years' experience on the Canadian Pacific. Some trouble was at first experienced with the joint between the large tube and the back tube sheet, but this was overcome by properly thinning the edges of the lap, as in firebox construction. There has been no leakage from the various joints in the front end and, in fact, so far nothing has developed that would lead to any additional expense in maintenance.

The smoke-tube superheaters of the Schmidt type have given no trouble in service, but the arrangement of bolts and clips for securing pipe flanges to the headers is inconvenient, and it is quite difficult to make the joints perfectly tight to commence with; once tight, however, they do not appear to develop leakage, and it seems probable that by the independent bolting now arranged for there will be no difficulty in this respect. In the Schenectady type there has been no trouble with the headers, but the ends of the superheater pipes toward the fire-box have blistered in a number of cases, due to the dampers not operating properly and allowing the pipe end to become overheated; this has been overcome by welding a solid plug into the end of the pipes, which should remedy the defect as in the Schmidt design, in which steel return bends are used; this action has not developed, as the metal is sufficiently thick to stand a considerable temperature without deforming when steam is admitted. The dampers must, however, be kept in an operative condition, as otherwise, when the blower is applied with a hot fire immediately after shutting off, the pipes may be subjected to an intense heat, which is unsafe in view of their containing no steam. The 5-in. tubes have not been giving any especial trouble; in fact, they have lasted as well as the smaller tubes; this applies, of course, to good water districts, and there is no available experience to determine whether, on bad water, they would stand up until the other tubes need renewal, but it is evident that their position in the flue sheets is favorable and the circulation around them is better than around the more closely spaced fire tubes.

As a matter of fact, it is too early yet to say anything definite about the expense of maintenance of superheaters; there is, of course, a possibility of a comparatively rapid deterioration of the pipes occurring, but there does not appear to be any immediate expense that will develop in one or two years' service. On the other hand, there is the advantage of decreased evaporation for the same work that occurs in compounds on account of their increased efficiency, and there is also an advantage in the dryness of the steam and reduced liability of water in the cylinder. On the smoke-box superheater with its high superheat, it is almost impossible to work water over into the cylinder, excepting when first starting out before the apparatus has been warmed up, and while this is not the case to the same extent with moderate superheaters, it is an advantage to a certain degree.

A possible advantage of superheating has not been utilized in its application in America, namely, a reduction in boiler pressure without loss in efficiency, although in Germany this has been usual. There is no doubt that the increase of pressure from 175 to 200 and 210 lbs. that has taken place within the last few years has been of doubtful advantage. While there is a gain in economy, this is accompanied by an increase in the losses due to leakage, both in engine and boiler, and by a considerable increase in the cost and trouble of boiler maintenance. By superheating, the initial pressure becomes of less importance, and with the proper amount of superheat, it will be possible to return to pressures of 175 lbs. or less, without any appreciable loss in economy, and with a relief from those boiler troubles which have become more serious as the pressure, however, when accompanied by a corresponding increase in alone will overbalance any additional expense connected with the maintenance of the superheater.

Herr Garbe, in addition to the reduction of boiler pressure, advocates a still further advance, namely, the enlarging of the cylinders sufficiently to develop the full power of the engine, with cut-offs of 30 to 33 per cent. A reduction in power is then effected chiefly by throttling, the cut-off remaining practically constant. This method may possibly prove advisable in American passenger work, but it does not appear practicable for freight locomotives. It is evidently impossible to develop the same tractive power with a given weight on drivers, with a cut-off of 30 per cent. as with 80 per cent., since there is a greater variation in the maximum effort in the former case, and with the conditions here prevalent, where the loading is so closely equal to the capacity of the engine, a reduction in capacity could not be tolerated. A reduction in boiler pressure, however, when accompanied by a corresponding increase in the cylinder dimensions, does not affect the tractive power and would appear to be a decided advantage.

In general, therefore, it may be assumed that the maintenance of locomotives using superheated steam will not be necessarily greater than that of ordinary locomotives of similar size, as, although certain additional expenses are introduced, these are offset by economies in other directions, and the net result will not be very much different. If this position is correct, the advisability of superheating depends entirely on the relation between the initial additional cost and the saving obtained, and as, at present, the cost of applying a superheater is about $1,000 per engine, and the tendency will be rather to reduce this amount than increase it, it is evidently a very good investment. A 200,000-lb. freight engine making 30,000 miles per annum will burn about 2,500 tons of coal, which, at $2 per ton, costs $5,000, so that evidently a saving of 10 per cent. will pay 50 per cent. of the additional cost per annum, and it appears perfectly safe to state that with a superheater at least that amount can be saved. While slightly more expensive, at first cost, than compounding, there is in the application of superheated steam a possible development in locomotive engines, which obtains at least as great an economy in fuel, which is practicable and without complication in its construction, which costs nothing extra for maintenance, does not reduce the efficiency of a locomotive in any way as a mover of freight, and which, without any desire to appear too enthusiastic, certainly promises to become one of the greatest steps in the direction of economy that has been introduced for many years past.

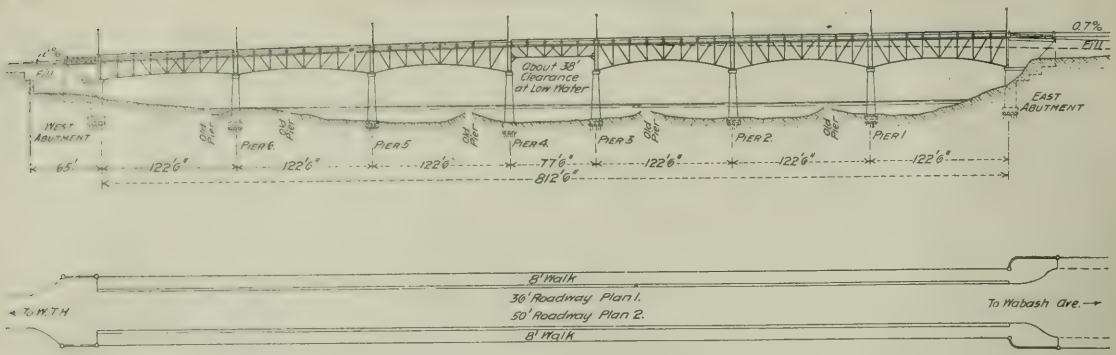
Railroad Legislation in Michigan.

While the session of the Michigan legislature just closed has not been prolific in the number of railroad bills passed, a number of measures have been enacted into law that are of interest and importance to the railroad properties in the state. The most important ones are those affecting the state tax commission and the assessment and taxation of railroad property. Under the present law the tax commission composed of five members assesses the railroad property at its true cash value, and levies against such property a tax at the average rate paid by all other classes of property for all purposes for the preceding year.

When the first assesment was made under this law, the board became satisfied that other properties were not assessed at their cash value, and levied a tax at what they determined would be the average rate upon the basis of the true cash value of such other property. This action was reviewed by the courts, and much bitterness was engendered against two members of the commission on account of their making, for the railroad companies, affidavits of their findings and belief regarding the assessment of local property, and the injustice to the railroad companies of that provision in the law, but the court held that the law was mandatory in its terms, and that no discretionary power was vested in the commission.

The laws just passed provide for the legislating out of office the present commission, effective Nov. 1, 1905, and for the appointment by the governor of a new commission consisting of three members. They also give the board power and authority, while acting as a board of assessors, to make a full and thorough investigation of all assessments in the state, and to fix the rate of tax to be paid by railroad companies upon the basis of the true cash value of all property in the state, according to their best judgment, without reference to the assessed value by the local officers.

Another measure of some importance gives the Attorney General



Plan and Elevation of New Highway Bridge Over the Wabash River at Terre Haute, Indiana.

free access to all books and accounts of the Michigan Central for the purpose of securing information to be used in suits now pending against that company by the state. This was bitterly fought by those who believed that it was in the nature of class legislation, and that all corporations and persons should be subject to the same general law upon this subject, but it became a law.

Another law gives electric and street railway companies the same right of eminent domain for the condemnation of property as is now given to companies organized under the general railroad law, and provides that the railroad commissioner may order and require fencing and farm crossings on such lines, the same as is now done with steam roads. Bills were also passed providing penalties for either steam or electric roads making crossings of the tracks of any other roads until such crossings have been regularly approved either by the commissioner of railroads or the board of railroad crossings.

Highway Bridge Over the Wabash at Terre Haute, Indiana.

This bridge, now nearing completion at the foot of Wabash avenue, replaces an old wooden Burr bridge erected in 1864 by a private company and operated as a toll bridge until bought by Vigo County in 1874. The old bridge consisted of five three-truss spans approximately 160 ft. each in length, and a short draw span of the tipping style. The grade was level and the floor about 5 ft. above maximum high water. The piers were composed of stratified limestone on wooden grillage supported by piles. The timber in the old bridge was remarkably well preserved but brash, most of it being

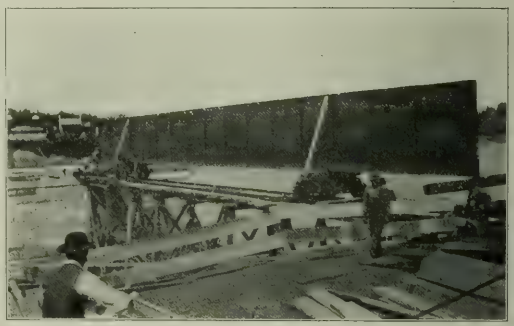
View Showing Traveler and Girders in Place.

yellow poplar in the trusses with a few main braces of oak. The masonry was so badly weather checked that it was all condemned and used for riprap around new piers.

The new bridge is composed of six 120-ft. spans and one 75-ft. span in the center. The roadway is 50 ft. between curbs and the two sidewalks are 8 ft. wide. As the War Department demanded 38 ft. clear headroom above the water under the 75-ft. span (which is a movable span without machinery until the War Department shall demand its installation), the floor is about 14 ft. above the elevation of the floor of the old bridge in the center and slopes down towards the ends with a grade of 1.225 per cent.

The six 120-ft. spans are composed of two riveted trusses about 53 ft. center to center, and three plate girders each 121 ft. 6 in. long. The trusses have the centers of the top chords 4.5 ft. above the top of the curb and form a barrier between the roadway and the sidewalks. The sidewalks are supported by brackets riveted to the posts of the trusses. The sidewalk stringers rest on the brackets and carry a cement finish on buckled plates riveted to the stringers.

The roadway is paved with brick on a Portland cement concrete foundation supported by buckle plates riveted to stringers. Between the trusses and the adjacent plate girders, the stringers are riveted between the floor-beams while between the plate girders they rest on top of the floor-beams. Two lines of rails on steel ties traverse the roadway at the center for interurban cars. The riveted trusses have the ordinary chord section for the top chord, built-up channels for the bottom chord, rolled channels for the verticals and four angles connected by a ¼-in. plate for diagonals, the plate not being consid-



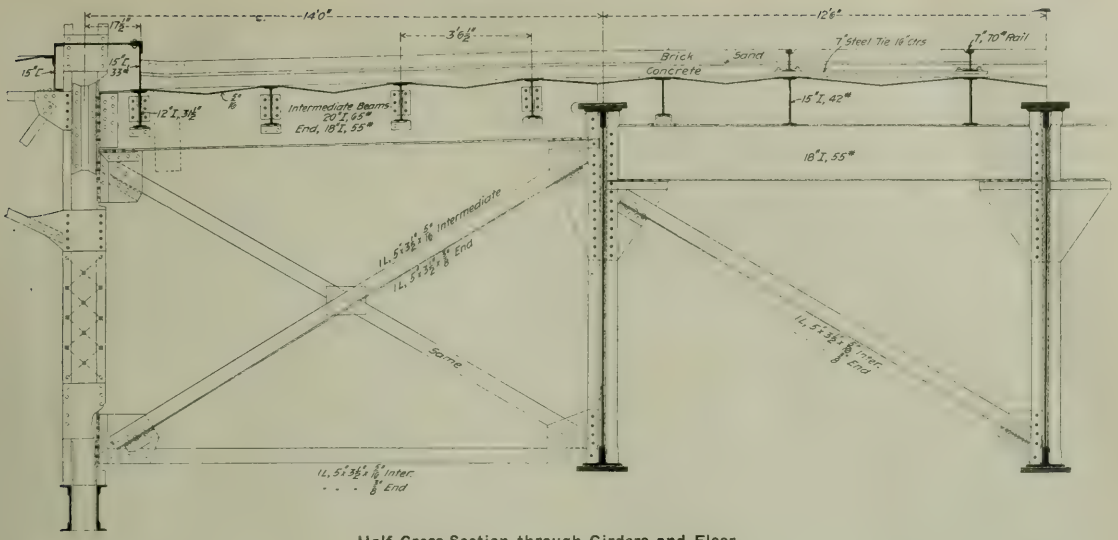
Placing 120-ft. Plate Girder in Position.

ered as part of the sectional area. The sidewalk brackets are riveted to the stay plates on the verticals. The expansion of the trusses is provided for by 8-in. segmental cast-steel rollers on T-rails which extend under the bearings of the adjacent span. The plate girders are the longest used up to this date for a highway bridge. They were shipped complete in pairs on three cars.

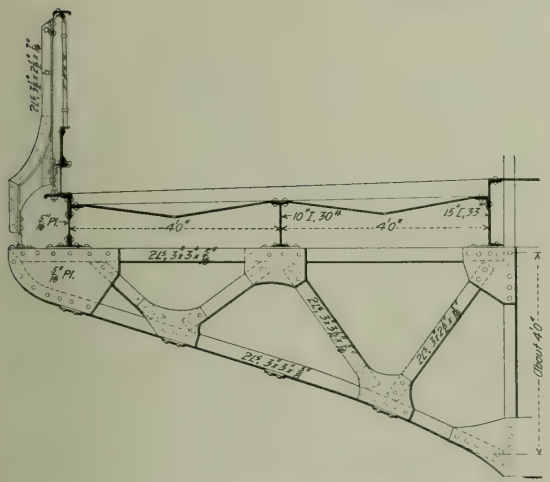
The substructure is composed of quarry-faced ashlar and concrete, on pile foundations. The bottom of the concrete masonry is 9 ft. below low water in the piers and extends to low water where the ashlar facing of Bedford limestone commences. This is backed with concrete.

The abutments are on piles, but the bottom of the masonry extends but 2 ft. below low water. The wing walls are not bonded

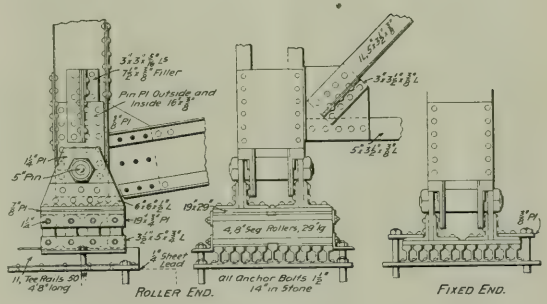
Truss Girder Erected and Ready to be Moved into Position.



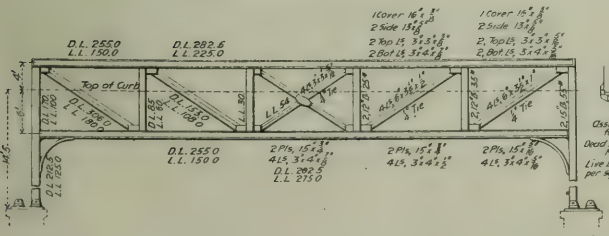
Half Cross-Section through Girders and Floor.

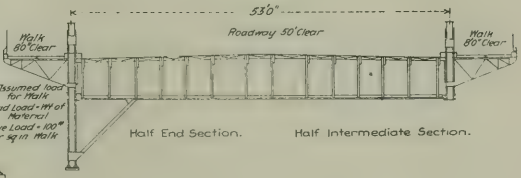


Detail of Sidewalk Bracket.

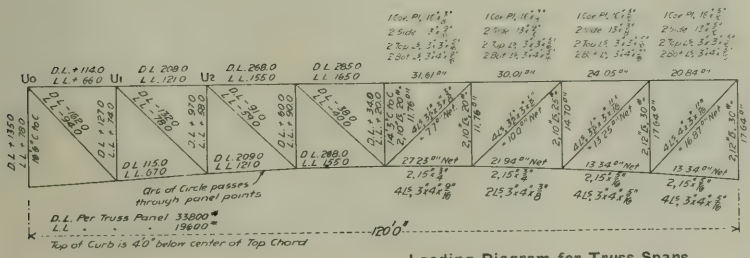


Details of End Bearings for Truss Spans.

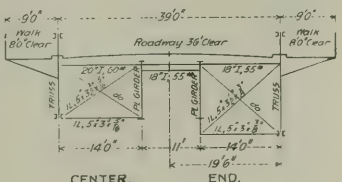




Loading Diagram of Center Span.



Loading Diagram for Truss Spans.



to the abutments and rest upon the soil. The old abutments were upon the soil at an elevation some 10 ft. higher than the bottom of the new masonry. The pile driving was a slow process as the piles drove hard in the sand and gravel bottom. A drop hammer was used throughout the work, and in the east abutment foundation a water jet was successfully used until a penetration of about 16 ft. was reached, when it became useless; the driving was then continued with a hammer until a penetration of 20 ft. was reached.

The net quantities of masonry are as follows:

East abutment	1,330 cu. yds.	Pier 4	670 cu. yds.
Pier 1	650 "	" 5	650 "
" 2	650 "	" 6	650 "
" 3	670 "	West abutment	1,000 "

Piles of green hardwood to the number of 718 were driven—88 under each pier, 116 under the east abutment, and 84 under the west abutment.

Some of the shipping weights of the steel are given below:

Cast-iron drain pipes, etc.	7,477 lbs.
Sheet lead	8,321 "
Steel ties and rail clips	101,672 "
Street car rails	88,227 "
Buckle plates	689,855 "
Railings	74,300 "
Invoices 10 to 47	3,306,946 "
Total	4,159,328 lbs.
One 120-ft. plate girder	60,500 lbs.
One 120-ft. riveted truss	51,400 "
One intermediate sidewalk bracket	750 "
One light pole	1,250 "
One 75-ft. riveted truss	40,000 "
One intermediate floor-beam, 75-ft. span	16,000 "
One set cast-steel rollers	792 "
One wall plate of T-rails	1,280 "

There were about 125,000 open holes to be filled with ¾-in. and ⅞-in. rivets. Of this number a comparatively few were filled with bolts. Curb angles, stringer shelf angle connections were bolted, and a few end floor-beams, where it was impossible to drive rivets, were connected with turned bolts having a driving fit and nut and washer on each end.

The contract price for the entire structure, including a temporary bridge, the removal of the old superstructure and substructure, etc., was $271,200, of which $192,500 may be considered as the cost of the new superstructure, the temporary bridge and the removal of the old bridge, and $78,700 the cost of the substructure and approaches.

The method of erection may be briefly described as follows: Falsework capable of carrying a single line of railroad track was built between two of the 120-ft. plate girder positions. A single girder was loaded on two standard freight car trucks and then, by means of tackles, moved out until the ends were over the masonry, where it was placed on blocking and moved sidewise until in its proper position. When the girders for a span were in position, the floor-beams, stringers and sway bracing were put in place and bolted up. The riveted trusses were assembled by placing the floor-beams running from the trusses to the adjacent girders on top of the deck already formed and anchoring them down with the outer ends projecting beyond the girders about 2 ft. Then the truss verticals were bolted in place and the remaining members assembled and bolted. The outside rivets were driven and then the truss and floor-beams moved sidewise and lowered into their proper positions. One-half of the bridge was erected in this manner and then the falsework for three spans was moved forward, the railroad track being shifted to the lower flanges of the plate girders in place.

The only delay in traffic experienced was a few hours Sunday afternoon, when the ice took out the temporary bridge, and a few hours on the following Monday required to complete a plank roadway on top of the buckle plate floor. Some of the trusses had not been riveted up when this occurred, but the joints were securely held in place with bolts and drift pins. Sixteen feet of the roadway was used for traffic while one-half was paved; then the traffic was turned on the pavement and the remainder paved. Practically all rivets were driven with pneumatic hammers and heated in oil furnaces.

The contractor for the entire work was the Lafayette Engineering Company, Mr. Wallace Marshall, President; Mr. Frank Hanna, General Manager at Terre Haute, and Mr. O. G. Wright, Superintendent of Erection. The steel work was fabricated at the Detroit branch of the American Bridge Company. The mill and shop inspection was done by the Pittsburg Testing Laboratory. Mr. Malverd A. Howe and Mr. J. E. Starbuck were designing engineers and Superintendents of Construction for the Commissioners of Vigo County.

A Berlin physician, professor and official, made a tour to Trieste with his automobile, and on his way back shipped his machine home from Munich by rail, unmindful of the fact that there were some five gallons of benzine remaining in the tank, and also unmindful, and possibly ignorant, of the fact that according to the German traffic regulations benzine, because of its inflammability, must be particularly described when shipped, and if not so described is taxed 12 marks per kilogram, including the package, in addition to the freight as billed by the shipper. Twelve marks per kilogram is, as near as may be, $1.22 per pound. The railroad agents discovered the benzine, reckoned the whole automobile as the package—which it was—and made out the freight bill accordingly, which is said to have amounted to more than $5,000, which the doctor paid under protest. The chance tourist, Yankee or other, should bear in mind that a box of matches in his trunk renders the trunk and its contents liable to this charge—but, unless there is a custom house on the route, the presence of the matches will not be discovered.

Storage vs. Primary Batteries.

At the last meeting of the Railway Signal Association Mr. J. W. Gladstone, of the Battery Supplies Company, read a paper giving the cost of certain installations of caustic soda batteries for automatic signals, and comparing the figures for these batteries with those which had been given for storage batteries in a paper presented by Mr. Reynolds at the March meeting of the Association. On the Central of New Jersey the primary batteries used for 110 miles of signals (double track) between Bound Brook and White Haven have given for the last five years an average service of 10 to 12 months, 16 cells of battery being used at each signal. The first cost was $8,267 (3,984 cells at $1.95 each, $7,769; labor of installation, $498; maintenance (1 1-5 cells per year at 75 cents), $3,586. Mr. Gladstone in comparison with these figures estimates the cost of storage battery for the same signals at $37,719 and maintenance $4,718. For the storage batteries he would have five charging stations, and in the cost of maintenance he would include five per cent. on the excess of investment required for storage above primary batteries and 10 per cent. depreciation on this excess. He thus shows a saving of $1,132 a year in maintenance by the use of primary batteries, and claims even a greater saving than this because the cost of primary batteries includes the first charge for each cell, so that there is no expense for renewal for the first 10 months, so that the final comparison shows that the storage batteries will cost 44 per cent. more than primary batteries.

Referring to the installation on the Lackawanna road spoken of by Mr. Reynolds, Mr. Gladstone said that the cost of 160 battery boxes ($1,040) should not be included unless a deduction was made for the battery box provided in the signal post, which costs $25 a signal. Making this allowance he finds the first cost of storage battery equipment to be ten times greater than that of primary batteries. He also complained of the omission of interest charges in Mr. Reynolds' comparison. Again, the comparison of the cost of battery men, labor, etc., was inexact.

Where storage batteries are carried to and from signals on cars the question of transportation is a considerable item, as the cells must be handled with great care; so that this expense must not be assumed to be the same as the expense of transportation of primary batteries, for which material is sent packed in boxes, and this at any convenient time and at no risk.

Speaking of tests, Mr. Gladstone cited an experiment on the Lackawanna road where batteries were worked every half minute 10 hours a day for two months without a battery failure. In this and in a similar test on the Central of New Jersey each battery served for 60,000 signal movements before failing. As to withstanding cold weather, caustic soda batteries will make no trouble if put in boxes 24 inches deep, sunk in the ground to the level of the lid. Moreover, such boxes are cheaper than the cast iron cases which are a part of the signal post. These cost $25 each. The Michigan Central has 600 caustic soda batteries in shallow boxes which have worked well for five years. The Lackawanna has 100 of these in the Pocono mountains, where the batteries gave no trouble during the intense cold of winter before last; and last summer the Lackawanna put in all its remaining caustic soda batteries (700 signals) under ground.

June Railroad Decisions.

The following abstracts cover decisions on railroad cases in the United States Supreme Court and the Federal courts for the month of June:

Service of Process on Director of Foreign Railroad Company.—The service of summons on a director of a railroad company of another state who is casually within the state for a few days will not confer jurisdiction on a Federal court, where the railroad company is doing no business and has no property in the state where the process is served. Remington vs. Central Pacific R. Co. (U. S. Sup.), 25 Supreme Ct. Rep. 577.

Adjustment of Compensation for Carrying Mails.—The compensation for carrying mails may be adjusted as to an extension constructed since a former adjustment, and may be confined to the extension alone without readjusting the compensation for the whole route as extended. Chicago, Milwaukee & St. Paul Ry. Co. vs. United States (U. S. Sup.), 25 Supreme Ct. Rep. 665.

Taxation of Coal Outside the Taxing State.—The appraisement of railroad property for taxation under the revenue laws of Pennsylvania should not include the value of coal mined in the state, but

outside the state awaiting sale at the time the appraisement is made. Such action by the tax officers amounts to a deprivation of property without due process of law. Delaware, Lackawanna & Western R. Co. vs. Commonwealth of Pennsylvania (U. S. Sup.), 25 Supreme Ct. Rep. 669.

Lookouts on Trains.—The Tennessee statutes requiring lookouts to be stationed on locomotives, whose duty it is to sound the whistle when any person or object appears on the track, and construed by the state courts to allow recovery of damages by persons injured where this precaution is not observed, though the injured person is guilty of contributory negligence, does not apply in favor of the foreman of a railroad construction gang killed as the result of being struck by a locomotive which he had seen approaching while standing near the track clearing it for the train to pass. Rogers v. Cincinnati, New Orleans & Texas Pacific Ry. Co., 136 Federal Rep. 573.

Care in Transportation of Mail Clerks.—A railroad company owes the same degree of care to a mail clerk riding in a mail car in charge of the mail that it does to passengers for hire on the train, and that care is prescribed by law to be the highest degree of care, skill and foresight consistent with the carrying on of its business. Cavin vs. Southern Pacific R. Co., 136 Federal Rep. 592.

Notice of Claim for Injury.—The requirement of four months' notice of a claim for injuries under the Connecticut statutes cannot be invoked in a sister state in which the action for the injuries is brought where no such condition is imposed. Brown vs. New York, New Haven & Hartford R. Co., 136 Federal Rep. 700.

Expert Evidence as to Speed.—A railroad conductor long in the service of a railroad company and familiar with the locality of a railroad crossing accident is competent to testify as an expert as to the speed at which a locomotive was propelled at the point in question. Baltimore & Ohio Railroad Co. vs. Connell, 137 Federal Rep. 8.

Overhead Bridges.—In the trial of a suit for injuries to a brakeman by striking a low trestle with which he was unfamiliar, an expert in railroad management is qualified to testify what, in his opinion, good railroading requires with respect to tell-tales on each side of overhead bridges. Pittsburg S. & N. R. Co. vs. Lamphere, 137 Federal Rep. 20.

Mechanics' Liens.—The furnishing of proper materials for the construction or improvement of a railroad is sufficient to sustain a mechanic's lien under the laws of Missouri without proof that the materials were used for that purpose. Westinghouse Air Brake Co. vs. Kansas City Southern Ry. Co., 137 Federal Rep. 26.

Removal of Causes to Federal Court.—An action in a state court to recover for injuries alleged to have been caused by failure to equip cars with safety appliances is not to be removed to the Federal court on the sole ground that it is alleged that the defendant is engaged in interstate commerce, since the question of fact whether the defendant is engaged in interstate commerce, and if so whether it has complied with the law, are not federal questions. Myrtle vs. Nevada C. & O. Ry. Co., 137 Federal Rep. 193.

Liability of Lessor Road for Illegal Acts of Lessee.—A railroad company leasing its lines to another company is not liable for the illegal acts of the lessee in carrying oil at a discriminating rate during the continuance of the lease. Western New York & Pennsylvania R. Co. vs. Penn Refining Co., 37 Federal Rep. 343.

Findings of Interstate Commerce Commission.—The provision of the Interstate Commerce act that the findings of fact of the Commission shall be prima facie evidence of the facts found in a subsequent proceeding to enforce the Commission's order, contemplates a clear-cut finding so prepared and arranged in the report that it can be offered in evidence unaccompanied by arguments, opinions, or other conclusions. The law allows no appeal from or writ of error to review a decision of the Commission denying or awarding reparation for an alleged violation of the act. In an action to enforce a reparation order based on a discriminating freight rate, the question of the reasonableness of the rate is for the jury and not the court. Western New York & Pennsylvania R. Co. vs. Penn Refining Co., 137 Federal Rep. 343

Jurisdiction to Enforce Telegraph Right of Way Contracts.—In a suit to enforce telegraph right of way contracts with consolidated railroad companies the necessary parties being subject to the court's jurisdiction, it is not material that a portion of the property affected is beyond the court's territorial jurisdiction. Western Union Tel. Co. vs. Pittsburg, C., C. & St. L. Ry. Co., 137 Federal Rep. 435.

The Consulting Bridge Engineer.*

The practice of having the designs of bridges and other structures made by engineers employed by the purchaser, and letting the contract to a manufacturer on a pound-price basis is now becoming the standard practice of the country. Most of the large railroads have their own bridge and structural departments, or, for work of unusual magnitude, employ outside experts to design and supervise construction. Only a few of the smallest railroads adhere to the ancient practice of inviting manufacturers to submit competitive designs accompanied by a lump-sum bid.

The competitive system has had its day and has served a good purpose. It has been an important factor in developing the art of bridge building in America. It has been productive of establishing rational types, practical and scientific proportions; it has united theory and practice. However, at present, it is fast becoming a thing of the past. What is left of this practice is mostly confined to bridges for electric railways and light structural work. Many purchasers of structural work, who have had no experience themselves, do not seek professional advice, as they would in other cases where large expenditures of money are involved, believing that they can save the money paid for professional services by inviting manufacturers to make competitive designs accompanied by a lump-sum bid. The fact is, however, that the manufacturer has to pay for making the designs not only once, but many times over, as only once in a number of cases he is the successful bidder. The manufacturer will naturally add this extra expense to the cost of the structure, yet the designs are not made in the interest of the purchaser, but in that of the manufacturer. This practice has a demoralizing influence, as it puts a premium on the poorest design and tends to decrease the professional standard of an important branch of engineering.

The standard practice to be recommended, as the only fair and business-like method, is to let contracts for structural steelwork on a pound-price basis, on designs and specifications furnished by an experienced engineer employed by the purchaser. This method is fair to the honest manufacturer, as all competitors bid on the same basis; it is an advantage to the purchaser, as he employs the engineer who will protect his interests, study the conditions and requirements, and design a structure to suit the needs of his client. It will benefit a number of engineers, who are now compelled to waste their time and energies in making speculative designs to suit the commercial interests of a manufacturer, regardless of good practice, by elevating them to more independent positions, thus enabling them to raise their professional standards to the highest ideals of good practice.

Plans for bridges and other structures, on the safety of which the lives of human beings depend, should be designed and not manufactured; their design and the supervision of their construction should be entrusted only to competent engineers, who, besides the requisite theoretical and practical knowledge, should, above all, be endowed with common sense and good practical judgment.

Most of the largest bridges and other steel structures which have been built in later years have been designed by engineers not connected with manufacturing establishments. The manufacturer should confine himself to his legitimate field of manufacturing structural steelwork at so much a pound. The line between engineers and manufacturers will be even more marked in the future, when the same distinction will prevail as now exists between the architect and the contractor. The manufacturers of structural work, in the future, will devote their energies to improvements in their tools and machinery and methods for handling material. Their engineering force will consist of mechanical experts, shop draftsmen and engineers, who, with a thorough knowledge of shop practice, are skilled in putting the engineers' designs into convenient shape for the workshop.

*Extract from the annual address of Mr. C. C. Schneider, President of the American Society of Civil Engineers.

Train Accidents in the United States in May.[1]

unx, 1st, Baltimore & Ohio, Valley Falls, W. Va., a freight train was derailed and the engine and several cars were badly wrecked. The engineman was killed and two other trainmen were injured.

unx, 1st, Chicago, Milwaukee & St. Paul, Ottumwa, Iowa, a westbound passenger train was derailed on a curve; engineman killed, fireman injured.

o, 4th, Baltimore & Ohio, DeForest, Ohio, the locomotive of a freight train was wrecked by the explosion of its boiler; the fireman was killed and the engineman and one brakeman injured.

unx, 6th, Louisville & Nashville, Sulphur, Ky., passenger train No. 7 was derailed on a curve and the engine was overturned and the mail car wrecked. The engineman was killed and two passengers and four postal clerks were injured.

*unx, 6th, 11 p.m., Galveston, Houston & Northern, Harrisburg,

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more persons.

Tex., a passenger train was derailed and the engine and seven cars were overturned. The tender was broken open and the fuel oil contained in it was spread over the wreck, which took fire instantly and was entirely consumed. The engineman and fireman were killed and their bodies were burnt up.

unx, 9th, Gulf & Ship Island, Laurel, Miss., a car in a freight train was derailed and, running on to a trestle bridge while off the track, broke through; and, with two other cars, fell to the ravine below. One brakeman was killed.

unx, 10th, Southern Railway, Lockhart, S. C., a mixed train was derailed and the cars fell down a bank. Two men were killed and a third was injured.

*†11th, 1 a.m., Pennsylvania road, at Lochiel, Pa., two miles east of Harrisburg, two cars of an eastbound freight train were derailed and were pushed to one side so as to foul a westbound passenger track. A westbound passenger train ran into the derailed cars, one of which contained blasting powder, and there was at once a terrible explosion, killing or fatally injuring 20 passengers and three employees, and injuring 109 other passengers and three employees. The passenger train was second No. 19 westbound. The freight, eastbound, consisting of engine, tender and 68 cars, with 34 cars air-braked, was stopped by a flagman protecting a switching engine, which was occupying the main eastbound freight track; and the application of the air-brakes on the first 34 cars caused two cars, the 35th and 36th, to "buckle." The 36th car, loaded with Judson powder, was forced to one side so as to partially foul the westbound passenger track. The engine and first three or four cars of the passenger train passed the derailed freight cars without great damage, though it appears that the shock was sufficient to awaken all the passengers in the sleeping cars and to do considerable damage to the engine and first two or three cars of the train. The engineman of the passenger train was probably killed at this time. Immediately after the first shock and the passenger train having come to a stop, there were two minor explosions, caused by some of the scattered powder being ignited by the fire from the engine. This was followed very closely by a very heavy explosion, caused by the entire lot of powder becoming ignited. There is no truth in the report that the locomotive boiler exploded. The engine was repaired and was put in service in three days. All the cars appear to have been set on fire at once by the explosion and survivors describe the spread of the flames as very rapid. Many of the surviving passengers were burnt and many were cut by broken glass. The Coroner's jury found that the railroad company and its employees were not guilty of any negligence by reason of which the accident occurred; that the rules of the company in regard to the flagging of trains and the stoppage of trains were strictly observed, and "the company and its employees are to be commended for their actions after the accident in taking care of the wounded and distressed." This accident was reported in the *Railroad Gazette* of May 19 and was discussed in the issue of June 2.

bc, 11th, Pennsylvania road, Warren, Pa., butting collision between an empty engine westbound and two engines coupled together eastbound. Two of the engines were wrecked. One fireman was killed, one engineman fatally injured and two other men badly scalded. It is said that the two freight engines had been delayed by an accident to the machinery of one of them, and that the men in charge failed to properly protect their train.

unx, 11th, Southern Railway, Knoxville, Tenn., several cars in a freight train were derailed and ran against a watchman's cabin. A policeman in the cabin was killed and the watchman was injured.

unx, 11th, St. Louis, Iron Mountain & Southern, Tillar, Ark., a freight train was derailed and six cars were wrecked. A brakeman was killed and two trespassers riding in one of the cars were injured.

12th, St. Louis Southwestern, Weaver, Tex., a passenger train was derailed on or near a small bridge which had been weakened by a flood and the engine and five cars were overturned. Five trainmen were injured.

xc, 12th, Chicago & North-Western, Chicago, Ill., an empty engine moving east, backward, ran over a misplaced switch and into the side of a car in a passenger train moving westward, badly damaging one car. Seven passengers were injured.

xc, 12th, 8 p.m., St. Louis & San Francisco, Kansas City, Mo., a southbound passenger train collided with some freight cars which had accidentally run onto the main track, and the engine was overturned. The mail car was wrecked and the passenger cars much damaged. Three trainmen and four passengers were injured, one of the trainmen fatally.

unf, 12th, Weatherford, Mineral Wells & North-Western, Weatherford, Tex., a passenger train broke through a bridge which had been weakened by a flood and two passenger cars fell into Dry Creek; 20 passengers were injured. It is said that the trestle was knocked out of line by a log, which floated against it just before the train approached.

bc, 13th, Pennsylvania road, Hyde Town, Pa., butting collision of freight trains, wrecking both engines and 12 cars. One engineman and one fireman were killed and several freight trainmen were injured.

unx, 14th, Gulf & Ship Island, Lumberton, Miss., a passenger train was derailed and the rear coach was overturned. Five passengers were injured.

unf, 14th, Atchison, Topeka & Santa Fe, Emporia, Kan., a passenger train was derailed at a point where the rails had been maliciously loosened, and five cars were ditched, most of them being wrecked. Six passengers were injured, two probably fatally.

dn, 15th, Cleveland, Cincinnati, Chicago & St. Louis, Otterbein, Ind., passenger train No. 11 was derailed at a misplaced switch and the engineman and fireman were killed; three passengers and two mail clerks were injured.

unx, 15th, Long Island road, Woodhaven, N. Y., the locomotive of a passenger train was derailed at a switch and was overturned. The passenger cars were considerably damaged and 12 or more passengers were injured.

o, 15th, Pennsylvania road, Leaman Place, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler. The fireman was fatally scalded; but the engineman, who was hurled into a ditch with the cab, escaped with slight injuries.

dn, 15th, 8 p.m., Southern Railway, Flovilla, Ga., passenger train No. 9 was derailed at a misplaced switch; the fireman was killed and two other trainmen were injured.

xc, 17th, Lake Shore & Michigan Southern, Buffalo, N. Y., collision between a passenger train and two yard engines; one fireman killed.

unx, 17th, St. Louis & San Francisco, Francis, Ind. T., a northbound passenger train was derailed and the first three cars were wrecked. Four trainmen were injured.

bc, 18th, Illinois Central, Echols, Ky., butting collision of freight trains, making a bad wreck; seven trainmen were killed and one trainman and two passengers were injured. It is said that the collision was due to an error in reading the time in a telegraphic order.

dn, 19th, Norfolk & Western, Mackey's Ferry, N. C., a mixed train was derailed at a misplaced switch and the engine and two freight cars were wrecked. A brakeman was killed and several other persons were injured.

unf, 19th, St. Louis & San Francisco, Kosoma, Ind. T., northbound passenger train No. 2 was derailed on a bridge and the engine and first three cars broke through the bridge. Four trainmen and 11 passengers were injured. It is said that the derailment was due to the weakening of the bridge by a flood.

unx, 19th, St. Louis & San Francisco, Lamar, Mo., three cars of a freight train were derailed and ditched, and two tramps were killed.

unx, 22d, Cleveland, Cincinnati, Chicago & St. Louis, Sidney, Ohio, a freight train, made up entirely of new cars, was derailed while running at high speed, and 14 cars were wrecked. A woman walking near the track was killed.

unf, 23d, 4 a.m., Louisville & Nashville, Columbia, Tenn., passenger train No. 1 was derailed at a washout, and two sleeping cars fell down a bank and were submerged in 7 ft. of water. Eight passengers were injured.

xc, 24th, Atchison, Topeka & Santa Fe, Hutchinson, Kan., a passenger train collided with a string of freight cars. One mail clerk was killed and the engineman, fireman and five other persons were injured, the engineman and fireman probably fatally.

bc, 25th, Augusta, Ga., collision between a freight of the Charleston & Western Carolina and a switching train of the Central of Georgia, badly damaging both engines; a brakeman was killed.

bc, 27th, 5 a.m., Louisville & Nashville, Madisonville, Ky., butting collision between a freight train and a work train, wrecking both engines and many cars. One fireman was killed and two other trainmen were injured.

unx, 28th, Texas & Pacific, Keithville, La., westbound passenger train No. 51 was derailed and the engine and baggage car were overturned. Two trainmen and two passengers were injured.

unx, 29th, Pennsylvania Lines, Bloomville, Ohio, the rear car of a passenger train was derailed and ran against a hand-car loaded with ties. A workman near the hand car was killed and two others were injured.

xc, 30th, Galveston, Harrisburg & San Antonio, Sartartia, Tex., a passenger train of the Missouri, Kansas & Texas collided with a freight train which was entering a side track, wrecking three cars. A roadmaster who was riding on the engine, acting as pilot of the train, was severely injured, and the fireman less severely.

xc, 31st, 2 a.m., Seaboard Air Line, Fairfax, S. C., passenger train No. 66 collided with some freight cars which had escaped control and run from a siding to the main track, and the engine and mail car were wrecked. Three trainmen were injured.

xc, 31st, Pennsylvania Lines, Sheridan, Pa., a freight train ascending a grade broke in two and the rear portion ran back into the head of a following passenger train, wrecking the caboose and one car and damaging the engine. One passenger and two trainmen were injured.

unx, 31st, 6 a.m., Texas & New Orleans, Mabank, Tex., a mixed train running backward was derailed and the engineman and fireman were injured, the latter probably fatally.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 2. FRIDAY, JULY 14, 1905.

Mr. Midgley's proposition to establish clearing houses for settling freight and passenger balances between railroads may with the "average reader" find more or less acceptance; but when it encounters experienced railroad accountants things are not so serene. The accountants are, in fact, up in arms at once. We print Mr. Midgley's essay on another page, followed by what the accountants have to say about it. Neither side presents anything like an adequate or comprehensive argument, or even a clear statement of the facts. We do not know that it is necessary or desirable that either of them should. There has not been any loud demand for a clearing house lately, except from Mr. Midgley himself; and he will need to get a larger following before his cry will amount to much. The obvious argument in favor of a clearing house is that it saves labor and time; avoids repetition of writings and enables cash settlements to be made more promptly. But *how much* saving? In England, by reason of the compact territory, the small number of companies, and the stability of rates, it seems to have been possible to clothe the clearing house with authority to settle a large share of the disputes summarily—without waiting to get authority from either party to the dispute. This is a vital matter. If there were no disputes about monthly statements a clearing house would run like a clock anywhere. In this country the abolition of the great mass of correspondence about differences is probably entirely out of the question. This being so, each road would continue to keep as full records in its own office as it kept before; and that would spoil the argument about saving in clerical work. An American railroad treasurer sends out, say, 500 checks a month to 400 different railroads. The clearing house, let us say, would reduce this to one check a month. This would be a real saving in any business. But, as Mr. Kirkman and the other accountants intimate, this in itself is not a sufficiently large saving to warrant the establishment of an immense bureau, which would multiply papers, fill the baggage cars with letters, and grow fat on its own vanity.

CAST-IRON WHEELS.

The discussion which has been going on recently over the use of cast-iron wheels under high-capacity cars differs somewhat from previous discussions, which have taken place periodically during the last twenty years in that the purely mechanical problem of producing a wheel of chilled cast-iron which is safe and which will give good service has been lost sight of. The discussion has hinged on the commercial problem of whether or not a cast-iron wheel can be made for a certain price and at the same time be safe and give long service. The mechanical problems involved in the design and manufacture of cast-iron wheels for freight cars are more difficult than they have ever been before, because of the greater loads and speeds, but, at the same time, they are not impossible of solution. Mr. P. H. Griffin pointed out some of these problems in his contribution printed in these columns on May 19, but there are others which he did not touch upon. Mr. Muhlfeld, in his valuable paper on the cast-iron wheel problem printed in the *Railroad Gazette* May 5, suggested certain changes in design which, in his opinion, would remedy some of the many defects which have developed in service under 100,000-lb. cars. Elsewhere in this issue will be found still another contribution on the subject. This is by a wheel maker, who suggests some improvements in foundry practice and changes in design which he believes will produce an entirely satisfactory wheel. Certain recent tests of the breaking strength of cast-iron wheel flanges would seem to indicate that for very heavy loads, with the existing form of wheel flange, cast-iron wheels are not safe to use; and the makers of steel wheels have taken the results of these tests as a basis for the argument that only steel wheels should be used under cars of high capacity, or cars which are run at high speeds. The cast-iron wheel makers presented to the Master Car Builders' Association last month a proposition to reduce the guarantee on wheels, claiming that it was not possible to make a wheel at the price which the railroads were willing to pay, which could be guaranteed for the time now usually named, and against the defects specified in the form of guarantee now in general use.

Briefly stated, then, the wheel situation is this: Cast-iron wheels under high capacity cars are not giving altogether satisfactory service, and with the keen competition and the severe tests required, coupled with the unwillingness on the part of the railroads to pay more for a higher quality wheel, the problem has resolved itself into one of how good a wheel can be made for a certain price. And this commercial aspect, as before said, has caused both wheel makers and railroads to lose sight of the more important mechanical problems. Mr. Griffin, speaking for the wheel makers, admits that their chief aim is to make wheels as cheaply as they can be made and stand the tests imposed by the railroads, without regard to durability; and the railroads, in trying to save money on renewals, endeavor to turn back on the makers as large a share as they can of the wheels which are condemned. Both parties are trying to save pennies by working at cross purposes, when they might be saving dollars by working together.

The cast-iron wheel has come in for much more than its fair share of condemnation since the introduction of the high capacity car. Because it has failed under such cars more frequently than under

cars of lighter capacity, its enemies have been quick to claim that it was unfit for such service, when, as a matter of fact, almost any type of wheel would have failed under similar conditions. The most frequent cause of failure of wheels is the heating action of the brake shoes combined with the rubbing of the flange against the rail. As far as vertical strength is concerned, the cast-iron wheel apparently has an ample reserve; but under high capacity cars the braking action and the flange wear are both much more severe. Normally, there is no flange wear on straight track, unless the truck fails to return to its normal position after leaving a curve. If a car has weak bolsters or badly designed center plates and side bearings a truck may be held in a slued position, and the wheel flange grind on the inside of the rail mile after mile. Any wheel would show flange wear under these conditions, and it is obviously unfair to criticise the cast-iron wheel because it fails under such conditions. The fault is not with the wheel.

The heating action of the brake shoes under heavy cars is much more severe than under light cars, for two reasons: First, because there is more braking pressure with practically the same area for radiation of the heat; and, second, because, as a rule, the high capacity cars are braked more continuously—a larger part of the time—than the lighter cars. In making up trains the heaviest and strongest cars are usually put next to the engine, and the light cars in the rear of the train. The trainmen then couple up the air brakes on the first ten or fifteen cars and depend on the brakes of those cars to control the entire train. This practice has been very general up to the time when the statutory requirement of 50 per cent. came into operation. On mountain roads where retaining valves are used, the front cars in a train may have the brakes applied continuously for as long as an hour, while the rear cars have only a few hand brakes set up. This practice undoubtedly has much to do with the larger percentage of wheel failures under high-capacity cars than under cars of lighter capacity. We are not criticising the practice, because experience has shown that in many situations probably this is the best way to control a train; we simply are pointing out that it is not fairly the fault of the wheel when it fails under such service.

We do not here discuss the relative merits of the different designs of single and double plate wheels, with and without brackets, which have been suggested as improvements over existing designs. Experience only can determine whether or not minor changes in the shape and location of the brackets and plates will prevent troubles from cracks in the body of the wheel due to uneven expansion, or whether they will assist in radiating the heat from the tread to such an extent as to eliminate part of the trouble from transverse and longitudinal cracks. The most radical suggestion which has been made is to thicken the flange and to enlist the co-operation of the maintenance of way departments to increase the clearance at frogs and guard rails so that a thicker flange may be used. With a thicker flange more gray iron can be used to re-inforce the weakest point of the wheel without sacrificing any of the chill. From experience on the Southern Railway it would seem that this can be done with no difficulty.

Viewing the whole matter impartially there would seem to be no reason to doubt that some of the many expedients proposed to improve the quality and increase the strength of cast-iron wheels will eventually prove satisfactory; will remove all ground for fear that the cast-iron wheel is unsafe and cannot be made safe to run under the conditions of modern service. The best care on the part of the founder and the use of high-grade charcoal iron would eliminate many of the troubles now experienced; and as regards this feature of the matter it is only a question of whether the railroads prefer to pay a moderate price for the better material and for the better foundry practice adopted, or to pay much more for steel wheels, which apparently have an excess of strength, but which have not yet shown that they have a sufficiently longer life to pay for the difference in first cost. It is a significant fact that in their petition to the Master Car Builders' Association asking to have the guarantee reduced, the wheel makers made no claims about being able to produce a wheel to meet the present guarantee if the railroads were willing to pay for it. This can hardly be taken as an admission that they cannot produce such a wheel, but it would have made their position stronger had they offered a specification and a guarantee for higher priced wheels, and had shown that they were prepared to furnish such wheels if the railroads wanted them. Their attitude is thus a defensive one, and they have not strengthened their position by taking it. Meanwhile, the steel-wheel makers are taking every advantage of the situation to secure favor, and by means which necessarily tend to create distrust of the cast-iron wheel. The question is not yet by any means settled, but nothing has occurred thus far to justify the notion that the chilled-wheel makers must go out of business. They know how to make better wheels, and they ought to know how to induce the railroads to use better wheels.

Somewhat imperfectly and through the mists of partisanship in the Canadian journals the details reach us of a railroad contest at Ottawa which involves some broad principles of national—and international—policy. It appears that some time ago when President Hill, of the Great Northern, acquired the British Columbia charter for the Victoria, Vancouver & Eastern Railroad, he found that document imperfect for his ends, as it requires the road to be "all-Canadian," i.e., entirely within Canadian territory. This defect he now seeks to mend by obtaining Canadian authority to cross the border at intervals and at eligible points for local traffic. Both President Hill and the Canadian Pacific, it should be added, are pushing into southern and southwestern British Columbia to obtain the first grasp of the trade—and thus, in a sense, an "all-Canadian" line is antagonized with an American system seeking both the Pacific traffic and a kind of in and out business along the border. Hence arises a question of considerable national magnitude in Canada, especially as applied to its far western but, in large regions, rapidly developing border land where railroad facilities are so vital. Should Canadian policy, in such a case, it is asked, insist on the "all-Canadian" idea in the development of railroads—while, of course, conceding the right of President Hill to connect with his main system—or should it ratify what his opponents call his "see-saw" plan? "Keep the railroad business in Canada," say the Canadian foes of his project, "and protect and build up our own lines." To which comes the reply: "Break up the Canadian Pacific monopoly. Give our new settlers the quickest railroad facilities they can get and the cheapest access to the markets." We confess our acute sympathy with the latter Canadian plea rather than the former, especially when we reckon in on the one hand the crying need for railroads in new communities and, on the other hand, the larger fact that nations mutually profit by international railroad intercourse. But whatever the theory, the international practice will probably have to be reciprocal. If Mr. Hill is to be permitted to "see-saw" back and forth across the far western Canada border the Canadian Pacific can with justice demand the same privilege. The raising of the general question on our northwestern boundary, where communities on both sides are probably as unanimous in getting railroads as they are indifferent to the nationality of the builders, suggests that the problem will grow deeper and, it may be, reach a diplomatic stage before it is solved.

Speaking of one of the most prominent railroads in the United States a daily newspaper says: "Wisely mindful of the comfort of passengers traveling in sleeping cars the ——— has issued orders to all departments to avoid all unnecessary disturbances in the vicinity of sleeping cars, while trains to which the sleepers are attached are halting at stations or in the large yards of the company." As all well-regulated railroads have had a rule like this in their codes for years, this item means, we suppose, that some officer on the road referred to is trying to make the re-issue of a rule take the place of the care and patience necessary to enforce a rule already issued. And is not this one of the features of the service for which there should be more inspectors? It is safe to say that not one superintendent in a hundred takes the intelligent care to do his part in this matter that the Pullman superintendent does to do his part. If a Pullman employee breaks one of the rules pertaining to passengers' comfort he is likely to hear from his boss very soon; but enginemen may ring bells, bump buffers and even blow whistles, at any hour of the night and nothing is said. At least this is the impression that one gains frequently while riding in sleeping cars. Keeping everything quiet while handling locomotives and cars is a matter requiring a high degree of intelligent care, and only by efficient and vigilant inspection can such care be insured.

NEW PUBLICATIONS.

Practical Perspective. By Frank Richards and Fred H. Colvin. New York: The Derry-Collard Company, 1905; 5 in. x 8 in., flexible cloth, 60 pages, illustrated. Price 50 cents.

The object of this book is to show the practical value of isometric perspective by removing the difficulties that have prevented its wider use. Isometric perspective is really the only practical perspective in which to show mechanical work, and the authors seem to feel that if the simplicity of this style of drawing could be made clear to the draftsman it would be more generally used than at present. In the first part of the book Mr. Richards explains in simple language the principles of isometric drawing. This is supplemented by illustrations which are so clear that it is hard to see how any one, having a taste for drawing, could but help to master the subject after carefully following the instructions. The second part of the book,

by Fred H. Colvin, explains the use of the D-C isometric sketching paper, and shows examples of work done on it, including architectural details, lathe work, locomotive details, structural steel work, etc.

Performance of Automatic Block Signals Under Unfavorable Conditions. By H. S. Balliet. New York: The *Railroad Gazette*, 83 Fulton street. Pamphlet, 42 pages. Price, 50 cents.

This is a reprint of the original, interesting and highly useful papers by Mr. Balliet, which were published in the *Railroad Gazette* last year. In them he describes the experiences of himself and of many other signal engineers in dealing with the numerous and varied difficulties connected with the maintenance and operation of automatic signals in severely cold weather—42 deg. F. below zero—as well as in all other temperatures; and also in seasons when lightning and other atmospheric or terrestrial phenomena disturb the working of electrical apparatus. Mr. Balliet not only has had unusual and extensive experience in this field but also brings to his work the qualification to discriminatingly weigh and comment upon those experiences of other men which he incorporates in his essay.

TRADE CATALOGUES.

Painting Structural Steel.—The fourth edition of "Hints on Painting Structural Steel" by Houston Lowe, of The Lowe Brothers Company, Dayton, Ohio, has lately been issued. The book is in pamphlet form, 5½ x 8, contains 45 pages, and is intended as a hand-book for paint users. It discusses briefly the problems of preserving and protecting steel and iron in bridges, railroad equipment and other structures, and contains suggestions of specifications for cleaning and painting structural steel with a view to obtaining best results. There are chapters on Paint and Painting, Steel, Rust and Cleaning; on Liquids and Solids for use in metal coverings; also chapters on Tests and on Conclusions. The book is an interesting and instructive contribution on the subjects with which it deals.

The Chicago & North-Western passenger department includes in its summer literature two pamphlets bearing the respective captions "The Pacific Northwest" and "Personally Conducted Tours." The former contains 51 pages devoted to the natural resources, scenic features and commercial advantages of Oregon, Washington and Idaho. It is fully illustrated with half-tone views. Some space is devoted to the Lewis and Clark Centennial exposition, and a page to Alaska. The second pamphlet gives the itineraries, with expenses and features of the trips, of four personally conducted tours from Chicago to the Pacific Coast and return, over the North-Western and Union Pacific lines. The dates for leaving Chicago are July 6, 12 and 27 and August 10 respectively.

Valves and Gages.—The Ashton Valve Co., Boston, Mass., sends its complete catalogue No. 12. It is 6 in. x 9 in. and contains upwards of 120 pages. A full page half-tone portrait of Henry G. Ashton, founder of the company, is shown on the front page. This is followed by illustrations and descriptions of the various devices made by the company such as "pop" safety valves, water relief valves, cylinder relief and drifting valves, blow-off valves, steam vehicle fittings, chime whistles, pressure and vacuum gages, revolution counters, engine registers, locomotive and marine clocks, gage testers, gage cocks, water columns, test pumps, thermometers, pyrometers, etc.

Smooth-On Elastic Cement.—The Smooth-On Mfg. Co., Jersey City, N. J., sends a copy of its new Smooth-On elastic cement instruction book. This cement is the latest production of the above company. It is an iron elastic cement prepared in paste form, ready for use. The advantages claimed for it are that it is metallic and can be applied to hot iron, the heat causing it to metallize instantly, which makes it invaluable for stopping leaks.

Modern Sanitation.—This is the title of a monthly magazine published by the Standard Sanitary Mfg. Co., Pittsburg, Pa. It is exclusively devoted to the advancement of sanitary plumbing and the June issue contains Part V. of an interesting series of articles on the "Principles and Practice of Plumbing" by J. J. Cosgrove. Parts I., II., III. and IV. of the above series will be furnished upon request to the publishers.

Steel Piling.—The Friestedt Interlocking Channel Bar Co., Chicago, sends an interesting catalogue descriptive of its interlocking channel bar piling. Details of its construction are shown and illustrations of various structures throughout the country in which it is used are given. Its advantages and extensive field for applicability are also set forth.

Pop Safety Valves.—The American Steam Gage & Valve Mfg. Co., Boston, Mass., sends an illustrated folder descriptive of its American special pop safety valve. This valve is designed for a working pressure up to 300 lbs. with a test pressure of 450 lbs. It is made in single and duplex types. In the duplex type the two valves are mounted on one body casting having a common inlet and a common outlet.

"Compressed Air."—The June issue of this magazine, issued by the Ingersoll-Sergeant Drill Co., is being distributed. It contains a number of interesting articles devoted to applications of compressed air. It also contains a general round-up of the pneumatic tools and devices which were exhibited at the recent railway appliance exhibit in Washington.

Graphite.—The Joseph Dixon Crucible Co., Jersey City, N. J., is distributing its July issue of Graphite. It contains an article on "Grease and Automatic Grease Cups," also one on "The Care of Driving Belts." It also contains its usual amount of light reading matter.

Storage Batteries.—The Electric Storage Battery Co., Philadelphia, Pa., sends its bulletin No. 95, which describes in detail the application of storage batteries to the lighting and power plant of the Carnegie Steel Co.'s plant at Youngstown, Ohio.

Wattmeters.—The Westinghouse Electric & Mfg. Co., Pittsburg, Pa., is distributing a small illustrated pamphlet descriptive of its Type B integrating wattmeter, single-phase, 7,200 and 16,000 alternations, for two and three-wire circuits.

The Tabor Indicator.—The Ashcroft Mfg. Co., New York, sends a handsomely illustrated catalogue descriptive of the latest type of the Tabor indicator and of indicator parts and supplies.

CONTRIBUTIONS

Cast-Iron Car Wheels.

McKees Rocks, Pa., July 10, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Following the introduction of the 100,000-lb. capacity car has come a succession of failures in the detail parts of car equipment. This is particularly true of the cast-iron wheel which has failed so signally. The railroads and the wheel makers have recently been discussing with much concern ways and means for improving its efficiency, and some have even gone so far as to suggest its entire abandonment under high capacity cars. Among the most important suggestions which have been made for overcoming the difficulties, the following may be particularly noted:

(a) Designing the wheel with a single plate located almost under the sand rim and increasing the coning of the tread, at the same time making the throat of the wheel flange conform closer to the radius of the rail head. This design has recently been adopted by one of the large railroad systems.

(b) The railroads to pay a better price for their wheels so that the wheel makers may use more charcoal iron in their mixtures, and improve their general foundry practice. If it is true, as this suggestion implies, that a large number of the freight wrecks caused by breakages of wheels, have been due to bad foundry practice, it is evident that there has been either gross negligence on the part of the management of the wheel foundries, or that the ordinary foundry practice is fast becoming obsolete. Recent experience has shown that the continuous pouring process is the only one that will bring about the much needed improvement in cast-iron car wheel foundry practice. If the most correct design of pattern is used, and the very best irons are charged into the furnace, still a poor quality wheel will be the result if the foundry practice is bad. It is well known that the mold should be made of sand of uniform "temper," the iron melted and poured, and the wheels "shaken out" and pitted, within certain well defined limits in temperature. In ordinary foundry practice where the iron is carried at greatly varying distances from the cupola, and the wheels are shaken out at similar distances from the pits, these important conditions *cannot* be regulated with any degree of uniformity.

(c) Add ⅛ in. more metal to the back of the flange. In regard to this proposition it is interesting to know that it took nearly 5 per cent. more pressure to break a wheel flange a scant $^{1}/_{32}$ in. too thick, than it took to break the strongest wheel flange recorded of the tests made at Purdue University. It is also worthy of note that this wheel was cast in a continuous pouring foundry, weighed 700 lbs. taped 3 (P. R. R. 121), and had only 13 brackets. The pressure was applied between two of the brackets. It was also chilled to sufficient depth to pass the specification requirements of the principal railroads. The record of this test was brought before the members of the recent M. C. B. convention during the topical discussion on the results of the M. C. B. design wheel in service.

(d) Use a 700-lb. single-plate wheel of special design in which

the flange is practicallly a continuation of the plate, and the rim supported by [illegible] sets.

To make wheels for service under the 100,000-lb. capacity cars, I would [illegible]:

First.—The increased coning of the tread and the general pattern design referred to in A, except that the single-plate should be increased to 1 1/16 in. and the number of brackets reduced to not more than 13. The brackets act principally as "whirl gates" for the iron. When their combined area is too great the metal flows towards the chill with lessened circular motion which is detrimental to the chilled surface. In regard to the wheels now made from the design referred to in A, it is a matter of experience that whenever they crack under the thermal test and heat strains, the cracks extend under the tread and through the brackets. This is an element of danger. Wheels of the M. C. B. and similar design, under the same strains may crack at the intersection of the plates. If this occurs in service the latter design wheel will still run many miles while the former is sure to break at the first lateral blow.

Second.—Increase the flange thickness up to the limits allowed by guard-rail and track conditions. There seems to be no question about adopting this at once judging by the discussions on this point at the recent M. C. B. convention. In the meantime it would seem the part of wisdom for the railroads to instruct their inspectors to accept wheels with flanges slightly thicker than the present maximum allowed.

Third.—The wheel makers should use a mixture of such strength that the hardest wheels made from it under normal foundry conditions, will stand the thermal and drop tests. This mixture must be melted under the best cupola conditions, the iron poured at the right temperature into molds of uniform "temper," and the wheels "shaken out" and placed in the pits neither too hot nor too cold.

Fourth.—Improved car and truck construction. There is no doubt but that the construction of cars and trucks of early design, for the 100,000-lb. cars, has been the cause of many wheel failures.

Wheels produced as outlined above will be superior in design and quality to the best now in service under the high capacity cars, and will meet all expectations as to safety and wear.

In regard to guarantee and tests there is no doubt but that the railroads and the wheel makers should come in closer harmony and the following suggestions might assist in bringing this about:

Guarantee.

Tape 5.	P. R. R.	123—	from plain	chills.		One year less than tape 3.
" 4.	"	122—	"	"	"	½ year less than tape 3.
" 3.	"	121—	"	"	"	Normal guarantee period.
" 2.	"	120 —	"	"	"	½ year more than tape 3.
" 1.	"	119—	"	"	"	One year more than tape 3.
" 0.	"	118—	"	"	"	1½ year more than tape 3.

Tests.

Tape 123,	in lots of	100.	Drop test and chill measurement.	
" 122.	" "	100.	Drop test and chill measurement.	
" 121.	" "	100.	Normal thermal, drop test and chill meas.	
" 120.	" "	100.	Normal thermal, drop test and chill meas.	

For each tape size below 120 an increase of 10 per cent. in the drop test, and 25 per cent. in the thermal test. Wheels with the maximum chill, manufactured as they should be, will be of sufficient strength and give the best service.

The guarantee and tests as suggested above would be fair to the wheel makers and the railroads, and would do away with the unfair and ruinous penalty now imposed by some of the methods of inspection.

J. W. HENDERSON,
Supt., Central Car Wheel Co.

Allfree-Hubbell Locomotive Valve Gear.

Chicago, July 3, 1905.

To the Editor of the Railroad Gazette:

My attention has just been called to an article appearing on pages 634 and 635 in your issue of June 9th with regard to information concerning the relative performances of Central Railroad of New Jersey locomotives No. 581 and No. 582. From the conclusion of your article it appears that you have some doubts as to the value of the report published by the officials of the Central R. R. of N. J., and you apparently think it would be relatively an easy matter to simply transfer the valve gear used on the Allfree-Hubbell locomotive 581 to the No. 582 and thereby reverse the record given in the test that has just been made.

The 582 is equipped with the Stephenson link motion only, and has cylinders 19 in. x 26 in., with ports 1⅞ in. x 18 in., and of the usual design, extending from near the center of the cylinders to each end, and contain approximately 550 cu. in. volume. When the 582 is working at 7⅛ in. cut-off, with a maximum port opening of 29/64 in., exhaust occurs at 16¾ in., or after completion of only 64.4 per cent. of the stroke. Exhaust closure also takes place at 16¾ in., or at same percentage of stroke, with 9¼ in. volume in compression.

Engine No. 581 on the other hand has cylinders with exceedingly short ports opening directly into the ends of the cylinders. This engine has the usual Stephenson link motion, but supplemented by the Allfree-Hubbell valve gear. The ports to the cylinders of the 581 are also 1⅜ in. x 18 in., but are very short, being only 2 in. from the face of the valve seat to the bore of the cylinder, and are located at the extreme ends of the cylinders and contain approximately 90 cu. in. volume. When working at 6⅝ in. cut-off with a maximum port opening of 29/64 in., exhaust occurs at 22 in., or after completion of 84.6 per cent. of the stroke and exhaust closure does not take place until 23 in., or after completing 88.5 per cent. of the stroke, with only 3 in. volume in compression.

You will note, therefore, that the valve gear of the No. 581 increases the expansion period and decreases the negative work of compression 66⅔ per cent. In addition to this, please bear in mind that the cylinders on both locomotives are 19 in. x 26 in., with ports of same cross sectional area, and the difference in the performance of the 581 and the 582 is materially affected by the great difference in the port volumes as previously noted.

The valve gear employed in the 581 makes possible the great reduction in the port volumes, therefore, the results given could not possibly be reversed by simply transferring the valve gear from the No. 581 to the No. 582; but, if the entire system of steam distribution, which includes the cylinders, valves, and valve gear, which constitutes the Allfree-Hubbell locomotive, are transferred from the No. 581 to the No. 582, and the cylinders, etc., of the 582 are applied to the 581, there is no doubt but that the No. 582 would then make the same showing over the No. 581 that the No. 581 made over the No. 582.

The record made by the 581 over the 582, as in all other instances where the Allfree-Hubbel locomotives are to-day in service running opposite locomotives otherwise of the same specifications, except as to steam distribution, is due entirely to the combination of the reduction of cylinder clearance (port volume), for the striking distance is always the same, increased expansion, decreased negative work of compression and a marked reduction in cylinder condensation inseparable from, and possible only in the Allfree-Hubbell locomotives because of the valve motion employed.

The details of this test on the Central Railroad of New Jersey and others were recently submitted to one of our engineers of national reputation, and commenting upon the records, he says: "The improved results obtained appear entirely reasonable and capable of being produced by the method employed."

I beg to take issue with you "that any design of valve gear could produce as high a saving in percentage of water and coal, 10.45 per cent. to 15.92 per cent., and 10 per cent. to 16.1 per cent., respectively, over a well-designed Stephenson link motion running in good condition." Much has been said regarding the Walschaert gear as being superior to the Stephenson link motion. If you will compare the record of the Walschaert gear on the New York Central locomotive No. 2,749 with the valve chart of the 581, you will find that, with the Walschaert gear at quarter stroke, pre-admission amounts to 11/16 in., lead 3/16 in., port ¼ in., cut-off 8⅛ in., release 22 in., or at 62.8 per cent. of stroke, closing for compression when the piston is within 10 in. of the end of its stroke, or at 62.8 per cent. of stroke. The New York Central engine has cylinders 23 in. x 32 in., and you will note that with the Walschaert gear there is the same early release of the steam from the cylinders and the same early closure of the exhaust port for compression, as under the Stephenson gear; therefore, the valve events being the same, the steam distribution must be the same with either Stephenson or Walschaert gear, and therefore there can be no particular difference in the steam economy nor is any economy in the use of steam possible in any other valve gear or any other system of steam distribution with early exhaust openings and closures.

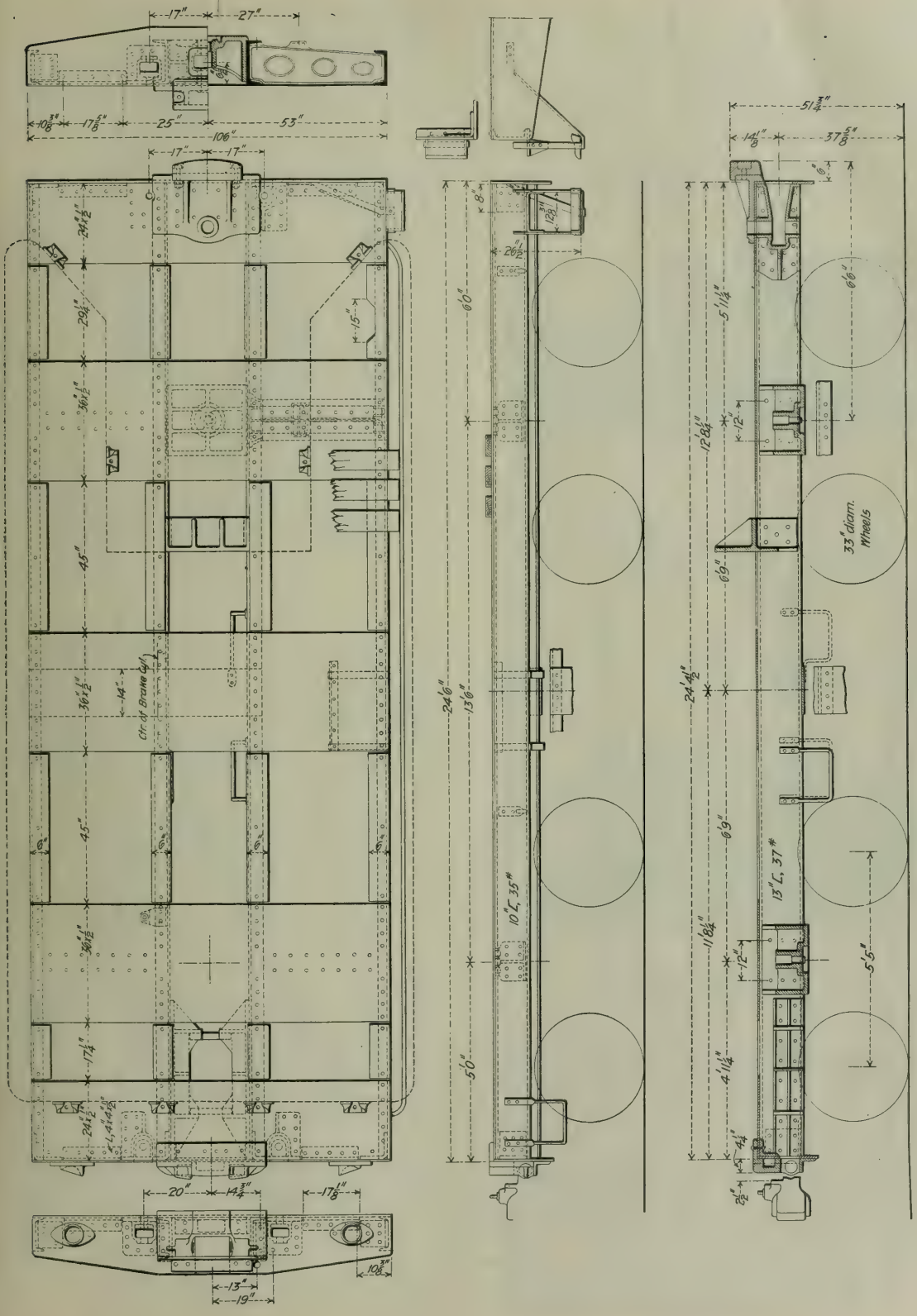
On the Central New Jersey, the No. 581 beat the No. 582 solely because of increased expansion, decreased negative work of compression, and reduction of waste in the cylinder clearance, all of which are regulated and controlled by the valve gear, and by the marked reduction in cylinder condensation possible in our system only.

IRA C. HUBBELL.

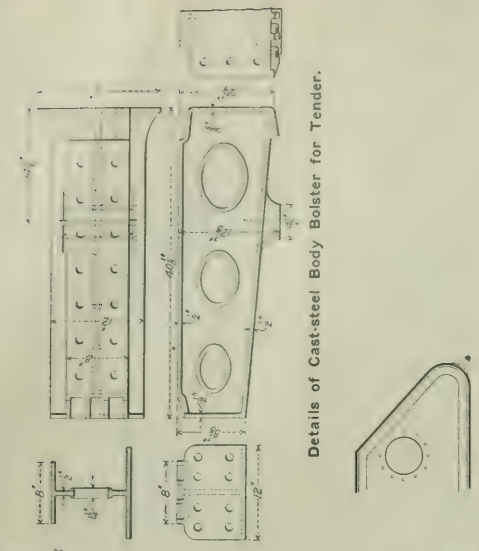
7,000-Gal. Tender of the Louisville & Nashville.

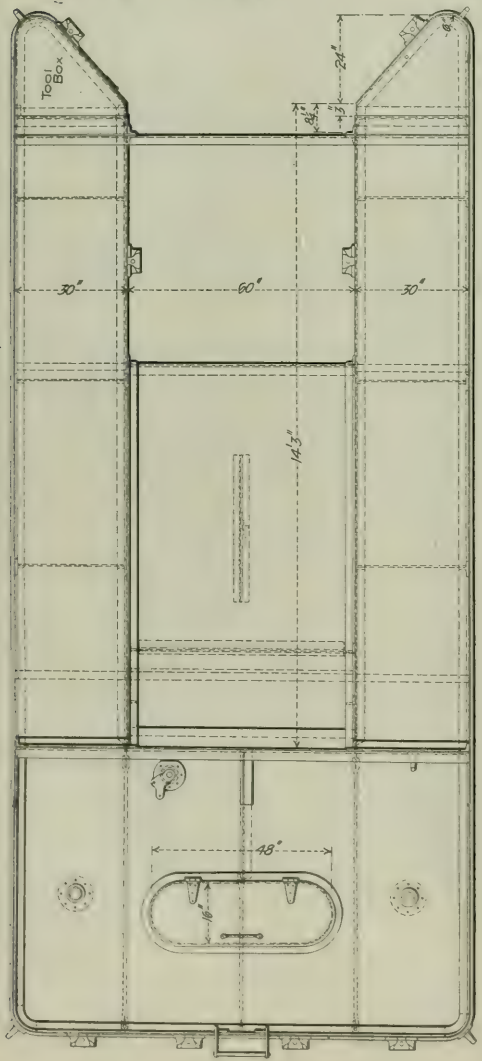
The 7,000-gal. tender illustrated herewith was designed by Mr. T. H. Curtis, Superintendent of Machinery of the Louisville & Nashville. It will be noted from a glance at the drawings that the sheets forming the coal space are so shaped as to insure all of the coal coming down to within easy reach of the fireman. In addition to its convenience in this regard, it avoids the accumulation of "old" coal. The easy curves—6-in. radius—of the 5/16-in. plates will also be noted, together with the arrangement and relation of the sloping and vertical back sheets.

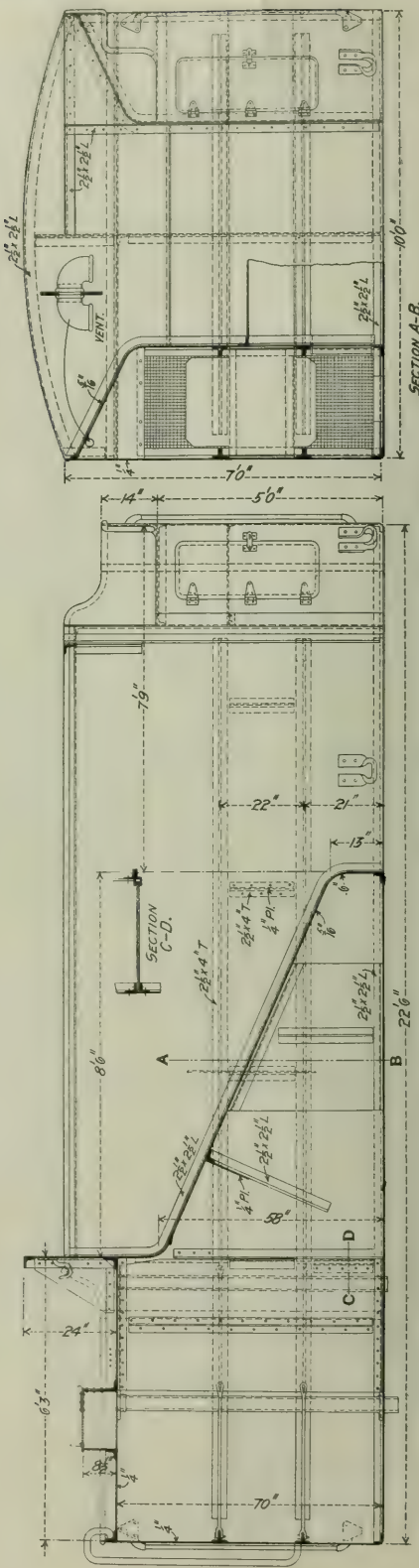
The bracing forward of the back line of the coal space is all by plates, angles and tees. The water legs are tied transversely by three plates secured to tees riveted to the side sheets. Two of these plates, which also act as splash plates, are 17½ in. wide, and the third and rear one is 34 in. wide. The sloping back sheet of the coal space is supported by a longitudinal plate 39 in. long, on the center line of the tank, stiffened by a tee. It is also stiffened higher up by a splash plate 12 in. wide extending transversely across it. The side sheets of the tank are stiffened longitudinally by two 2½-



Underframe for 7,000-gallon Tender—Louisville & Nashville.







Plan and Sections of Tank for 7,000-gallon Tender—Louisville & Nashville.

in. x 4-in. tees running their entire length. In the rear water space, on the center line of the tank, a longitudinal vertical plate 35 in. wide is riveted to the top and bottom sheets. This plate extends to the edge of the manhole. The space is also tied longitudinally by three pairs of ⅞-in. rods, the middle pair being shorter than the other two, and attached to the plate above mentioned. A 17½-in. splash plate extends across the tank at the rear of the water legs, 24 in. above the bottom. The entrance to each water leg is closed by a strainer of ¼-in. mesh, containing a door 34 in. high—large enough to admit a man.

It will be noticed that the front end of the left-hand water leg is stopped off by a transverse plate to leave space for a tool box or cabinet. This cabinet is closed by a door, as shown by the drawings. The coal is retained at the front end by a combination wood rack and chain gate 7 ft. high; the bottom part consisting of removable chains, and the top part being a permanent wood rack 30 in. high.

The steel underframe is of simple design and substantial construction. The center sills are 13-in., 37-lb. channels and the side sills 10-in., 35-lb. channels. The body bolster is formed of two duplicate steel castings of the form shown in the details, extending from side to center sills and riveted to both, and a separate casting between the center sills, the whole being covered by a ½-in. plate 36 in. wide. There is also a similar floor plate across the frame at the middle. At the ends of the frame there are floor plates 24 in. wide across on top of the sills, and to the ends of the latter are attached plates 11½ in. wide at each end and 17½ in. wide at the middle, stiffened with angles. All details of the frame are shown in the drawings.

The tank valve arrangement is a departure from usual practice. A circular pot 10 in. in diameter and 8½ in. deep is applied under the front end of the water leg on the right-hand side. Leading out from this pot are two 2½-in. pipes 6½ in. apart, terminating in the usual hose sleeve and nut. Each pipe contains a 2½-in. plug valve, the ordinary shut-off valve operated from above being entirely omitted.

The tender is mounted on two L. & N. standard 80,000-lb. trucks with built-up bolsters, 5¼-in. x 9-in. journals, 33-in. wheels and roller side bearings on the rear truck.

The Tennessee River Bridge of the Illinois Central.

BY H. W. PARKHURST.

One of the most important of recent improvement works of the Illinois Central has been the reconstruction of the bridge across the Tennessee river, on its main line from Louisville to Memphis and New Orleans. This was made necessary on account of the lightness of the old structure and its inability to carry with safety the heavy engines and trains now indispensable in moving the large traffic. The renewal has been accomplished by the construction of an entirely new bridge on a new site, as shown in Fig 1. The line of the railroad from a point about three-quarters of a mile southwest of

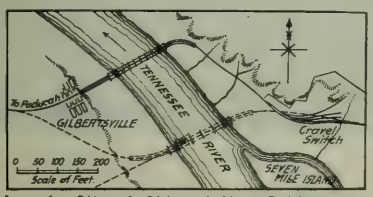


Fig. 1—Site of Old and New Bridges over the Tennessee River—Illinois Central.

the river was diverted and a new crossing made about half a mile further up the river, the diversion taking out nearly 120 deg. of curvature, and making the crossing of the stream more nearly at right angles with the current. The new bridge is about 5 ft. higher than the old, to give proper clearance under the new superstructure, but the grade on the approaches is light, being only 2-10 of a foot per 100 ft. The old bridge had a draw with two openings of 123 ft., while the new draw has openings of 198 ft., and it crosses at a more desirable point, both as to the location of the draw, and also as to the channel and the approaches to the opening. Serious objections had been made to the earlier bridge, and expensive sheer-booms were at one time ordered to be put in by the United States engineer officers in charge of the river, to satisfy the demands of the navigation interests, but the work was held off until the new bridge could be built, when modifications could be made to overcome the not unreasonable objections of the steamboat men.

In designing the new structure the utmost care was taken to see that an ample waterway was provided. The old bridge had about 900 ft. of trestle on each approach, built through timbered bottom land, and it might be thought that some of this opening could have been omitted. The Tennessee is, however, liable to sudden floods, and has a range of nearly 50 ft.; it was therefore deemed unwise to reduce the waterway to less than before. The new bridge was made to cover the whole width of the open stream, and the length of the approaches was adjusted to give an opening as nearly equivalent as possible to the original one. At the same time, the proper

Old Bridge of the Illinois Central over the Tennessee River, Built in 1888.

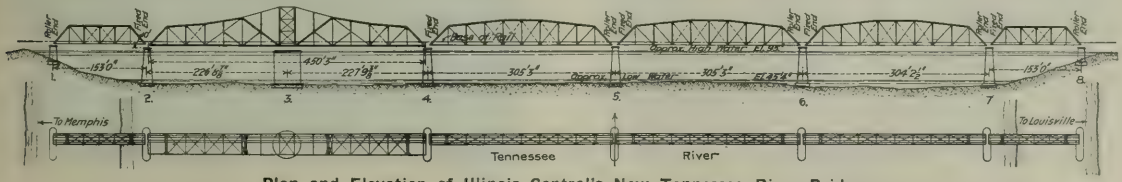
allowance was made for the longer spans and the less obstructed character of the new trestle work, so that the area of the new waterway is slightly less than before.

The original structure was built in about 1888, the superstructure plans being dated July 24 of that year. The spans were all of the "combination" type, but the draw had been replaced before the Illinois Central owned it; the plans of the present draw being dated February, 1894. The whole structure was designed for a comparatively light loading, viz.: two 90-ton consolidation locomotives followed by a load of 3,000 lbs. per linear foot. A fair allowance was made in addition for the dead load of the bridge and floor. The new spans are designed for two 165-ton consolidation locomotives, standing on 108 ft., followed by a load of 4,600 lbs. per ft., which is about twice as heavy as the old specification. Of course, the dead load of bridge and floor is added in the calculations for the new spans.

The consideration of how and when to replace this bridge was

New Bridge of the Illinois Central over the Tennessee River.

taken up early in 1902. Careful examinations were made of the piers and spans and estimates were made not only for an entirely new bridge, but these were compared with other estimates for rebuilding the old bridge under many different conditions. Owing to the great dissatisfaction with the old structure, it was probable that, if allowed to rebuild at the old location, a new and possibly a longer draw must be put in, and it might also be insisted that the draw be moved nearer the westerly side of the stream, where it would be more nearly in line with the channel. As the old piers had been founded on grillages only (no piles being used except in the west abutment), and as the old masonry was badly cracked,



Plan and Elevation of Illinois Central's New Tennessee River Bridge.

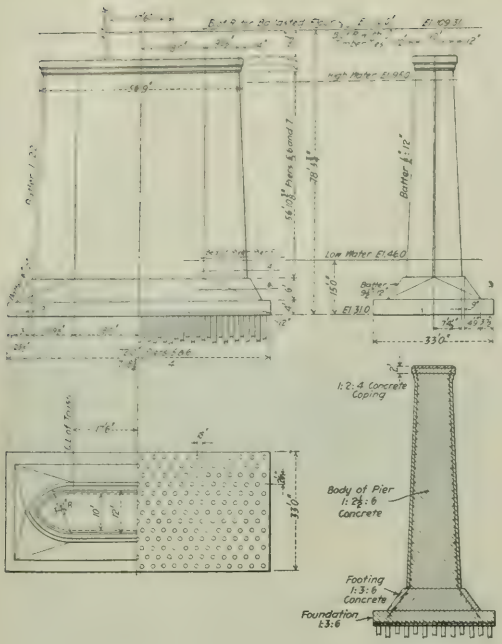


Fig. 3—Details of Piers Nos. 4, 5 and 6.

Fig. 5—Cofferdam for Pier 5, Showing Spacing of Corrugated Bars.

Fig. 6—Cofferdam for Pier 6.

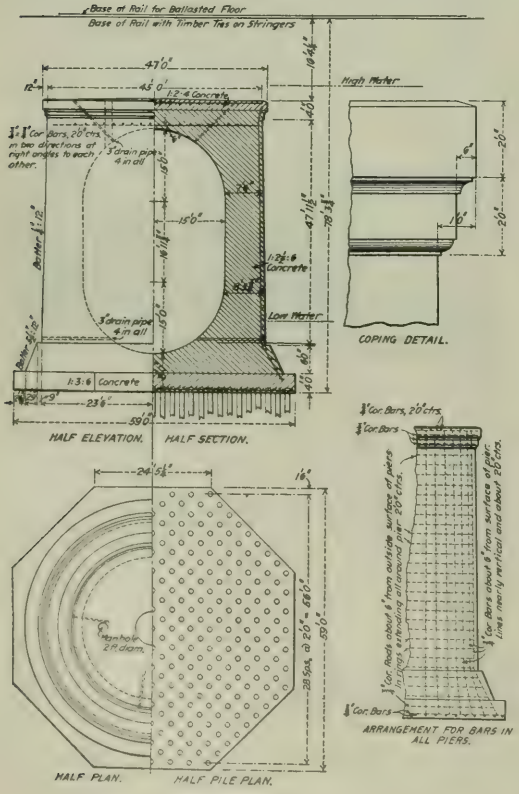


Fig. 4—Details of Center Pier for Draw Span.

Fig. 7—Looking West from East Bank, Oct. 24, 1904.

Fig. 8—Concreting Pier 1 on West Bank.

no method of repair was practicable (the piers being of sandstone), but to put on expensive jackets of concrete, and to reinforce the foundations with piles around them, to which more concrete must be added, to make a set of piers substantial enough to support even a single-track structure. A comparison of the estimates made upon the above basis showed that a new bridge throughout could be built for little or no more than it would cost to make the old structure thoroughly good. (And there would always exist the doubt as to whether the old piers could be made trustworthy.) It was therefore

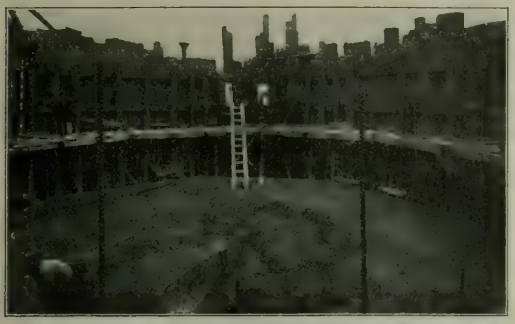


Fig. 9—Inside of Cofferdam for Pivot Pier.

practically necessary to build a new bridge, and plans for it, bearing date of June 6, 1903, were sent to the Secretary of War for approval. The formal approval bears the date of September 2, 1903.

A good deal of time was spent in determining just what should be built; that is, to what extent the structure should provide for carrying two tracks. While not needed immediately, the necessity would arise in the future, and perhaps at no distant day; hence it was necessary to make comparative estimates of the relative cost of converting a structure partly ready for two tracks into a complete double-track bridge. The estimates on these conditions being

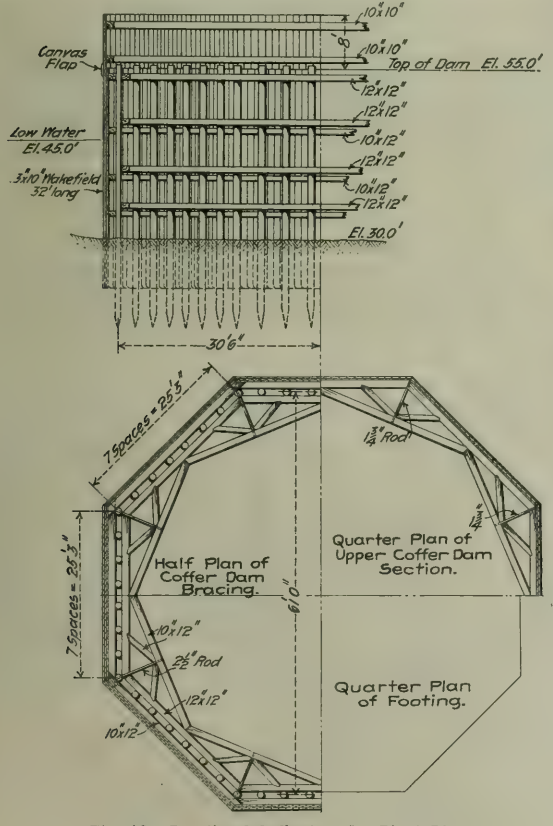


Fig. 10—Details of Cofferdam for Pivot Pier

completed, it was determined (1) to build the piers at once for a double track; (2) to make the fixed spans with one light and one heavy truss, and (3) to make the draw with two heavy trusses, leaving one floor only to be put in to make a complete double-track draw-span. This arrangement will permit conversion into a full two-track bridge without delaying traffic, and at a minimum of expense, and the resultant structure should be perfect for the service proposed. The first cost is kept as low as possible, considering that in the near future a second track must be had.

Substructure.—All the piers are founded on piles, borings in the center and on both sides of the river showing that the bed-rock was too deep to be reached by any reasonably expensive process. As the old bridge had no piles in the river, the thought may occur that this example could have been followed safely with the new bridge. But the experience with the old piers was sufficient to settle

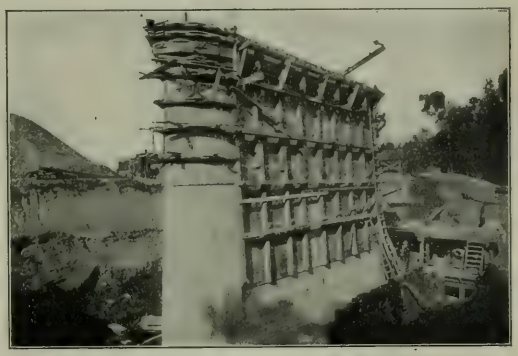


Fig. 12—Pier 1 Nearly Completed.

the question in the opinion of any one familiar with the bridge. While the material is mostly a heavy gravel, it has required large quantities of riprap to protect them from scour, and they have been all too easy to tip and to crack. The new pier foundations were carried well down into the bed of the stream, not only to give sufficient waterway without entirely omitting the use of riprap, but to safely allow a scour to take place, as it naturally will, around each pier. In spite of careful soundings and unlimited riprap, it has been known in one case that a pier actually slid off the hill of riprap on which it stood, and the two adjacent spans went into the river, stopping traffic on that bridge for weeks.

The dredging was generally done in advance of the pile driving,

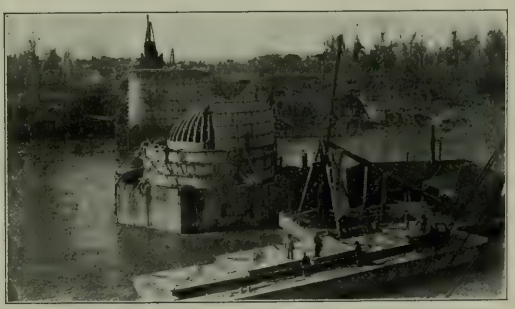


Fig. 11—Erecting Forms for Pivot Pier.

and before building cofferdams. The latter were put in, made up first of piles and then sheeting, and when the excavation was down, the piles under the pier were driven. The latter were cut by a circular saw mounted on a vertical shaft and set at the proper level to have the pile extend a foot or more into the concrete footing, making a bond with the same. As the excavation progressed, the bracing was set at the proper level in the cofferdam. Extensions of the cofferdams were made, generally at the up-stream end, for sumps, from which to pump the water. The dams were sealed, generally by depositing 2 or 3 ft. of concrete over the whole area by means of a bottom-dumping bucket, allowing it to set, and then pumping the interior dry by means of the sumps. Usually a 6-in. pump was ample to take care of the leakage, especially when a little calking had been done

The piers were built of reinforced concrete throughout, Johnson corrugated bars being set in both horizontal and vertical lines, spaced in regular order, as shown in Figs. 3 and 4. These bars were intended to perfect the vertical bond, as well as to distribute

any stresses and prevent cracking of the surfaces of the concrete. It will be noted that there are horizontal bars at the tops of the piles, at the tops of the piers, and also above and below the open space in the center of the pivot pier. Fig. 5, the cofferdam of pier 8, shows the general manner of securing and placing these bars. This view also shows the general construction of the cofferdams, as do also Figs. 6, 7 and 8, the latter also showing the concreting plant at pier 1, on the west bank. Fig. 9 shows the interior of the cofferdam of the pivot pier, details of which are shown in Fig. 10. It has no cross struts in the center, the bracing being made efficient by means of a series of horizontal trusses around the inner side of the cofferdam, leaving the center nearly unobstructed. This is a novelty in the way of bracing. Fig. 11 shows the forms being erected for this pier.

The general arrangement of the concrete mixing and handling machinery may be seen from Figs. 6, 7 and 8, in which are shown the concreting plants at several of the piers. Some of this work was done in three shifts, and the record of 1,800 cu. yds. in 24 hours is considered quite good.

The construction of the concrete molds may be seen in Fig. 7 and also in Fig. 12, which shows pier 1 nearly completed. All molds were made of lumber having dressed inner surfaces, and the result, as shown by the illustrations, fully justified the additional expense. This is best seen in Fig. 13, and also in the view of the finished bridge.

A tabular statement is given herewith, covering the items and totals of the substructure, from which an idea may be formed of the magnitude of the work.

Table I.—Data for Substructure Work—Tennessee River Bridge.

Pier No.	Spans, length, lin. ft.	Excavation, cu. yds.	Cofferdams, size & M. ft., B. M.	Piles, No.	Masonry, Footings, cu. yds. 18x63 ft.	Masonry, Tops, cu. yds. 7x37 ft.	Corrugated st'l b'rs, lbs.
I.	150	6,300	90	144	370	885	12,100
					33x69 ft.	10x35 ft.	
II.	225	5,400	120	305	873	1,356	16,200
			66 ft. oct. x 25 ft. high		59 ft. oct.	45 ft. cir.	
III.	225	3,500	120	410	1,254	2,290	20,300
			38 ft. w. x 78 ft. long,		33x72 ft.	10x36 ft.	
IV.	300	3,800	25 ft. high. 125	356	762	1,356	16,900
			38 ft. w. x 78 ft. long,		33x72 ft.	10x36 ft.	
V.	300	11,000	23 ft. high. 125	356	896	1,427	16,900
			38 ft. w. x 78 ft. long,		33x72 ft.	10x36 ft.	
VI.	300	2,500	25 ft. high. 125	356	992	1,427	16,900
					33x69 ft.	10x35 ft.	
VII.	150	6,000	120	305	761	1,427	16,200
					18x63 ft.	7x37 ft.	
VIII.		5,090	40	144	380	885	12,100
Totals	1,650	43,500	865	2,376	6,288 (17,341)	11,053	127,600

Time Finished.—Pier I.—Oct. 22, 1904; II.—Dec. 21, 1904; III.—Jan. 7, 1905; IV.—Dec. 24, 1904; V.—Dec. 17, 1904; VI.—Nov. 12, 1904; VII.—Nov. 26, 1904; VIII.—Sept. 24, 1904.

Note.—Sizes of tops of piers give length of the square, to the point of curvature. Points up and down stream are struck with radii as shown on plans.

All the substructure work was done by contract with the Bates & Rogers Construction Company, Chicago. The contract was dated May 21, 1904, and provided that the contractors should furnish a certain portion of the necessary plant, and should do the work on a "Force Account" basis, being paid a percentage for their services and allowing a bonus, as another percentage, should they finish the work before the stated time. The date set for completion was January 9, 1905, and as the work was finished on the second day of that month, the bonus was fairly earned. The exact cost of the substructure work has not yet been calculated fully, many minor accounts not being closed, but the contract work was done at approximately $255,000, this allowing for the contractors' percentages in profit and bonus, and making deductions for the salvage of tools, materials, etc.

Superstructure.—The contract for the superstructure of the Tennessee river bridge was included in a general contract for bridge superstructure let to the American Bridge Company, dated September 9, 1902, the work then being practically decided on, though no exact plan of length of spans had been settled on. The prices at

Fig. 13—Completed Pivot Pier.

which the work was let were: (1) for pin-connected trusses, $0.0364 per pound; (2) for draw-span, including turntable, $0.0445 per pound. It was stipulated that the railroad company should furnish all the detail plans, and that the manufactured material should be delivered at Chicago, or at some other convenient point on the Illinois Central Railroad. The contract did not include the erection work. The estimated weights of the bridge were as follows:

250 ft. spans	834,000 lbs.
300 ft. spans	3,960,000 "
Draw-span and turntable	2,200,000 "
Total	7,360,000 lbs.

Later estimates place the total at 7,520,000 lbs. No final estimate has yet been made, some minor matters being yet unadjusted.

The earlier plans for the new bridge were for a draw-span of 400 ft., four spans of 275 ft., and one of 250 ft., making a total of

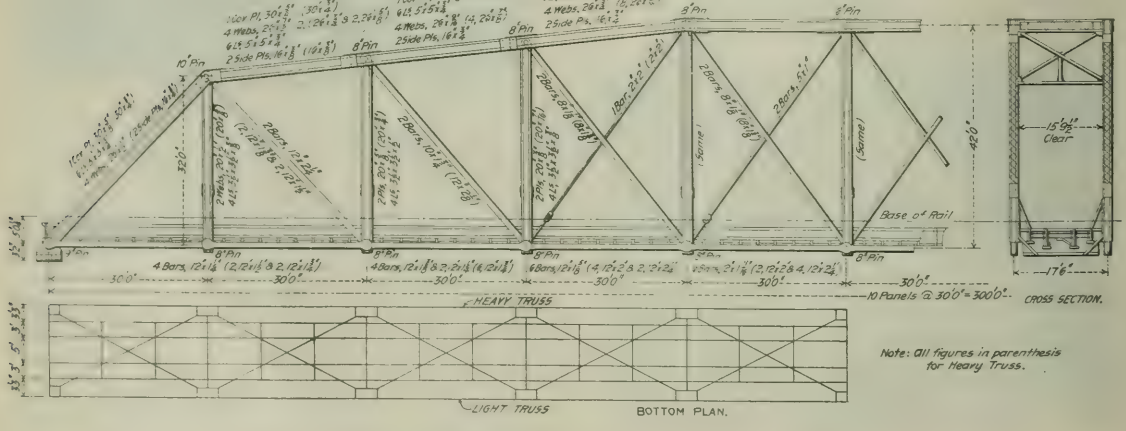


Fig. 14—Details of 300-ft. Fixed Spans—Tennessee River Bridge.

1,750 ft. This would probably have been a cheaper bridge to build than the plan actually used, but the United States engineers insisted on a longer draw, and the location of the channel and the width of river to be spanned made the plan of using 300-ft. spans with the longer draw of 450 ft. about as economical as the original plan.

The general features of the 300-ft. fixed span are shown in Fig. 14. There is nothing of special novelty about either of the spans. Details of the wedges for raising the ends of the spans are shown in Fig. 15, and the general plan and some detail of the center of the draw, and the machinery to operate it in Fig. 16. The spans are set in the following order: Beginning at the west end, one 150-ft. span, next the 450-ft. draw, then three 300-ft. spans, and last, at the east end, one 150-ft. span; making, inclusive of pier spaces, which vary

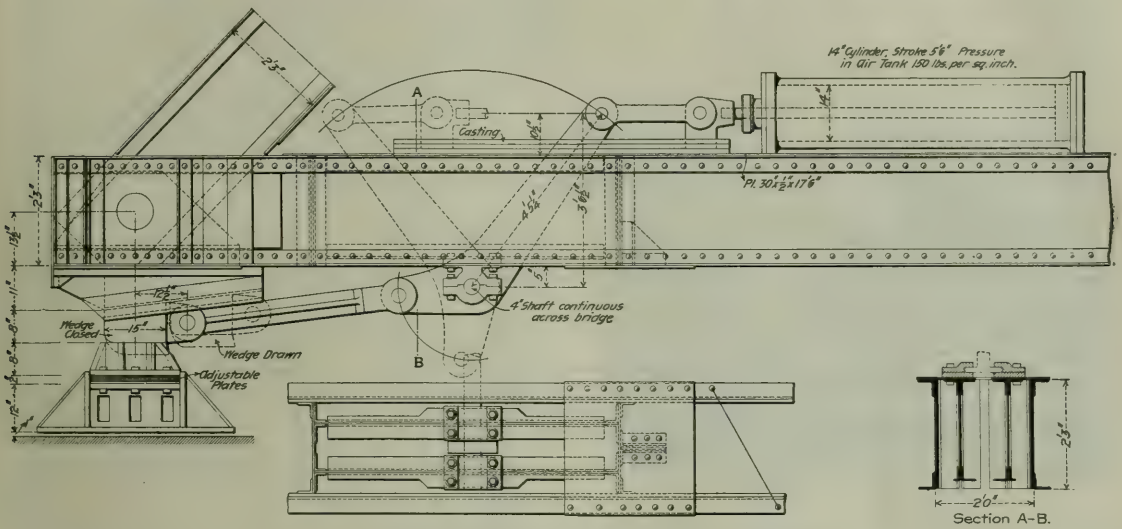


Fig. 15—Details of End Lift of Draw Span—Tennessee River Bridge.

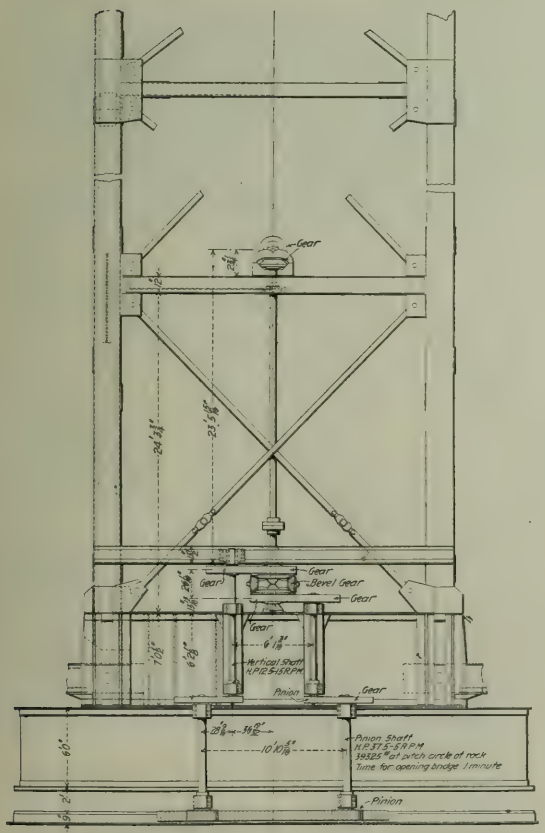


Fig. 16—Details of Turning Mechanism for Draw Span.

with the sizes of the spans, a total length of 1,675 ft., 2¾ in. from center of pin on the west to center of pin on the east piers.

The new bridge is about 50 ft. longer than the old, as to the steel structure. A comparison of the old and new bridges does not do justice to the latter, since the older picture was taken 14 years ago, when the earlier bridge was in its prime. It is now much less sightly, having an old Phoenix span in place of one combination span second east of the draw, put in to carry the track after a fire had destroyed a span, and the falsework used to erect it was left in till the old span should be removed. Drift has lodged in this falsework and is very unsightly. Then, too, 16 years of age are telling on the timber of the old bridge, and it would be serviceable for but a short time. For these reasons the views do not picture fairly the relative conditions. Then, too, the piers are deceptive, at the very least, to the casual observer. They were the main reason for building a new bridge. With their foundations placed at too high a level; with no piling under them to distribute the load, or to carry it to a lower and less uncertain stratum; with masonry of poor sandstone, already cracked, and likely to go to pieces at any time; with the chance of being undermined by any high water, when it might be impossible to riprap them, there was always a vast uncertainty about them, no one daring to vouch for their integrity, or regard them with confidence. They were known to have been moved more or less, and they might do so once too often. A steamboat had, and might again, run into one of them, and knock it off of its uncertain footing into deeper water than would be safe, and where it would be impossible to right it. Those piers were therefore sources of anxiety, and likely to bring discredit on any engineer who had to care for them. They are being replaced none too soon.

The wooden floor of the old bridge was another almost insuperable objection to rebuilding it. It was composed of 8-in. x 16-in. timbers, 18 to 20 ft. long, supported on I-beams built into the bottom chords, and not easily to be strengthened without uncoupling the spans. Figs. 17 and 18 show two views of this floor.

The contract for the erection of the bridge was let to the Kelly-Atkinson Construction Company, Chicago. It is dated November 21, 1904, and provided for the completion of the erection in 120 days from date, under a penalty and bonus clause of $50 a day, the saving or loss of one day being valued at that figure. The contract provided that if the draw should be erected leaving the opening through it for use of boats, the rate should be $23.50 per ton; but if the draw was closed, a rate of $1 less per ton would be fixed. The draw was left open, entitling the contractors to the larger rate. The work is not yet done at this writing and the contract limit has elapsed, but it is expected that the work will be done in the

next ten days. The tabular statement following gives the principal data of the [illegible] work.

Table II. [illegible] Tennessee River Bridge.

Steel	L. F.	Draw.	IV.-V.	V.-VI.	VI.-VII.	VII.-VIII.
Piles [illegible]	[illegible]	[illegible]	88	88	84	25
Falsework [illegible]	[illegible]	[illegible]	300	300	300	150
Steel [illegible]	[illegible]	[illegible]	679	679	679	189
Riveting [illegible]	[illegible]	[illegible]	9,986	9,986	9,986	3,798
Painting [illegible]	[illegible]	[illegible]	679	679	679	189
Work [illegible]	[illegible]	[illegible]	June 1.	May 20.	May 13.	May 6.

It is not necessary to go into further detail, except to say that the erection has gone on in the usual way, being handled by a traveler

Fig. 17—Floor of Old Bridge.

running on falsework put up under each span in turn. Falsework piles were driven by a double driver pushed forward in front of the trestling, and piles were driven rapidly and easily therewith. A pneumatically-driven riveting plant was used throughout, much to the satisfaction of the engineers. The work went together in good shape, and the draw, which has been turned once by hand, fits well and is in fine adjustment. The turning of the draw verified the

Fig. 18—Under Side of Floor of Old Bridge.

layout of the engineers to ¼ in. The cost of the erection cannot be stated yet with any exactness, the work being still unfinished. It will, however, approximate $90,000.

The trestle work of the approaches deserves special mention, as it has some novel features, at least as an adjunct to a big river bridge. It was originally proposed to make an iron viaduct for this portion of the bridge, as is often done where permanent work is desired. But in this case the use of iron work was not desirable, since the approaches need not be double-tracked for any present service, and the time when two tracks would be essential was uncertain. Estimates were also made for building the approaches of concrete arches, and had there been any immediate use for two tracks on them, the concrete work would have been in high favor. Under the existing conditions it seemed inadvisable to go to a large expense for the approaches, and it was decided to make them of creosoted piling and timber, as being the just mean between the wooden or iron single-track trestle. The material of the trestle is all creosoted, and to make it safer against fire the floor is made nearly fireproof by filling in between the heavy ties with creosoted boards, making a tight floor, and then covering it with finely-crushed ballast to a depth of 1½ or 2 ins. This not only keeps the sparks off the wood work, but deadens the roaring noise which would otherwise be too apparent, and makes an easy floor to walk on and to maintain. A heavy guard-rail at the end of the 10-ft. ties will keep the wheels on the deck and also confines the ballast.

The work has been handled throughout by the bridge and building department of the Illinois Central Railroad. The general plans were all prepared in the offices of the company, and any details not prepared there were subject to their inspection and correction. The minor details of the substructure were made out by W. H. Torrence, who was at first Resident Engineer at the bridge. He was succeeded by H. H. Hadsall, who has carried the work to completion. The superstructure was designed by R. E. Gaut, then chief draftsman, now Engineer of Bridges, and the work is being finished under his general direction. As Engineer of Bridges and Buildings, the writer started the earlier estimates and work, but was succeeded Sept. 1, 1904, by F. H. Bainbridge, who was his assistant in the early stages. Mr. Bainbridge resigned his position on February 1 last, and was succeeded by Mr. Gaut.

The work therefore bears the impress of many hands, but it is an integral whole, without faults or misfits, and will do honor to all who were in any way connected with it.

Calculating the Cost of Handling Freight at Large Stations.

At the recent meeting of the Local Freight Agents' Association at Minneapolis, reported in the *Railroad Gazette* of June 30, page 757, the members again discussed the question, reported on in 1902, of classifying the expenses of a freight station; and, after a full expression of views, the convention adopted the classification which was reported by the committee in that year. This classification is as follows:

1. General Supervision. 2. Supervision and Clerical Work. 3. Labor.

General Supervision.

General foreman, Assistant foreman, Watchmen and sealers.* Clerks,

The cost of General Supervision to be distributed pro rata between warehouses, platforms and team tracks, on basis of pay rolls for each separate place.

Supervision and Clerical Work.

Warehouse.	*Platform.*	*Team Tracks.*
Foremen,	Foremen,	Foremen,
Clerks,	Clerks,	Checkers,
Receiving checkers,	Loading and unloading checkers,	Sealers, and
Delivery checkers,	Watchmen and sealers.†	Watchmen.†
Loading and unloading checkers,		
Weighers,		
Watchmen and sealers.†		

Labor.

Warehouse.	*Platform.*	*Team Tracks.*
Loaders,	Loaders,	Laborers engaged in loading and unloading package freight on team track.
Packers,	Packers,	
Truckers,	Truckers,	
Coopers,	Coopers.	

*If the service of watchmen and sealers extends over all three departments—Warehouse, Platform, and Team Tracks.

†If not included under General Supervision.

Tonnage should also be classified as follows:

Warehouse Freight.—General merchandise received and forwarded; includes handling from cars to teams and from teams to cars.

Platform Freight.—Freight transferred at platform from car to car or checked from and returned to same car.

Team Track Freight.—Freight handled from cars to teams or taken from teams to cars when supervision, checking or labor is furnished.

To arrive at the total number of tons handled credit should be taken but once for the actual number of tons handled in receiving and disposing of the freight.

The cost per ton for handling is to be obtained by dividing the tonnage obtained as above into cost for labor at warehouse, platform or team track.

Total cost per ton for operation is to be obtained by dividing the tonnage obtained as above into the total cost for supervision, clerks and labor at warehouse, platform and team tracks.

Cole Balanced Compound for the Erie.

The American Locomotive Company has just turned out at its Schenectady works a 4-4-0 Cole four-cylinder balanced compound locomotive for the Erie, a photograph of which is reproduced herewith. It has the same size cylinders, 15½ in. and 26 in. by 26 in. stroke, as the original Cole compound for the New York Central built last year (see *Railroad Gazette*, May 13, 1904), but in many of the details it has been materially changed. The Erie engine has 115,000 lbs. on two driving axles and a total weight in working order of 206,000 lbs. This is 5,000 lbs. more on drivers and 6,000 lbs. more total weight than the Central's compound, and is, we believe, the heaviest weight yet put on a single driving axle. The perfect balance exhibited by the Cole compound on the St. Louis Exposition testing plant undoubtedly influenced the builders to increase the weight on drivers to this extreme amount. The Erie's roadbed is hardly up to the standard of the New York Central, and it will be interesting to see what effect, if any, this new engine has on lighter rails when running at high speeds.

The principal difference in appearance between the two locomotives is due to the fact that the Erie engine has been lengthened 1 ft. between the center of the low-pressure cylinders and the leading driving axle. The boiler has been lengthened correspondingly by inserting 17-ft. tubes instead of 16-ft. tubes. This permits the use of a longer inside connecting rod. The outside rods have not been lengthened, the additional distance being compensated for by extending the cross-head guides and lengthening the piston rods as in the Baldwin compounds. Some minor changes have been made in the valve and cylinder castings, notably leading the high pressure steam along the side of the valve casting instead of along the top.

In point of boiler power, this new engine surpasses the Central's compound. It has 56.3 sq. ft. of grate area as against 50.3 sq. ft., and 3,622.02 sq. ft. of heating surface as against 3,446 sq. ft., most of which is gained by the additional length of tubes. The Central Atlantic engines have proved to have ample reserve boiler power, and this engine should prove equally as satisfactory in this respect.

The accompanying table gives the principal dimensions of a recent de Glehn four-cylinder compound, the Cole compound of the New York Central and the Baldwin compounds on the Santa Fe. It will be seen that the Erie engine is the heaviest and most powerful engine of this type yet built.

	de Glehn.	Baldwin.	Central.	Erie.
Total weight, lbs.	142,193	193,760	200,000	206,000
W't on drivers, lbs.	71,200	101,420	110,000	115,000
Cylinders, in.	13.4 & 22x25.2	15 & 25x26	15½ & 26x26	15½ & 26x26
Diam. drivers, in.	80¾	73	79	78
Total, htg. surf., sq. ft.	2,274	3,083	3,446	3,622.02
Grate area, sq. ft.	29.6	49.5	50.3	56.3

The following table gives the principal dimensions of the Erie engine:

Kind of fuel	Bituminous.
Weight on drivers	115,000 lbs.
" truck wheels	91,000 "
" total	206,000 "
Weight, engine and tender loaded	368,800 "
General Dimensions.	
Wheel base, total, of engine	28 ft. 9 in.
" driving	7 " 0 "
" total, engine and tender	60 " 9 "
Height of stack above rails	15 " 2¼ "
Heating surface, firebox	188.47 sq. ft.
" " tubes	3,433.55 "
" " total	3,622.02 "
Grate area	56.3 "
Wheels and Journals.	
Drivers, number	4
Drivers, diameter	78 in.
Drivers, material of centers	Cast-steel
Truck wheels, diameter	36-in.
Journals, driving axles, size	10 in. x 12 in.
Journals, truck axles, size	6½ in. x 12 in.
Cylinders.	
Cylinders, diameter	15½ in. and 26 in.
Piston, stroke	26 in.
Piston rods, diameter	3 in.
Piston rod packing	Cast-iron rings
Valves.	
Kind of	Piston, 14 in. diameter.
Maximum travel	6 in.
Outside lap	1 in.
Inside lap or clearance	H. P. 3/16-in., L. P. ⅜-in.
Lead	¼-in. forward at 11 in. cut-off.
Boiler.	
Type of	Extended wagon top.
Working steam pressure	220 lbs.
Diameter of barrel, first ring	70¾ in.
Firebox.	
Length	108 1-16 in.
Width	75¼ in.
Thickness of sheets	Crown ⅜-in., tube 9/16-in., sides ⅜-in., back ⅜-in.
Water space, width	Front 4 in., sides 3½ in., back 3½ in.
Tubes.	
Number	388
Material	Charcoal iron.
Outside diameter	2-in.
Length over sheets	17 ft.
Other Parts.	
Exhaust nozzle, single or double	Single.
Exhaust nozzle, diameter	5⅜, 5⅝, and 5⅞ in.
Stack, diameter	18 in.
Tender.	
Tank capacity	8,500 gallons.
Coal capacity	16 tons.

Cole Four-Cylinder Balanced Compound Atlantic (4-4-2) Type Locomotive for the Erie.

A Railroad Clearing House.

In two recent circular letters J. W. Midgley reviews the work of the British railway clearing house, and discusses the adaptability of some such system to the conditions in this country. Parts of these letters follow.

The clearing system as applied to inter-line traffic in England has been on trial over 60 years. In 1842 complaints of the public of the inconvenience of being obliged to purchase tickets at each junction and arrange for the transfer of their goods to the next carrier, became so grievous that Mr. Kenneth Morison, who was Auditor of the London & Birmingham Railway, evolved a remedy, and bringing it to the notice of prominent railroad officers, induced them to join in what, in this country, is termed through ticketing of passengers and through way-billing of freight. To carry out the arrangements and duly distribute the proceeds between the participating companies Mr. Morison organized a bureau with a small staff of clerks, and located the same in a modest house in Drummond street. The supervising body was called a committee, and to the latter reference is made in the Clearing Act which was passed by Parliament in 1850.

Similar steps were initiated in this country in the case of passengers, through the intelligent action of general ticket agents of connecting lines; and later, a similar work was inaugurated, scarcely less beneficial to the public, in the through way-billing of freight and its transportation for long distances without breaking bulk by the establishment of co-operative or fast freight lines.

But when English railroad managers experienced difficulty in enforcing contracts to distribute gross earnings arising from the through (or continuous) transportation of passengers and freight, all they had to do was to petition Parliament for the requisite authority and it was conferred in what was termed the Clearing Act. This was procured largely through the efforts of George Carr Glyn, Esq.—afterward called Lord Wolverton. He was Chairman of the London & Birmingham Railway, with which company Mr. Morison, the first Secretary of the Clearing House, had been connected as Auditor. The Clearing Act was amended in 1897 in accordance with the desire of interested railroad companies, and the institution has proved so beneficial that it is regarded with a favor which would hardly be comprehensible in this country.

As a matter of fact, credit for the initiation of the clearing system is not due to the railroads of England but to the banks. It was from the latter that Mr. Morison derived the suggestions which he induced his colleagues to apply to inter-line traffic. The following outline of the growth and objects of the English Clearing

House is taken from an official pamphlet issued in London in 1901.

In 1838 it became evident, when the railroads which extend from London to Liverpool had been completed and connected, that arrangements must be adopted to facilitate the passage of through traffic at the points where the three railroads joined. It was found that not only must passengers be permitted to make a continuous journey without being required to change their carriage, but that a similar rule must govern every description of through traffic. The change of carriage, with its attendant worries in connection with baggage, the transferring of goods, with the loss of time and increase of risk, were characterized as the "evils of the system," the "supineness of railroads," and the "results of monopoly."

Thereupon, the directors of certain railroads tried to comply with the requirements of the public. Mr. Kenneth Morison and Mr. Robert Stevenson conceived that a central office, constituted on a similar plan to that of the Bankers' Clearing House, would furnish a remedy. This plan was submitted to Mr. Glyn, who saw its advantages and set to work to perfect it. This was not done without surmounting many obstacles. Those who feared their dishonest gains would be curtailed fought vigorously against it; some opposed it because it involved trouble, others upon principle—the universal one—that it was new. The more he considered the practicability of the idea the more Mr. Glyn became convinced of its necessity, and he agitated and argued for it. At length the various difficulties were surmounted, and on the 2d of January, 1842, the system of the Railway Clearing House came into operation on the railroads extending from London to Darlington in one direction, and from Manchester to Hull in another.

The wisdom of its promoters was soon exemplified, and through traffic began to be worked with facility, economy, despatch and justice. As stated by Mr. Morison, the Clearing House had its origin in the desire of the railroad companies to further their own interests in the only way in which those can be effectually promoted or permanently secured—by consulting public opinion. It has grown with the growth of the railroad system, and unless the public accommodation be restricted and the exigencies of the commercial, manufacturing and agricultural interests be disregarded, it must advance to the limits to which continuous communication by railway extends.

This recital may be interrupted to note another difference between conditions in England and in America. The managers of English railroads are not only at liberty to agree upon uniform methods and regulations to govern the transportation of passengers and freight, but they have the sanction of law so to do. Furthermore, by means of the Clearing House, the classification of freight which governs throughout the United Kingdom is formulated and revised. In like manner, schedules of rates are agreed upon, whether for through line or competitive traffic. Thus, while companies retain the independent right to establish all tariffs, those are usually made by agreement with rival companies through the Clearing House.

Such procedure as the one just described is prohibited in this country. The construction placed by the Supreme Court upon the anti-trust law forbids common carriers associating to agree upon rates, notwithstanding those should be reasonable. It was held in the trans-Missouri case that it would be a restraint upon trade for the Association (composed of roads operating west of the Missouri river) to meet at stated periods for the purpose of formulating uniform rules, rates and regulations to govern the transportation of traffic over their respective lines. The decision was affirmed in the case of the Joint Traffic Association—an organization of the trunk lines and affiliated roads operating between North Atlantic seaports and Mississippi River crossings. Attempts of railroad companies to act together or agree upon uniform rates were declared to be in violation of the anti-trust law.

As one of the main purposes of the English Clearing House is to promote uniformity and agreement between carriers—which are admittedly in the interest of the public—it is manifest that similar advantages cannot be assured in the United States until a modification of the existing prohibition is obtained from Congress.

Returning to the English organization, it appears that during the first five years, only passenger traffic, and that in small parcels, were handled by the Clearing House. Goods were carried "by toll" —in some degree analogous to the express system of the United States. At the end of that period arrangements were made for assessing the proportionate charges for goods traffic, and crediting the various companies for the use of their rolling stock.

After the death of Mr. Morison, Mr. P. W. Dawson was appointed Secretary of the Clearing House. The clerks employed by the Secretary not only officiate as accountants, but perform in many respects the functions of bankers. All balances due on accounts sent to Seymour street are paid in, no delay being allowed for clearing alleged errors or disputed points. All inter-line business is settled there, and accounts are eventually balanced to a farthing. So prompt and thorough are the methods employed that provisional settlements of reasonable accuracy are made with all lines before the end of the succeeding month. The annual clearings approximate $150,000,000, and not being conducted for profit there is never a surplus nor a deficiency. The Clearing House is conducted at a total annual cost of about $150,000. Where great differences of opinion occur they may be carried forward for future settlement, or a suspense account may be opened; but in no case can the decision of the Clearing House be resisted. By the Act of Parliament which created the institution, anything declared due by it is legally due and must be paid.

The governing body is composed of a delegate from each affiliated company—often the Chairman of the company, but always a Director. The committee of delegates meets every quarter. From its own body it appoints seven members as a Committee of Superintendence, meeting monthly, and it is to this body that the Secretary makes his report every month.

Reverting to the Clearing Act, which is stated to have been necessary owing to the inability of the committee to enforce payment of amounts declared due, it is not clear why difficulty should have been experienced in that respect. If the reference had been to balances for service performed pursuant to contract, no trouble should have been experienced in enforcing the same. For example, if three companies form a continuous through line, each one is entitled to its agreed share of the proceeds for the transportation of passengers or goods, as the case may be, and could enforce collection. The presumption is that the committee in charge of the first clearing house was not authorized to initiate legal proceedings, but the individual companies could not have been debarred from their inherent right of action.

The point sought to be made is an important one. Parties are apt to infer that clearing houses for the settlement of inter-line accounts could not be maintained unless they were specially authorized by Federal statute. That belief grows out of the fact that pooling contracts were not enforceable at law. There is a distinction, however, between the latter and agreements for the division of gross receipts among parties to a through or continuous line. In the first case, responsive to inquiry from a Parliamentary Commission, the Solicitor General expressed the opinion that a stockholder could enjoin the company in which he was interested from paying monies (for services it had rendered) to a competing line, which latter had really not earned the same. In other words, if there were two rival roads operating between given points, that had agreed to divide the gross proceeds of the traffic via both lines in equal proportions, and one should carry only 40 per cent., then a stockholder could enjoin the excess line from paying 10 per cent. over to the other in order to make good its shortage for a service it had not rendered.

An American clearing house need not seek any such arrangement. It would suffice for it to provide for the distribution, in accordance with prior agreement, of the gross earnings for the through transportation of passengers or goods over a continuous or through line which may be composed of two, three or more connecting carriers. There would, necessarily, be many such transactions during one month, and as the settlements would not be made oftener than monthly, the clearance idea involves disposing of the same by one balance sheet instead of many. Manifestly, to do that does not require any authority of law, because it would in no wise concern the public—neither would the rights or interests of a stockholder in either company be affected; and in any event the authority of the individual companies to recover one from another would not thereby be vitiated or diminished.

Furthermore, there is small likelihood of litigation between railroad companies as to the settlement of accounts known to be justly due. It is a matter of common knowledge that the adjustment of joint coupon-ticket accounts, inter-line freight accounts, mileage and other accounts between railroad companies are regarded as debts of honor, and that drafts therefor are paid on presentation; and correction, if need be, is made in accordance with subsequent revision. This will serve, therefore, to indicate one marked difference which may be drawn between the English Clearing House and any similar organization that may be undertaken in this country. The latter would not require the assistance of Congress, and so far as I can judge, need not be chartered or incorporated, because it would simply contemplate an economical adjustment of accounts between interested railroads, the same as is daily performed by the banks in leading cities of the Union through their clearing houses.

As showing the difference between the operations of a Bankers' Clearing House and those of the English Railway Clearing House, the following statement by the present Secretary, Mr. Harry Smart, will be interesting:

> The work of the Bankers' Clearing House cannot well be taken into comparison with that of the Railway Clearing House. The former deals in already-made (possibly already lost) material (cheques), and can at once declare a balance; while here, before we are in a position similar to that of the Bankers' Clearing House, we have to perform various complex operations, such as receiving particulars in duplicate both from the forwarding and receiving stations, reconciling differences (a delicate task at times), condensing the items, ascertaining the debit of the cash-holding company, apportioning to each company its agreed share of receipts, preparing accounts showing the details required by the companies, and ascertaining the balance due to or by each company concerned in the month's transactions. These operations here precede the preparation of a balance.

Mr. Smart also explains, as follows, the departments into which the Clearing House is divided, and the manner in which work is conducted:

The London staff is organized in departments, with an Assist-

ant Secretary and four other principal officers; these are separated into divisions, with a chief clerk to each, and those again are subdivided. In the main office there is the Secretarial Department; the Merchandise Department—which is the largest and of great importance; the Coaching Department—comprising the passenger traffic and parcels and miscellaneous traffic; and the Mileage and Demurrage Department—which controls also the number-taking staff.

The Merchandise Department is one of the largest working offices in London, providing accommodation for about 1,000 clerks. Its purpose is the monthly apportionment of the receipts from the conveyance of goods, coal, coke and other minerals, and from cattle traffic—that is, traffic carried in goods, coal, and cattle trains as distinct from passenger trains, using more than one line of railroad in transit. With local traffic, except where traffic is the subject of agreement, it has nothing to do. To enable the Clearing House to make its settlements, it is supplied with monthly returns from stations of the totals of all invoices; these returns show the weight of the goods, and whether carried at rates which include collection and delivery or simply from station to station; the amounts "paid" and "paid out" at the forwarding station, and "to pay" at the receiving station. The returns show also the numbers and owners of the vehicles in which the traffic was conveyed. Separate returns of forwarded and received traffic are made by each station, and these are so sorted that the outwards returns of the forwarding station can be easily compared with the inwards returns of the receiving station; discrepancies are then adjusted by correspondence and the corrected totals transferred to "settlement" forms.

Next comes the calculation of what are known as "terminals." These are fixed sums allowed to the forwarding and receiving company for work done; but there are thousands of cases in which special or exceptional amounts are allowed by agreement between the companies, and all these have to be borne in mind by the clerks dealing with the returns. After deducting the terminal allowances and "paid on" amounts (amounts paid out by or allowed for some special service to the forwarding company) the remaining receipts are divided among the companies in the ratio of the mileage traversed, or in any other way that may be agreed. Frequently some doubt exists as to the route of the traffic, and then reference is made to the records of the Mileage Department and the exact route traced by means of the car numbers shown in the number-takers' returns. But the division of receipts is not always the simple matter that might be supposed. The Clearing House has to keep in view the numerous complicated agreements existing between companies, as well as the immense number of working arrangements made to facilitate the movement of traffic in all parts of the country; and when, in conjunction with these, disputes arise the Clearing House divides the undisputed portion of the receipts, holding the remainder in trust until the disputants agree.

The division of receipts having been completed, the next operation is the making up of monthly accounts for each of the companies. The account constitutes for each of the companies a permanent record of its entire monthly transactions, the final summary showing in one figure how much money is due to or from the company in respect of all such transactions. The account also shows how much cash is due to the company from each of its station agents, so far as traffic settled through the Clearing House is concerned. The earnings from "light traffic"—that is, traffic which in any month between a pair of stations in either direction does not exceed a certain fixed sum—are not divided in detail, but are apportioned in ratio to the results of the accurate division of the heavier traffic receipts in corresponding groups or partnerships.

The British railway clearing house plan could readily be put in use in this country for dividing the earnings on through coupon passenger tickets. Mr. Midgley describes the working of the English office as it was in 1898. For the great mass of through tickets, an English road reports to the clearing house the receipts, less its own share; but in the case of certain excursion tickets the whole fare, through, is reported, and is divided by the clearing house. Forty clerks are employed to assort the taken-up tickets, and in the summer a million such tickets are handled in a month. The number of settlements in a year is 7,500,000, and the money value of these tickets, $25,000,000. The whole staff of this department numbers 350. The clearing house also keeps the accounts of the through parcels traffic. Only approximate divisions of earnings are made monthly in this department, exact figures being made up only twice a year. There are 4,000,000 settlements yearly, and the traffic amounts to $10,000,000; 350 clerks are employed.

The Mileage department adjusts the compensation for interchanged freight cars. This department has its own number-takers at every important junction and keeps its records independent of the local agents. The number of cars sent from home to foreign roads monthly, including passenger cars, is over a million. Ordinary freight cars of capacities of not more than 10 to 20 tons each are charged at a rate of about one cent a mile. This is for a certain agreed limited time, and if the car is held beyond that time a penalty of 3s. a day is assessed. On cars of 15 tons capacity this rate is doubled; 20 tons, doubled again; 30 tons, 20s. a day. Penalties are also enforced for diversion. Mr. Midgley says that no demurrage is charged against consignees. The clearing house enforces payment of all its demurrage bills, because it has in its possession money belonging to the delinquent road, but the delinquent may appeal to the owner of the car. The Mileage department has about 400 clerks and 500 number takers.

The Secretary's department of the clearing house keeps records of the 400 or more meetings held each year; conducts a deposit bank for employees, and issues an elaborate hand-book of stations, with an official map and diagram of routes. In these publications about 1,250,000 distances are recorded. The hand-book of stations shows the accommodation provided at each station for the different kinds of traffic. Mr. Midgley calls attention to the fact that the Trunk Line Association, with headquarters at New York; the Central Freight Association; the Southern Freight Committee, and other bodies, would afford suitable foundations on which to build up clearing houses in this country. In the making of joint tariffs much time and expense could be saved.

Clearing House Not Needed.*

With the development of railroads in the United States the interchange of traffic between the various roads necessitated the devising of appropriate methods of interline accounting. The problem was a difficult one because of the great number of roads to be dealt with; the vast amount of territory covered; and the variety of accounts to be considered. . . .

As the general use of coupon tickets has enabled the railroads to ticket passengers over many roads on one ticket, issued at the point of departure, so the general use of standard forms and approved methods has made it possible to forward freight to any point in the United States, Canada or Mexico, over several roads, on one waybill. The American system of railroad accounting enables two or more roads to transact their joint business, retain full and exclusive possession of their records, and settle balances promptly.

Something has been said of late about the establishment of a general railroad clearing house for the settlement of interline freight, passenger, car, claim and other accounts, modeled after the English system. A comprehensive understanding of the problem in all its details will reveal the undesirability of this as well as its increased cost. A synopsis of the methods employed in handling some of the principal interline traffic accounts will serve to illustrate their simplicity, as well as the effective and economical manner in which settlements are made.

When freight traffic is way-billed through over two or more roads, the accounting officer of each road interested in the revenue is furnished with manifold copies of the waybills made from day to day, thus enabling him to critically examine the individual transactions, and in connection with junction reports showing the traffic passing to and from his line, to fully protect the revenue of his company. These waybills and reports constitute a permanent record of the business. The original waybills are verified at destination and examined in order that any changes made en route, such as weighing, inspection, etc., or on account of errors, may be passed upon. In the event any changes have been made, a correction notice is sent to each road interested in order that its records may be completed.

Statements of the business are compiled by the destination road, manifold copies being made for the roads interested in the revenue, which is apportioned to the several companies. These abstracts are accepted as rendered, and settlement of balances made by sight draft not later than the 25th of the succeeding month, any errors being adjusted in subsequent settlements. Thus, each accounting officer is enabled to determine the revenue accruing to his company from interline waybilling at the earliest possible moment and is in possession of all the data necessary for the compilation of required statistical information.

Economical and successful management depends largely on the promptness with which the results of operation are ascertained. Furthermore, the requirements of various states are very exacting in connection with the statistical information which they demand at stated intervals, often soon after the end of each month, under penalty of heavy fines. Time is an important factor and it is only through its most economical use that the accounting officers are enabled to meet the requirements in this particular. This is especially true on the larger roads and systems traversing, as many of them do, several states.

Correction notices and statements of interline account are made up at one writing, the use of carbon paper obviating duplication of work. The accounts upon which freight settlements are based are made up by the destination road, and as the traffic moves in

*This paper describing the manner of settling interline accounts between railroads in the United States, Canada and Mexico, was prepared by a committee of the Association of American Railway Accounting Officers, and unanimously approved by the Association at its meeting held in New York, June 30, at which over 200 of the principal accounting officers of American railroads were present.

both directions the expense and labor of writing up the accounts is thus equitably divided.

The apportionment of the revenue from interline ticket sales and the settlement of balances by sight drafts are accomplished promptly without friction or duplication, as are the freight accounts, and almost as early. By a similar process reports of car service (per diem and otherwise) and interline freight claims are exchanged and balances settled by sight drafts.

It has been claimed on behalf of a railroad clearing house that it would lessen the number of drafts, bills and vouchers required to be made. Under our system the number of drafts is reduced to the minimum, and few if any bills or vouchers are necessary, and the labor and expense incident to the actual making of the settlements is so small that a separate agency to handle them must necessarily increase the cost.

It has been claimed that a clearing house would facilitate and expedite the settlement of interline accounts and do away with much duplication of work. This is directly contrary to the fact; it would involve both delay and increased cost. It has also been compared to the various bank clearing houses which exist in the great commercial centers, but that any similarity could exist between a general railroad clearing house and a bank clearing house, is fallacious on its face. Bank clearing houses are limited to the city in which they are located, while railroads extend from one end of the country to the other. Business to be settled through any bank clearing house can be assembled at a moment's notice, while it would take days to assemble the business which it is sought to settle through a general railroad clearing house. Furthermore, the bank clearing house disposes of its transactions daily through the intervention of the parties directly interested and the items which enter into its settlements do not have to be subdivided or apportioned, whereas the business which would be settled through a general railroad clearing house would be composed of innumerable items from railroad companies widely separated.

If, in order to obviate this, clearing houses were established in different sections of the country the delay of final settlements and the expense would be still further increased, as it would necessarily involve inter-accounts between the various clearing houses, thus further duplicating and delaying the work. The necessity of continually referring to the various accounting departments and to the agents, regarding particular items in the accounts which require explanation, would still further complicate and retard the work.

In support of the contention that the establishment of a general railroad clearing house is desirable reference has been made to the Central Railway Clearing House at Buffalo, and the Star Union Line at Pittsburg. As a matter of fact these are simply adjuncts to the accounting departments of affiliated roads and accomplish only such results as are as quickly and economically worked out by the accounting departments of many companies similarly situated.

To sum up:

First.—The expense of the traffic department of the English Clearing House is approximately 1 per cent. of the revenue handled. A similar institution in America would be an almost wholly additional expense to the railroads which now do all their accounting (including revenue, disbursements and statistics) for less than 1 per cent. of their earnings.

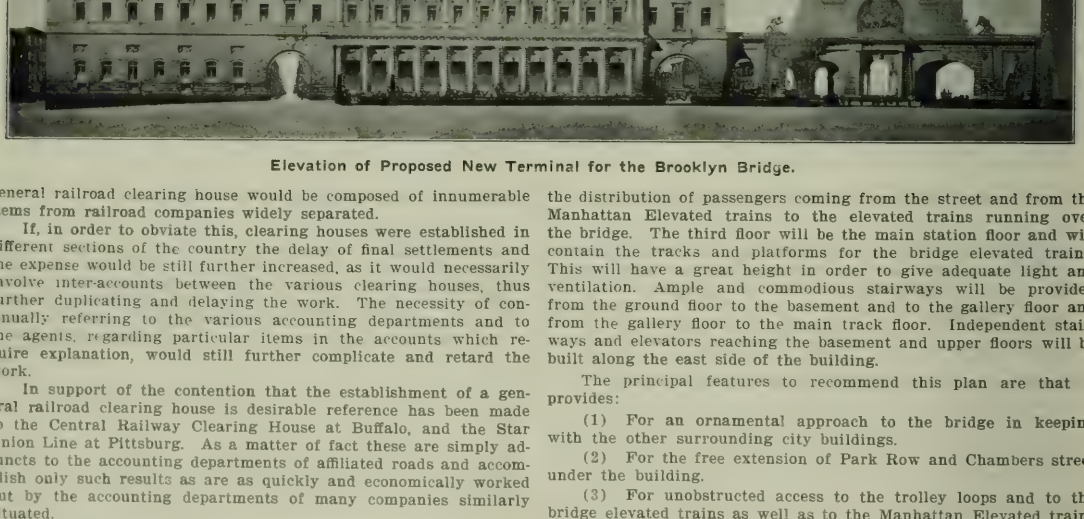
Second.—There would be serious delay in arriving at actual earnings and other statistical figures for our own use and for reports to Interstate and State Commissioners.

Third.—We feel assured that if interline accounting in England had reached the same state of efficiency it has in America, the clearing house would never have been started.

The New Manhattan Terminal for the Brooklyn Bridge.

On July 7, the Board of Estimate and Apportionment of the City of New York finally approved a plan for enlarging and rebuilding the New York terminal of the Brooklyn Bridge, and it is expected that work on the foundations of the buildings will be begun within a year. There have been innumerable plans proposed for improving the congested traffic conditions at the ends of the bridge, many of which were impracticable and well nigh impossible of application on account of their cost. The Bridge Department engineers have worked over the problem for the last six years and many other engineers have planned schemes which they have exploited in the technical papers and elsewhere but no two were agreed on even the same general plan. Former Bridge Commissioner Lindenthal drew up a plan two years ago which contemplated the erection of an enormous station and city office building on the ground bounded by Center, Reade, Duane and Pearl streets and Park Row. The plan as finally approved is substantially the same as the one proposed by him except that the building to be erected will be used exclusively for a bridge station.

The accompanying illustrations show the general appearance of the proposed new station and the arrangement of tracks. The present terminal will be entirely abandoned and a handsome and imposing building will be erected east of Center street. This building will have a basement below the street level into which the loop tracks for the trolley cars running over the bridge will be run. The ground level floor will provide for large waiting and assembly spaces with ample entrances from the street for the collection and distribution of passengers going and coming over the bridge. Park Row and Chambers street will be carried through the building under wide arches. A second or gallery floor at about the elevation of the mezzanine floor of the present station will provide for the distribution of passengers coming from the street and from the Manhattan Elevated trains to the elevated trains running over the bridge. The third floor will be the main station floor and will contain the tracks and platforms for the bridge elevated trains. This will have a great height in order to give adequate light and ventilation. Ample and commodious stairways will be provided from the ground floor to the basement and to the gallery floor and from the gallery floor to the main track floor. Independent stairways and elevators reaching the basement and upper floors will be built along the east side of the building.



Elevation of Proposed New Terminal for the Brooklyn Bridge.

The principal features to recommend this plan are that it provides:

(1) For an ornamental approach to the bridge in keeping with the other surrounding city buildings.

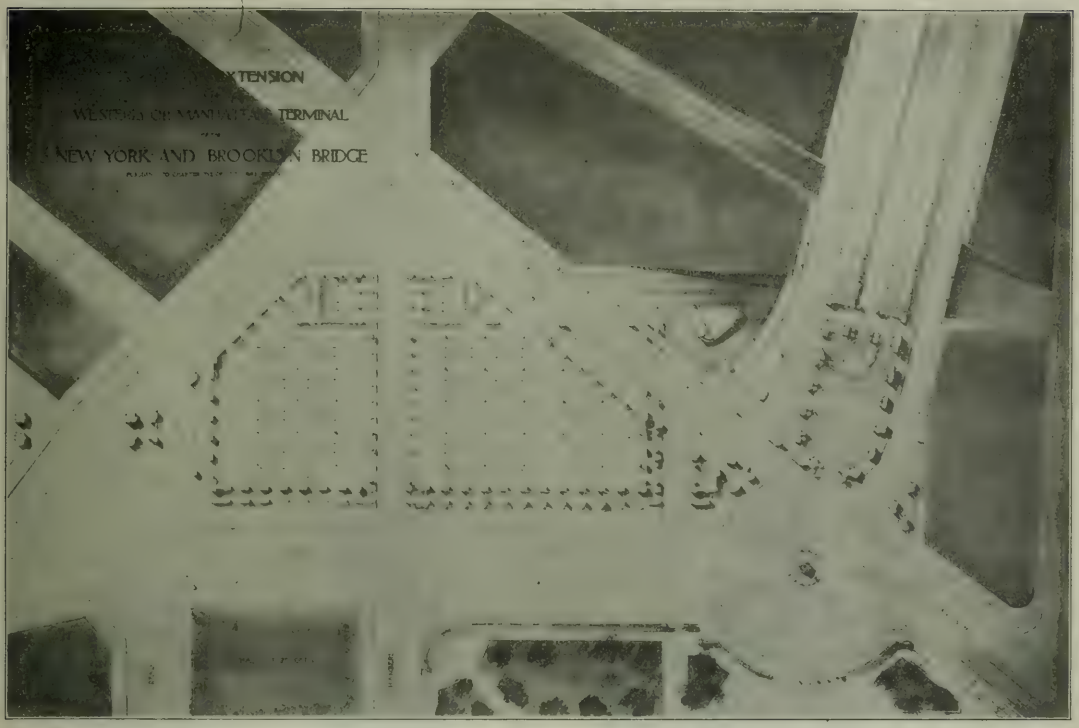
(2) For the free extension of Park Row and Chambers street under the building.

(3) For unobstructed access to the trolley loops and to the bridge elevated trains as well as to the Manhattan Elevated trains on Park Row.

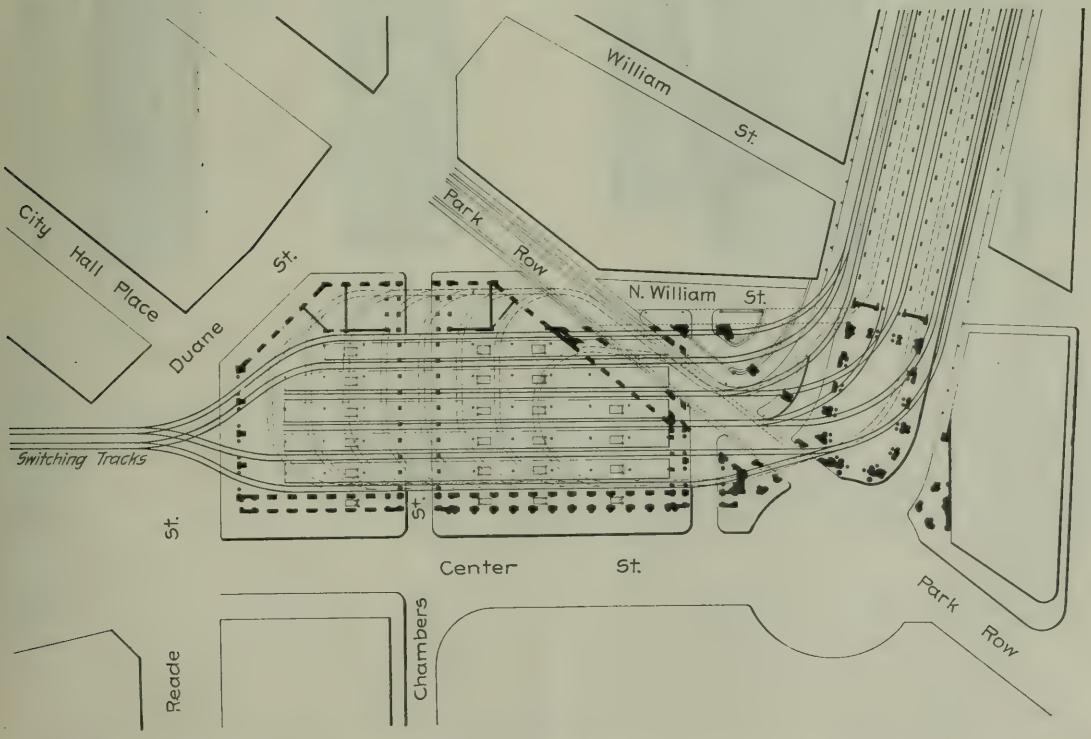
(4) For the assemblage of passengers taking bridge trains on separate platforms, avoiding the confusion, discomfort and danger of the present station where this separation is impracticable.

The new station will provide the same number of trolley car loops as in the present station and eight loading platforms for elevated trains, permitting the handling of about twice the number of passengers as is now possible. At present the number of trains which can be handled over the bridge is limited by the capacity of the station. With the new station the number of trains will be limited by the capacity of the bridge, which can be greatly increased over what it is at present.

The architectural features of the new terminal have been



Ground Plan of Proposed New Terminal.



Track Arrangement for Trolley and Elevated Cars in Proposed New Terminal.

worked out by Carrere & Hastings. It is estimated that the work will cost $3,000,000 exclusive of the cost of land, most of which has already been acquired by the city. Two years is the time estimated for completion after beginning the work, so that the new station should be in use by 1908.

We are indebted to Bridge Commissioner Best for the illustrations.

A Semaphore With a Vertical Motor.

The General Railway Signal Company, of Buffalo, is now using in its all-electric interlocking plants a semaphore signal worked by a motor of new design, and the mechanism is shown in the accompanying engravings. The motor, the axis of which is vertical, is in the bottom of the box, as shown in Fig. 3; and it lifts the vertical rod, which throws the signal to the all-clear position, by turning the screw which is seen in Fig. 4. The weight rests on ball-bearings. It will be seen that the apparatus as a whole has a very neat and compact appearance; and, as shown in Fig. 1, the case enclosing it is unusually narrow, so that the signal can be set between tracks where a wider box could not be used. The mechanism case opens both front and back, affording easy access to all parts.

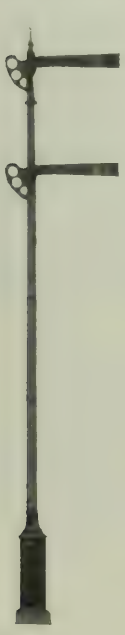


Fig. 1.

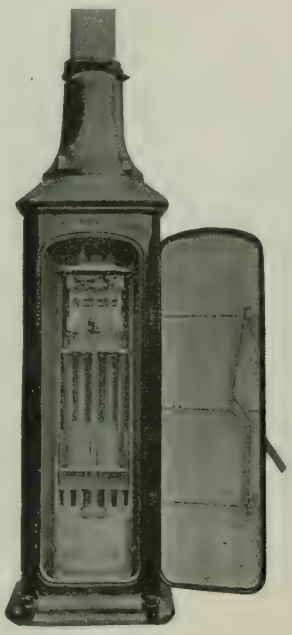


Fig. 2.

General Railway Signal Company's Vertical-Motor Semaphore.

The simple and substantial lock for the case is shown in Fig. 2.

The mechanism is arranged symmetrically about a vertical center line and it is of simple and pleasing design, strong and well made. The motor case, at the extreme base, is waterproof and frost proof. The armature shaft is direct-connected to a vertical screw operating a ball-bearing nut which when rotated in one direction by the motor raises one of the vertical rods to clear the signal arms. When the signal arm is fully cleared the current is cut off from the motor and is applied to a magnetic brake which holds the arm clear. When the arm is to be restored to the stop position the current is cut off the brake and the downward thrust of the counterweighted vertical rod rotates the armature backward, by means of the ball-bearing nut, and generates current for giving the "indication."

The signal is locked in the stop position by a simple device, and in the case of two arm signals the arms are interlocked so that when one is cleared the other remains locked. There are no moving wires in the mechanism and all mechanical parts are galvanized to prevent rust, in addition to which a canopy is so placed as to prevent drippings from condensation falling on the mechanism.

By exchanging standard parts this signal can be converted from a single arm to double arm, or to a 60 deg., 75 deg. or 90 deg. throw; and can be made slotted or non-slotted as desired. It can also be operated as either a two-position or three-position signal.

Fig. 4 is a rear view of the mechanism for a two-arm signal. It provides for throwing the arms to the stop position by the usual electric-slot arrangement. Where the slot is not used the dash pots are omitted. For a one-arm signal the apparatus is, of course, simpler than that shown in Fig. 4.

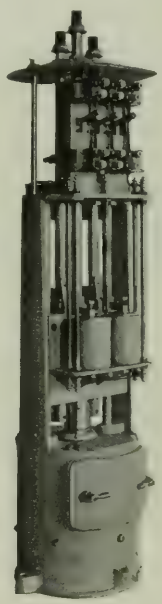


Fig. 3.

Fig. 4.

Mechanism for Two-Arm Signal.

Road Tests of the B. & O. Mallet Compound.

The Mallet articulated duplex compound locomotive, No. 2,400, which was built at the Schenectady works of the American Locomotive Company for the Baltimore & Ohio, is the largest locomotive yet built. It was completed about a year ago and was exhibited at the Louisiana Purchase Exposition at St. Louis during the summer. At the close of the Exposition, the locomotive was brought east and assigned to the Connellsville Division of the Baltimore & Ohio to assist heavy freight trains over the mountain. It was put into regular service on Jan. 6, 1905, and during the first five months made about 13,500 miles.

The object in building such a mammoth locomotive as this is was to balance the amount of power available on the division on the up and down grades and to reduce the number of locomotives and train crews required to handle the heavy slow freight tonnage over the mountains. The division on which it is working has heavy grades and therefore maximum adhesive weight was necessary, and this weight had to be distributed over a short rigid, and a long flexible wheel base, as the curvature is sharp, in one place being 9 deg. and at another point on a reverse curve on the heaviest grade 7 deg.

A complete description of engine No. 2,400 was given in the *Railroad Gazette*, May 27, 1904, but it may be well to give here the principal weights and dimensions, which are as follows:

Weight in working order, on all drivers	334,500 lbs.
Weight, total, including tender loaded	479,500 "
Wheel base of engine	30 ft. 8 in.
Rigid wheel base	10 ft.
Diameter of drivers	57 in.
Cylinders, stroke	32 in.
Cylinders, diameter	20 in. and 32 in.
Heating surface, total	5,585.7 sq. ft.
Grate area	72.2 sq. ft.

The total weight is about 193,500 lbs. less than the combined total weights of two of the largest consolidation locomotives used on the same division. While the drawbar pull behind the tender of two of the largest consolidation engines is about 79,400 lbs., the drawbar pull of engine No. 2,400 is 74,000 lbs. when working compound and 84,000 lbs. when working simple. Two of the consolidation locomotives double-heading, can take a train of loaded steel hopper cars of 100,000 lbs. capacity weighing about 2,025 tons up the mountain. Engine No. 2,400 and one consolidation can haul 3,210 tons up the same grade. These comparative figures are based on engine performances at 10 miles an hour under fair weather

and rail conditions, good average coal, and with engine No. 2,400 working compound.

The performance of the Mallet compound during five months of hard service has demonstrated that the various special features which have been combined in its design will give satisfactory results from an operating standpoint. The articulated wheel and cylinder arrangement, as well as the duplex compound system with its intercepting valve and simpling gear device, Walschaert valve gear, combination hand and power reversing gear and flexible intermediate receiver and exhaust pipes, have all given complete satisfaction and caused no trouble. The engine takes curves well when moving ahead or backing up and there has been very little flange wear, although all driving wheels have flanged tires. The steaming capacity of the boiler, working of frictional parts, cylinder packing, piston and slide valves and other features of the design have given no trouble.

This engine has tubes 2¼ in. in diameter and 21 ft. long, but no difficulty has been experienced with choked flues or leaking tubes or fire-box sheets, nor has there been any trouble on account of priming or defective lubrication in the cylinders. Some changes in the minor details might be desirable if more engines of this type are built in the future, but as a whole the design has proved very satisfactory for the work which is being done. The cost of maintenance remains for future performance to determine, but from present indications, the cost per ton-mile hauled will not be greater than that for consolidation engines engaged in similar helper service.

When operating over the Connellsville Division, which has both level track and long heavy grades, the Mallet compound has used less coal per ton-mile than the simple consolidation engines now in service, and when operated on comparatively level divisions it consumes materially less coal per ton-mile. The following data are the average results obtained on several through runs during the month of January, 1905, over the division between Connellsville and Rockwood and Connellsville and Sand Patch, the runs being from 44 to 60 miles long:

Running time	5 hrs. 29 mins.
Time lost by stops	3 " 38 "
Total time of trip	9 " 7 "
Speed while running, miles per hour	9.7
Temperature of atmosphere	33 degs. F.
Temperature of feed water	33 degs. F.
Kind of fuel used	Bituminous, about 40 per cent. volatile, run-of-mine grade.
Pounds of coal used per trip	24,900 lbs.
" " consumed per sq. ft. grate area per hour	61.8"
" " " per mile run	472 "
" " " per thousand ton-miles	215 "
Number of loaded cars hauled	34
Number of empty cars hauled	0
Gross tonnage per train (in tons of 2,000 lbs.)	2,193
Maximum boiler pressure	230 lbs.
Minimum boiler pressure	202 "
Average boiler pressure	220 "
Pounds of water evaporated per pound of coal	6.4"
Pounds of water evaporated per lb. of coal, from and at 212 deg. F.	7.9"
Minimum gradient on line	Level.
Maximum gradient on line	1 per cent.
Average gradient on line	0.5 per cent.

On the 1 per cent. grade, which is 6½ miles long, engine No. 2,400 was assisted by one of the regular consolidation type locomotives. On all other portions of the line, where the gradients range from 1 per cent. for a distance of one mile, .75 per cent. for a distance of five miles, .68 per cent. for a distance of two miles, and other grades average from .3 per cent. to .5 per cent., the compound handled the train alone.

The performance of this locomotive for 24 consecutive trips—helping trains and operating over a total distance of 14.8 miles up the mountain, the first 8.3 miles of gradient ranging from .2 per cent. to .5 per cent., and the remaining 6.5 miles being 1 per cent. averaged as follows:

Running time	1 hr. 45 mins.
Time lost by stops	2 hrs. 16 "
Total time of trip	4 " 1 "
Speed while running, miles per hour	9.1
Temperature of atmosphere	17 deg. F.
Temperature of feed water	33 deg. F.
Kind of coal used	Bituminous, about 20 per cent. volatile, run-of-mine grade.
Pounds of coal consumed per trip	8,225 lbs.
Pounds of coal consumed per sq. ft. of grate area per hour	66 "
Pounds of coal consumed per mile run	584 "
Pounds of coal consumed per thousand ton-miles	308.5"
Number of loaded cars per train	39
Number of empty cars per train	None
Gross tonnage per train (in tons of 2,000 lbs.)	2,049
Maximum boiler pressure	230 lbs.
Minimum boiler pressure	188 "
Average boiler pressure	218 "
Pounds of water evaporated per pound of coal	5.4
Pounds of water evaporated from and at 212 deg. F., per lb. of coal	6.7
Total amount of water used while running	39,142 lbs.
Total amount of water used during stops	6,652 "
Total amount of water used during trip	45,794 "
Per cent. of total amount of water used while locomotive was standing	14.5%

One engineer and one fireman were used on all of these tests to operate the locomotive during each trip. During the tests there were no fire-box, boiler tube, or other water or steam leaks around the boiler or machinery of the locomotive, and the waste was that relieved through the pop valves, from injector overflow, on account of condensation, using heaters on injectors, and other similar causes due to winter weather and freezing conditions. There were no failures or delays on account of the locomotive, except for fire cleaning, which work was performed at the termination of the run.

In mountain-helper service, locomotives are frequently required to remain at work for long periods between fire cleanings, and during such intervals with the forcing of fires to the maximum, and pushing trains up the grade, together with drifting down grade, and long time between trips, there is considerable opportunity for variation in the temperature in the fire-box and flues, which would tend to cause leakage and failure. Under such conditions, however, engine No. 2,400 has been able to meet the requirements, and at the same time make use of an ordinary grade of run-of-mine bituminous coal, and maintain ample boiler pressure at all times.

Transportation of Explosives on the P. R. R.

The Superintendent of Freight Transportation of the Pennsylvania Railroad has issued a circular (No. 174 A) giving elaborate regulations for the transportation of explosives. This is a carefully prepared document, and only lack of space prevents reprinting it here in full. For transportation purposes explosives are divided into six groups: Common black powder; high explosives; smokeless powders; fulminates; ammunition; fire works. Detailed instructions are given concerning each class, and the nature of the article is briefly described. The road prefers that black powder be shipped in wooden boxes or casks, but naked iron casks or kegs will be received if well made; and a test is prescribed. Such a cask filled with sand of the same weight as the powder must withstand a drop of four feet on a rail and not be ruptured. With few exceptions explosives must be put in packages of not over 100 lbs. each. High explosives will not be received if they contain over 60 per cent. of nitroglycerin (except gelatine dynamite). Gun cotton and smokeless powder must, when shipped, have a certain percentage of water. The term fulminates does not include percussion caps, etc.; it means fulminate of mercury in bulk. Fulminate of mercury must have 25 per cent. of water and be put in a duck bag. This must be put in a rubber bag, which must then be filled with water and securely tied. The rubber bag and its contents must then be put into a tight cask, packed around with sawdust, and the cask filled with water and bunged and sealed up. Ammunition for Government use is not dealt with in this circular. Fire works must be packed in tight wooden boxes. Fulminate, ammunition and fireworks must not be loaded with each other nor with the other classes named.

Carloads of explosives will be received any day except Saturday, but less than carloads only on Mondays and Thursdays. Ammunition and fireworks are received at any time.

Shippers and agents have to sign certificates of inspection. Agents must send copies of this circular to all shippers of explosives. Sections 23 and 25 say:

23. Only *steel underframe box cars, equipped with air-brakes in condition for service*, and which have been specially selected and specially inspected, will be used in the transportation of the first four groups of explosives in lots of 5,000 pounds or over, and they must be in first-class condition in every respect, both inside and outside. The following points must be carefully looked after: The car must in no case have loose boards or cracks in the roof, sides or ends, and the doors must be shut so closely that no sparks can get in at the joints. When these explosives are loaded in carloads the doors must be stripped, except when the cars are equipped with Wagner doors, which must not be stripped. The journal boxes and trucks must be examined, and so cared for as to reduce to a minimum the probability of hot boxes or other failure, requiring the car to be set off before reaching destination. The car must be carefully swept out before it is loaded and a careful inspection made of the inside. Holes in the floor or lining must be repaired and special care taken to see that there are no projecting nails or bolts, or pieces of metal which may work loose and produce holes in packages of explosives during transit. Short pieces of hard wood, two-inch plank, must be spiked to the floor over the king bolts or draft bolts to prevent possibility of their wearing through the floor and into the packages of explosives. Agent or inspector must examine cars and sign C. T. 477 before permitting the cars to be loaded or despatched.

25. In handling packages of explosives at stations and in cars, the greatest care must be taken to prevent their falling or getting shocks in any way, and they must not be thrown or dropped, but must as far as practicable be passed from hand to hand, or carried by one or more persons, and must not be rolled on the platform or car floor, unless they are so heavy that this cannot be avoided. The agent must choose careful men to handle explosives, must see that the platform and feet of the men are as free as possible from grit, and must take all possible precautions against fire. No unauthorized person must have access to the explosives at any time while they

are on the property of the company. Should any packages of high explosives when offered for shipment show outward signs of any oily stain or other indication that absorption of the liquid part of the explosive in the absorbent material is not perfect, or that the amount of the liquid part is greater than the absorbent can carry, *the packages must be refused in every instance, and must not be allowed to remain on the property of the company.*

A rubber stamp is prescribed for stamping a certificate on the way bill and on the car card. Section 30 says, in part:

30. (a) Not more than one car carded with C. T. 81 will be handled in a train for through road movement (except by permission of the Superintendent Freight Transportation). Such train must not consist of more than thirty (30) cars, two-thirds (⅔) of which must be air-brake cars in service. A car carded with C. T. 81 must be placed as near center of train as possible, but never closer than ten (10) cars from the engine. It must be placed between two box cars in good condition not loaded with oil or other inflammable material, lumber, or other articles liable to break through end of car from rough handling.

(b) Cars carded with C. T. 81 handled in shifting or distributing trains may be handled more than one car per train, provided train does not consist of more than thirty (30) cars and that all air-brakes in condition for service are used. Cars should be handled as near center of train as possible.

(c) In handling cars carded with C. T. 81 in yards or placing on sidings to unload, they must be coupled to engine protected by a car between. When this is not possible in placing cars on a siding, a rope or pole may be used, *but a flying switch must not be made under any circumstances.* Other cars must not be allowed to strike a car carded with C. T. 81. They should be so placed in yards or on sidings that they will be subject to as little handling as possible and removed from all danger from fire.

Finally, instructions are given for dealing with cars of explosives in case of a wreck. Damp earth mixed with explosives helps to render them safe from fire, sparks or blows. Where fulminate has been scattered on the ground it is necessary to saturate the ground with oil.

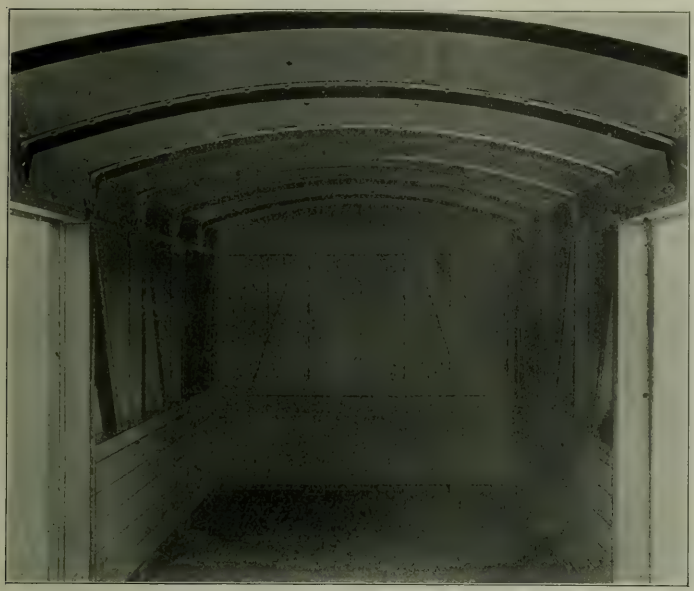
Box Cars for the Argentine State Railways.

The recent large order for cars given to the Middletown Car Works, Middletown, Pa., included besides 100 gondolas and 150 flat cars, 250 box cars of 66,000 lbs. capacity. The flat cars and gondolas have been illustrated and described in the *Railroad Gazette*, March 3 and May 5, 1905, and as the details of the underframing of the box cars are essentially the same as for those already illustrated, drawings have been omitted here. These box cars are 32 ft. 10⅜ in. long, 7 ft. 2⅜ in. wide, and 7 ft. 3 in. high, inside. They have steel channel underframes, made up of two 10-in., 15-lb. channel center sills placed back to back 14 in. apart and boxed in with top and bottom cover plates for 19 ft. 11 in. of their length between bolsters, two 12-in., 20.5-lb. channel side sills and bent plate end

Steel Underframe Box Car for the Argentine State Railways.

Underframe of 33-ton Box Cars for the Argentine State Railways.

sills with diaphragm bolsters and cross-bearers. The upper framing is of wood except the roof carlins, which are 2-in. x 2-in. x ¼in. angles bent to the proper curvature of 10 ft. radius. The posts and braces are framed into the plate and side sills with malleable iron pockets. Inside sheathing is carried up to the belt rail 32¾ in. above the floor. The cars have sliding doors in each side 6 ft. wide and 6 ft. high. They are mounted on diamond arch bar trucks built for meter gage, and are equipped with continuous draft gear, link and pin couplers, and are piped for vacuum brakes, although not equipped with diaphragms. The roof is made of ¾-in. boards covered with corrugated iron.



Interior of Box Car Showing Steel Carlins.

We are indebted to Mr. George I. King, Vice-President of the Middletown Car Works, for the illustrations.

The Testing Engineer.*

The gradual widening of the scope of the word "engineer" is very interesting. Used apparently as long ago as the time of William the Conqueror, to designate men who had the ability to design and construct works of value, such as castles, or fortifications, or bridges, especially in connection with military affairs, it soon took on a wider meaning, and was properly applied to men having ability to design and construct works of practical utility in times of peace. The military men having simply been called "engineers," it became desirable to distinguish those who were doing similar work during peace times, and they were called "civil engineers." Primarily applied apparently to one who had genius born in him, and therefore who had within himself the power to originate and to execute in course of time, we find the term applied to those also who simply direct, or carry to successful conclusion something they may have taken in hand. Indeed at the present time the one who controls the machinery of a ship, as well as the one who handles the throttle of a locomotive, is called an "engineer." And finally it is apparently no abuse of words to say of a man who has guided any scheme in which he was interested, with ingenuity and tact, or overcome obstacles by contrivances and effort, that he has successfully engineered his project through. In view of these thoughts, we are perhaps justified in regarding the man engaged in testing as an engineer.

It is plain that the testing engineer acts in a three-fold capacity. He is either an investigator, or a counsellor, or a judge. He is finding out new truths, he is protecting the interests of his client the producer, or he is determining by his tests that contracts are being fulfilled, or specifications lived up to, in the interests of his client the consumer. There are three kinds of testing engineers, the unattached engineer, the consumer's engineer and the producer's engineer. It did not take long after consumers began to test materials and prepare specifications before producers found it necessary to protect their interests and defend their materials by means of testing engineers in their own employ.

What shall be the cast of mind, and what the mental equipment of the testing engineer? We will perhaps all agree that he should be independent, self reliant, gifted with the power of analysis of facts, as well as with the power of drawing conclusions from the data at hand. He should be ingenious in devising methods to demonstrate the points at issue, and a careful observer of data. He must keep himself free from bias or prejudice, and take especial pains that he does not deceive himself. He should be fond of experiment and have a genius for it. Above all he should be a thinker. No man who, when a problem is presented to him, simply searches his memory for whatever he may have learned in the schools, or picked up in his reading, which bears on his problem, has any especial call to be a testing engineer. The power of seeing analogies between your own problem, and one that some one else has had, is legitimate and useful, but the one who habitually and continuously approaches every problem through memory, or by studying up what others have done, is far less likely to succeed as a testing engineer than one who habitually attacks a problem by an analysis of its elements.

But if experimenters are born, not made, what can the schools do in the way of training? Given fair mental endowment, it is possible for the schools to make successful testing engineers, or to spoil the material they start with.

But the mental equipment which the schools furnish is only a fraction of that needed by the testing engineer, especially if it be his duty to defend the interests of a great consumer. The schools should teach a young man how to learn, and should start him in a number of subjects, but his real education comes later. The man who expects to reach even moderate success as a testing engineer, must study harder the first five or ten years after graduation than he did at any time while in school. He must accumulate experience by arranging the information already acquired by reading, by study, and actual contact with industrial processes, and with the world's work, in every possible detail, and above all, a man must acquire experience by actual wrestling with problems that may be committed to his care. It is apparently not essential, in order to gain experience, that one should successfully solve his problems. Faraday was accustomed to say that he actually learned more by his failures than from his successes. The testing engineer should be an omnivorous student. Nothing is too trivial to interest him, nothing too remote from his present line of work to make a legitimate demand on his attention should opportunity offer. You can never tell what moment you will need and badly need some out of the way fact.

In a broken steel car axle recently seen, the break occurred 10 or 12 in. from the end of the axle. On examining both sides, there was some appearance of seams, not radial, but irregularly parallel to the circumference. These seams suggested that probably the axle was made from a billet coming from somewhere near the top of the ingot, and that the seams were in some way connected with the pipe. It was reasoned that if this were true, an analysis of the metal from the surface and from the center of the cross section of the axle, would show segregation, and that if, for example, much higher phosphorus were found in the center than at the circumference, it would almost be a demonstration of the location of the billet. Of course the whole object of the study was to see if any information could be obtained that would prevent the acceptance of such bad axles in the future. It should be mentioned that the broken off piece was sawed in two lengthwise, and that when this was done, from one of the halves a core amounting to about a third of the cross sectional area actually fell out, showing that the seam indications at the end were genuine, and that the seam did actually exist. The analysis above referred to was made, and to our astonishment showed lower phosphorus in the center than in the circumference. This seemed to settle the question as to the relation between the seam and the pipe, and indeed we regarded it as conclusive evidence that the billet from which this axle was made was not taken from too high up in the ingot, but it left unsettled the cause of the seam. Perhaps, however, a few words farther on certain well-known phenomena in steel metallurgy will help us in clearing up the point. It is obvious that if in a big ingot, a portion of it contains more than the normal amount of phosphorus, carbon or sulphur, as is actually the fact in the case of segregation, it must follow that there will be parts of the ingot which will contain less than the normal amounts of these constituents. It is generally assumed that the outside of a forging like an axle gives very close to the normal analysis of the steel, since from the method of manu-

*Extracts from the annual address by President Chas. B. Dudley, of the American Society for Testing Materials, delivered at the Atlantic City meeting June 29.

facture this outer metal was near the surface of the ingot when the metal was cast, and consequently cooled too quickly to permit perceptible segregation. Also if we are right the analysis of borings taken from different parts of the inner face of an ingot sawed in two lengthwise for the purpose, shows that phosphorus, carbon and sulphur, near the middle of the lower third of the ingot, are usually below the normal. Now since the phosphorus in the center of our axle was lower than in the circumference, it seems evident that the billet from which it was made must have been from somewhere in the lower third of the ingot. . . . Seamy bottoms of ingots are now usually explained by wet or insufficiently dried bottoms of ingot moulds. The steam or other volatile material generated by the heat of the molten metal can apparently only escape up through the molten metal itself, forcing a seam, which the subsequent treatment does not weld up.

Another brief illustration will perhaps emphasize the importance to the testing engineer of familiarity with the minute details of industrial processes. A couple of years ago, while the finishing cut was being taken on a steel driving axle in a lathe, the operator noticed in the freshly cut surface what appeared to be a small flaw. On testing this with a pin, the pin disappeared, and quite a length of fine wire followed it. On taking out a transverse slice of the axle at this point a cavity was found in the metal, which would hold half a pint or more. The walls of the cavity were perfectly clean and bright, and but for the fact that the finishing cut just happened to open up the cavity a trifle, its presence would not have been suspected, and the axle would have gone into service. It is perhaps safe to say that one-quarter or possibly one-third of the cross sectional area of the axle was embraced in the cavity. We have seen a number of such cases, and unfortunately the phenomenon is not rare. Almost any practical steel maker when asked for the cause of such a cavity in what is apparently a solid piece of metal, would probably laconically answer, "careless heater." In order to understand this statement, it is necessary to say that many driving axles, even when they are finished, are about 11 in. in diameter, and that the bloom from which they are forged is considerably larger. If now such a bloom when cold is put into a hot furnace, the outside layers get hot long before the inside has begun to rise much in temperature. A severe strain due to the greater expansion of the outside layers is accordingly set up, which strain is enough occasionally to actually rupture the inside. Subsequent forging opens out this rupture into a cavity. The rupture is usually accompanied by a noise like a pistol shot. The unfortunate part of the business is that there being a number of blooms in the furnace at one time, it is impossible to tell which one has yielded to the strain. As would be expected, the larger the axle the more common this defect, and we know of one large railroad that bores a 2 in. hole through every axle over 8 in. in diameter that is destined for passenger service. The boring of the hole enables the cavity to be discovered, either by the behavior of the drill, or by sight examinations after the hole is finished. It is interesting to know that something over 2 per cent. of all axles bored are found defective in this way.

It may seem an idle question, but it is certainly an interesting one, as to which of the three kinds of testing engineers has the most attractive field of work. The unattached testing engineer certainly has the greatest freedom, but at the same time, the least stimulus. The producer's testing engineer undoubtedly has the best financial reward, but at the same time the narrower field. He has, however, the advantage of concentration, and as almost every modern industry has scores of unsolved problems connected with it, there is no reason, if he will work, why he should not achieve a great success. On the other hand, the consumer's testing engineer has unquestionably the broader field, the greater chance for initiative, and perhaps more important than all, an opportunity to study the behavior of materials in actual service. This last gives him a great advantage. Behavior in service is unquestionably the ultimate criterion by which every industrial product must be judged, and by which decision, sooner or later, it must stand or fall. Undoubtedly individual characteristics are a legitimate element in the choice, but our counsel would be to every ambitious testing engineer to get as near to the service as possible, and to this end to take some sacrifice if necessary to secure a position with a consumer.

There is one more phase of the work of the testing engineer which will perhaps bear a few words, and that is the relation between the testing engineer and those whose material he is testing. This is unquestionably a delicate subject, one that we would all gladly feel did not need discussion or comment, and yet one that is constantly thrusting itself into prominence in some form. For the honor of human nature, it is gratifying to be able to put on record that during nearly 30 years of almost constant testing, only once have direct financial considerations been urged upon us to influence our verdict in regard to material. On the other hand, we have heard representatives of entirely reputable business organizations say openly, "It costs us something to sell our goods, and it is entirely immaterial to us whether this money goes to our selling agents, or to the representatives of the consumer." And this is not the worst phase of the matter. It is well known that the representatives of consumers who act in some sense in the capacity of testing engineers, in that their opinion or decision determines the giving of orders, not only accept substantial considerations from producers, but even demand them, if not openly, at least indirectly. An hour could readily be filled in narrating incidents of showing the forms in which the hydra-headed monster graft manifests itself. Neither side is free from blame. Strict open honesty is the only safe course. It may not be amiss to add that so insidious are the forms in which this evil manifests itself, that in the words of scripture they would at times deceive the very elect, and while it is not possible to discuss these matters, without raising interminable questions of casuistry and metaphysics, it is possible to so act as to have the continuous approval of a clean conscience. No universal rule can be given. Each one in a sense must be a law unto himself. Perhaps the best every day working rule for young testing engineers is, do nothing you would not be willing to talk over with your employer, even in the presence of the other party. It is sometimes a bit hard to resist and say "no," but of one thing be sure, every departure from strict integrity will sooner or later return to plague you, and should your actions ultimately result in your downfall, from none will you get less sympathy than from those who may have contributed to your disaster.

Holmen Coaling Stations on the Pennsylvania Lines West of Pittsburg.

Since the first of last year the Pennsylvania Lines West of Pittsburg have installed a number of patented locomotive coaling stations at different points, built from a design by Mr. A. R. Holmen, Chief Draftsman of the motive power department of the Southwest System. The simplicity of their design and operation has resulted in a considerable decrease in the cost of handling coal. The location of these stations and principal characteristics are as follows:

Location.	Storage capacity, tons.	Operating power.	No. of coaling tracks.	No. of buckets, tons.	Hourly cap. for handling coal, tons.
Lancaster, Ohio	150	Electric motor	1	2	75
Richmond, Ind.	350	" "	2	3	100
Logansport, Ind.	350	" "	3	3	100
Bradford, Ohio.	350	" "	2	3	100
Mansfield, Ohio	350	Lidgerwood hoist.	2	3	100
Toledo, Ohio	350	Lidgerwood hoist.	2	3	100

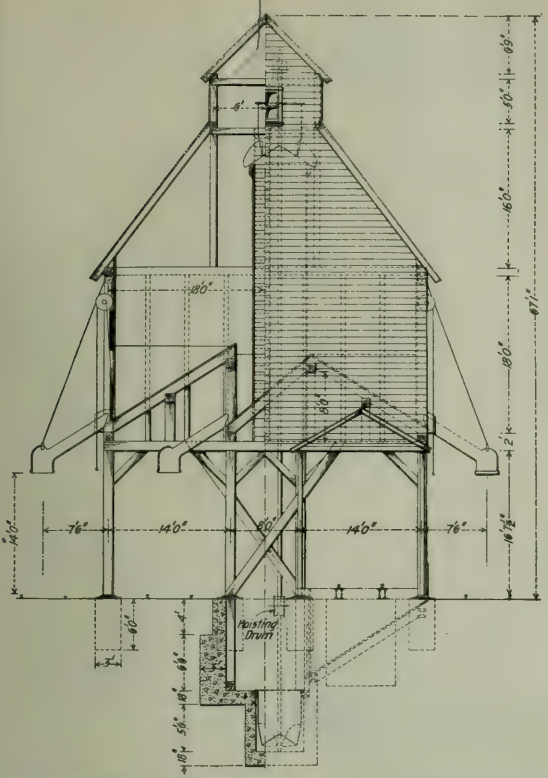
The drawings illustrate the Logansport station, with three coaling tracks and an unloading track, making a symmetrical structure with two tracks on a side. The coal is dumped from the car into a concrete pit having an inclined bottom formed of ⅛-in. steel plate. At the lower side of the pit are two sliding gates, each of which will admit coal into a bucket of three tons capacity. These buckets are raised alternately, the arrangement being such that one ascends as the other descends. At the top they dump automatically into the storage bin. The coal is delivered to the locomotives through gates and chutes which involve no novel construction. On some of the plants an undercut gate had been used both in the receiving pit and in the storage bin, but the simple sliding steel-plate gate shown in the drawings has been found entirely satisfactory and is therefore the preferred type.

The bucket pit is concrete. The buckets themselves are shown in detail. They are rectangular in section and made of $^5/_{16}$-in. steel. In the lower part of each side is an opening 30 in. high and the width of the bucket, which is closed by an apron hinged at the bottom. The bottom of the bucket slopes both ways from the middle. Each apron is closed by two latches on the outside of the bucket. The top of the bucket is higher on the side toward the unloading pit. Its contents would naturally be higher on that side because of the direction of flow of the coal into the bucket. The buckets are hoisted by wire cables running over sheaves at the top of the station, to a drum on the ground between the two bucket pits driven by an electric motor or a steam engine; the cables being so attached to the drum as to give the alternate motion already referred to.

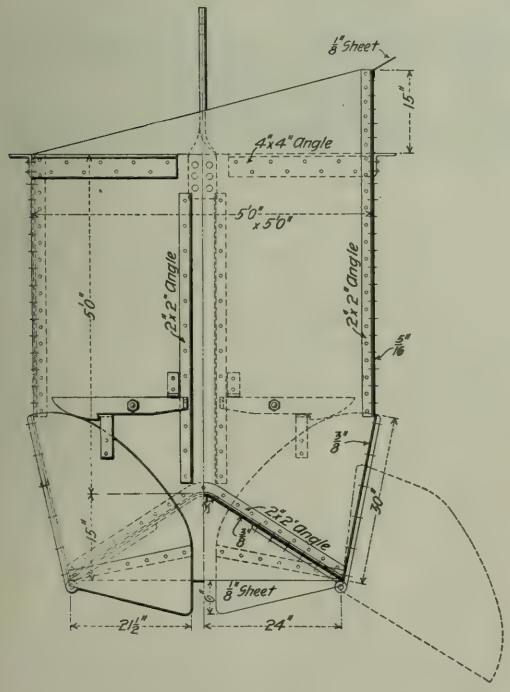
The guides for the buckets are 4-in. x 6-in. timbers faced with 4-in., 5¼-lb. channels. As the bucket reaches the top the apron latches encounter dumping springs secured to the guides, which release the aprons. The form of the sides of the bucket shaft at the top is such as to permit the aprons to open gradually. They are closed as the bucket descends by the curved springs seen on each side of the shaft, just below the top.

The four stations on the Southwest System are electrically driven, power being furnished by a d.c., series, 120 or 240-volt, reversible motor, geared directly to the hoisting drum. It is operated by a standard street car controller. A safety feature is provided in the form of a simple magnetic brake on the armature shaft. This brake holds the load the instant the current is intentionally or accidentally cut off from the motor. In addition to the regular overload circuit-breaker, a magnetic limit switch is arranged to trip the breaker if for any reason the bucket should overrun its regular travel.

The average time required for filling and elevating a bucket is



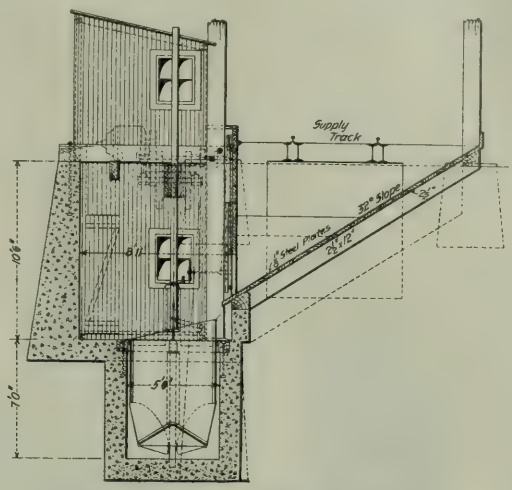
Cross-Section through Holmen Coaling Station for Pennsylvania Lines at Logansport, Ind.



Detail of Hoisting Bucket for Holmen Coaling Station.

one minute, the operation being under the control of one man. Where 70 to 80 per cent. of the coal is received in self-clearing cars, the station can be operated by three men. The hourly capacity averages 100 tons, and the number of hours a day necessary to run the plant therefore depends on the amount of coal used.

In his paper on "Progress in Yard Design" in the *Railroad Gazette* of May 12th, Mr. W. C. Cushing, Chief Engineer M. of W. of the Southwest System, gave some figures comparing the costs of handling coal per ton for various types of coaling stations, based on a daily capacity of 700 tons. The figures included interest, depreciation and repairs. Of the several types, the Holmen station showed the lowest cost per ton. Mr. Cushing adds that it "has been found to be an admirable compromise for the large majority of small and medium stations between the expensive trestle on the



Section through Unloading Chute and Pit.

one hand and the expensive belt conveyor on the other, which is the only type practicable for large coaling stations." Other Holmen stations are planned for the Pennsylvania Lines West.

Locomotives at the Liege Exhibition.

BY C. R. KING.

A general survey of the locomotives at the Liege Exhibition shows that the chief feature of difference in details between the 1900 exhibition of Paris and this one is the introduction of the piston valve and the widespread use of superheated steam among Belgian locomotives. Notwithstanding the strong objections which have persisted in Europe against piston-valves, their use is extending rapidly for four-cylinder compounds in France, Belgium, Italy, Hungary, many states of the German empire, and Russia. In Belgium, the reason given for their adoption is the wide introduction now made of superheated steam, although elsewhere there are numbers of engines fitted with slide-valves and using superheated steam, yet in all the French locomotives shown, piston valves are used with saturated steam.

The present exhibition shows a complete transformation in Belgian locomotive design. Excepting for the Nord Belge Railway, where the de Glehn type of locomotive of the French Nord has been employed for some years, the prevailing type of locomotive has been of Scotch design, in particular that of the Caledonian Railway. This Stephenson type, pure and simple, had supplanted the remarkable Belgian 2-4-2 engines originated in 1889, and now, in its turn, it is destined to disappear.

The leading features of the new locomotives, with an external appearance clearly attributable to the Scotch type, may be summarized as follows: Boiler of unusually large capacity; four cylinders compounded; cylinders located in one transverse line beneath the front end; piston valves, one for each cylinder; adoption of the Walschaerts valve gear, which has been very little used even with freight engines; working of the four valves by two sets of valve gears, and the use of a rocker shaft for the inside valves, both for compound and non-compound engines; all four main rods driving upon one set of wheels where the wheels are of large diameter, but in case of smaller driving wheels the first and second axles are driven from the different groups of cylinders. All these new types of 1905 have six connected wheels (4-6-0 type) and, as

before said, they have superheaters formed of three or else two small tubes, mounted and lodged in the upper rows of flues which are of especially large diameter. In general, the new Schmidt superheater is employed, although the Cockerill superheater has much the same arrangement for the position of the reheating tubes.

In not only these newest designs is the superheating system introduced, but it is fitted also to numbers of ordinary Scotch type single expansion locomotives, also on exhibition, intended for all varieties of haulage services.

Apart from mechanism, the Belgian boiler construction is almost always the "Stephenson" with round topped firebox shell in place of the true Belpaire wide locomotive firebox formerly so much employed in Belgium for slack fuel. In most cases the old English smokebox is used, or its external appearance maintained, but in the case of the fine machines built for the State Railways of Belgium by Cockerill of Seraing, the American or circular flue plate is employed both for the most advanced type of locomotive design, as also for a very large "Atlantic" type engine having the cylinders disposed on the Webb plan, or, as more popularly known, as the de Glehn "system": the latter having the modified form of "Belpaire" firebox so much employed in France. It is remarkable how much Belpaire and Walschaert's ideas have been neglected in the country of their origin.

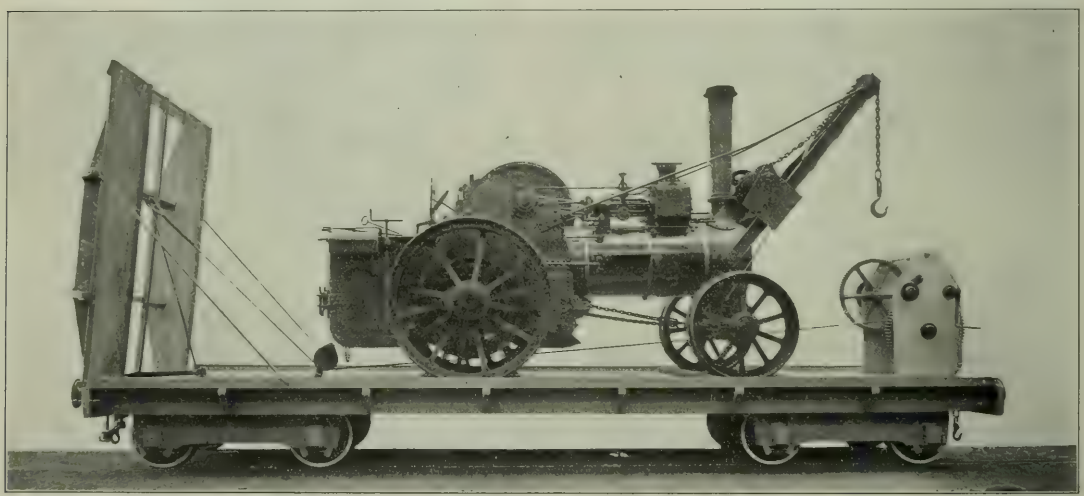
By a singular coincidence the two latest types of locomotives of the French "Nord" and Paris, Lyons & Mediterranean Railways stand alongside at the head of trains of specimen corridor cars belonging to those lines.

Both are four-cylinder compounds, the "Nord" engine originating from the de Glehn unconnected (therefore unbalanced) experimental locomotive introduced in 1885, but more directly from the modified (and connected or balanced) compounds which commenced service in 1902, or three years later than the Henry compound of the Paris, Lyons & Mediterranean line, which was designed in 1888 and put in regular service in 1889. These engines, to the number of six, were the first "balanced" four-cylinder compounds in Europe, for neither the Webb three-cylinder compounds which preceded the de Glehn experimental engine, nor this latter either, had their separate groups of engines connected together by side rods. Moreover, the Paris, Lyons & Mediterranean compounds were built, from the first, with the present approved location for the cylinders, that is, all in the same transverse line, although the rods drove, as they do at present, upon separate pairs of connected wheels. This arrangement of cylinders all in one cross line, is also to be noted in a de Glehn freight engine shown by the "Midi" or Southern Railways of France; but this disposition was only adopted for freight engines many years after the Paris, Lyons & Mediterranean.

Mr. Anatole Mallet, the originator of the first practical compound locomotive, who supervised the construction of the first tandem compound express locomotives built for Russia, is not represented at this exhibition by any locomotives of his own system; but a 16-wheel freight locomotive exhibited by the French Nord Railway is sometimes taken to be a modification of the Mallet system. This remarkable engine, which has been much noticed, differs from the Mallet in having two eight-wheeled motor trucks (of which twelve wheels are connected for adhesion) each truck having a separate pivot, whereas the Mallet engine has only one swiveling motor truck. Consequently the new freight locomotive has its trucks independent, as in the Fairlie engine, but it has only one firebox in its boiler, thus differing from the Fairlie. The design approaches more nearly to the Meyer system than any other, with these two principal exceptions, that the hinge connecting the two trucks together, as in the Meyer system, is not employed, and that instead of lateral main frames for the support of the truck pivots a central frame of box type extends from end to end of the engine and carries the draft gear, instead of the swiveling trucks carrying this as customary. Nevertheless, central buffing attachments are not provided, but instead, very broad side bumpers, suited for the ordinary freight truck of the Nord.

Special Flat Cars for Egypt.

The Leeds Forge Company, Leeds, England, has recently built for a plantation railroad in Egypt eight special flat cars for transporting agricultural implements. They have been designed especially for carrying traction engines which are used for steam ploughing, and the illustration shows a Fowler engine on the car ready to be moved. The cars are built entirely of steel and have a capacity of 25 tons. At one end a light steel runway is hinged to the endsill and at the other end a hand winch is permanently mounted. This is used for hauling the engines on to the car and for lowering them to the ground. When running, the runway is lifted to a vertical position and secured there by stays, as shown in the illustration. The buffers on the runway end are hinged at the bottom and



Special Flat Car for Transporting Agricultural Machinery in Egypt.

are held up against the endsill by a cotter pin which when removed allows them to drop down out of the way of the runway. Struts are also placed under this end of the car to carry part of the weight when the load is being hauled up. For loading light machinery such as ploughs and cultivators it is not necessary to use these struts, which are hooked up under the car when running.

The winch is used for raising and lowering the runway as well as for hauling up the load. The cable from the winding drum is passed through a snatch block attached to the floor of the car and is fastened to the outer end of the runway. Only a slight lift by hand is necessary to start the runway from a horizontal position and the remainder of the lift is done with the winch. To haul up a traction engine a snatch block is attached to the front of the engine and the cable is passed through it and fastened at the bottom of the winch. A pull of three tons can be obtained with the winch when working with double purchase so that with the snatch block arrangement a total pull of six tons can be had which is sufficient to load an engine such as is shown, weighing 22 tons. It is possible with this arrangement to lower the runway, load an engine and raise the runway ready for running in less than 30 minutes.

The Austrian-Hungarian State Railroad Company, which gets its name from the fact that it bought a state railroad long ago when the country needed money very badly and had no credit to speak of, has invested something more than $10,000,000 in manufacturing works in Austria and Hungary, including locomotive works in Vienna. Its income from these investments in 1904 was $144,000—less than 1½ per cent. on the investment.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 3. FRIDAY, JULY 21, 1905.

A monthly business meeting of officers and employees has been a feature of the service on the Bessemer & Lake Erie for several months past, and Superintendent Matson informs us that it has been both an interesting and a profitable feature. We call this meeting a "business" meeting because personal matters and grievances are excluded, and because it really promotes the smooth conduct of the business of the road; but General Manager Utley, in his circular announcing the scheme, calls the meeting just a conference for "exchanging ideas." However, the name is not essential. Mr. Utley's circular says:

> In order that the employees of the several departments may come into closer touch with the heads of those departments, for the purpose of exchanging ideas and making recommendations for the good of the service, and for the purpose of having rules and regulations interpreted, it has been arranged to hold a session of the heads of the departments, or their representatives, and the employees at Albion, Greenville, Butler Transfer, or North Bessemer, as may be decided upon from time to time, on the second Monday of each month. Time and place of meeting to be announced by the Superintendent by bulletin. Employees in any branch of the service, who can be spared from their regular duties or who can conveniently arrange to be present, are invited to attend these meetings, and present for discussion, or interpretation, any question pertaining to the good of the service. No personal matters or grievances will be presented at such meetings.

This must be an excellent thing, and it ought to be imitated. It has been said over and over again that the defects in the railroad personnel of this country are due in large measure to the growth of companies—to the fact that the employer is such a big concern that anything but the coldest connection between employer and employee is out of the question. Conferences like those here spoken of will do as much as any one thing to neutralize this evil. Schools established simply for instructing the men on the rules are likely to be too formal. Unless the instructor is an exceptionally good one—and a pleasant fellow besides—they may fall far short of the agreeable interview that they ought to be. Often, too little time is allowed for a given lesson at the school, leaving the result unsatisfactory on that account; voluntary conferences like those on the B. & L. E. should in large measure overcome this defect. The Chicago & North-Western has somewhat similar meetings of station agents. Provided only there is some one man at the head who sees that the subjects are not allowed to become weak and uninteresting and maintains a properly dignified atmosphere, almost any scheme of this kind is useful; for it helps to promote friendly acquaintance. A fair degree of acquaintance is necessary to the *esprit de corps* which is a necessary characteristic of efficient service.

Frequent informal conferences between superintendents, trainmasters, despatchers and road foremen, on one side, and conductors, enginemen and other trainmen on the other side can be made to relieve tension at other meetings. Recently the officers of the New Haven road intimated that committees of employees were a trifle too voluble—came too often and talked too much; such "grievers" ought to be allowed an opportunity to air their views at less formal conferences, and thus pave the way for prompt settlement of differences when they come before the higher officers. If they do not embrace the opportunity to talk to the superintendent, the general manager thereafter may fairly refuse to give up whole days, or even half days, to listening to their wishes or demands. And why should not informal conferences be brightened with pleasanter things than fault finding or difficulties? On the Southern Pacific not long ago the time for a certain grievance committee to send its "boss grievers" to the general officers came around, and there was nothing to grieve about; so they called on the proper officer and told him so; making an oasis in a dreary desert. In railroad life as in social life it is entirely allowable to compliment people before they are dead, if we take care to maintain truth and dignity, and see that our spokesmen are persons of good taste and sound judgment. A thoroughly conscientious and capable superintendent finds it necessary every now and then to spend an hour or two in giving friendly—but perhaps severe—admonition to an old employee who is well meaning but uses bad judgment too often. With proper care and with slight modification such private lectures may be made useful for others, and the hour made more profitable—by being combined, in part, with a conference like those on the B. & L. E. Last but not least, how profitable for themselves, personally, the officers of a division can make such a conference! An experienced retired trainmaster observed recently that not one trainmaster in twenty was well fitted for his position. Without stopping to question the accuracy of this ratio, it is perfectly safe for any trainmaster to assume that he is one of the 19; and as one of the most desirable accomplishments in a trainmaster is diplomatic ability—ability to discuss matters with his subordinates with skill, knowledge and all necessary affability and patience, what better experience can such an officer have than a monthly interview with 20, 50 or a 100 men, half of them armed with questions to test his powers?

THE COST OF MAINTAINING STEEL AND WOODEN CARS.

The plan that has been inaugurated by Mr. Kruttschnitt, of the Harriman Lines, to secure accurate data covering the relative cost of maintenance of their cars of steel construction as compared with all-wood cars promises to yield some interesting and valuable in-

formation. Although the record does not yet extend over a sufficient period to yield conclusive results, the figures already obtained are instructive and are indicative of what the final statement will show. The comparatively large number of cars involved, covering practically all important types, and the wide territory and large mileage represented, afford practically all of the conditions to be met with in service by equipment of this sort. The yearly cost of repairs to the steel construction cars, based on the monthly average for the six months covered by the statement printed elsewhere, is $24, and that of the wooden cars is $38. Some previous comparative figures of this nature, said to be based on returns from a number of different roads, place the cost of repairs to wooden cars at from $35 to $80, and for steel and steel-underframe cars at from $9 to $15 per car per year. (*Railroad Gazette*, Nov 25, 1904.) These latter figures were said to include steel cars that had been in service for six or seven years, and therefore were among the first steel cars of modern design to be built. While not questioning the correctness of the figures given, it was pointed out in our comments at the time that the figures for wooden cars were high, while those for steel cars were undoubtedly too conservative and could not fairly be used as a basis for comparison with the wooden cars because of the relatively short time even the oldest of the steel cars had been in service. It is, therefore, interesting to note that while the cost of repairing wooden cars on the Harriman Lines is close to the minimum quoted above, the steel cars are costing just double the average of the previous figures for this work. Nor is this higher figure in the present instance due to inadequate repair facilities, for, as is well known, the principal shop plants of the several lines composing the Harriman system are modern and of ample size properly to maintain the equipment. We understand that these roads consider themselves practically as well-equipped to care for their steel-construction cars as for their wooden cars. Furthermore, the steel and steel-underframe cars are of a sort that contain few parts that have to be supplied by the builders, and there is therefore no added cost from that source. The figure that they obtain, based, as it is, on careful records, certainly seems more reasonable and more nearly representative of general conditions and acceptable for comparative purposes, than one only half as large.

In analyzing the costs of car repairs on the Harriman Lines, the general conditions which enter as factors should be borne in mind. It is a rule on these roads to keep the high capacity cars in long-haul service as much as possible in order to derive the greatest possible degree of benefit therefrom. This doubtless contributes to a lessening of abuse of them in service and also should largely, if not entirely, avoid the coupling of high-capacity cars and the smaller and weaker cars into one train, all of which must have its effect on the repair bills. The amount of repairs made to Harriman Lines cars by foreign lines is undoubtedly much less proportionately than for an eastern road or system having an equal number of cars. This likewise should have a favorable effect on the repair account, particularly for the steel cars, as in the absence of a M. C. B. schedule of repair prices, foreign repairs to steel cars are undoubtedly more costly than home repairs if the facilities in the latter case are at all adequate.

The record will not be complete until it includes an appreciable percentage of wreck repairs, which will, of course, show up to the advantage of the steel-construction and the corresponding disadvantage of the wooden cars.

OUTLYING SWITCHES AND SIGNALING STANDARDS.

The Committee Report on Signal Standards, which was published last spring by the Maintenance-of-Way Association (*Railroad Gazette*, April 7), has elicited no comment, so far as we have observed, except that which was printed in these columns; and for the reason, no doubt, which applies in many a similar case, that declarations which are perfectly sound leave nothing for the commentator to say. But although this committee spoke wisely on the points that it dealt with it left other points untouched; and one of these, the question of the proper protection of isolated facing point switches, is a live one in many places. The signal engineer or chief engineer who wishes to do for himself what the committee has left undone, in the way of establishing standards, may well begin with this feature; or if he is sure that his practice is right already, he ought to try to promote its acceptance by other roads, for at present we seem to be tending toward an undesirable diversity. Many such switches are not protected at all. Of those we are not speaking. If the Mentor wreck and other less startling warnings of the same kind do not afford all necessary admonition on that point, it is difficult to imagine what would or could be effective. Some railroad officers, indeed, seem to deem a common switch stand a switch "protection." The next stage of enlightenment leads them to put up a common switch stand 20 ft. high, and be satisfied with that. In the third stage there is a signal some distance away, but the amount of the distance is not carefully considered, and there is uncertainty as to what the signal (when adverse) indicates to the approaching engineman; and so on, with variations. One prominent variation is the use of a semaphore at the switch in place of the usual switch stand. This arrangement was vigorously denounced by Mr. Ames in a letter which we published last December (page 640). Its undesirability is in some respects quite obvious. Admitting, as we must, that when an engineman enters the side track past such a signal he is passing a stop signal, our only reasonable refuge is to claim that the hand motion which directs him to proceed, takes the place of an indication by the second or dwarf semaphore arm which should be there, but is not. This is going back to a practice common in England twenty years ago. Even if we go to the expense of adding this second arm we still have the inconsistency of not having the post at what is usually the declared fouling point—45 ft. to 100 ft. back of the point.

In deciding on the character or location of a signal, whether for an isolated switch or for any other use, we shall do well to stick closely to simple and fundamental principles. This is not only easiest and pleasantest, but also doubtless the most successful course. Compromise with wrong principles has afforded nobody any satisfaction in the past, and it is not likely that it can afford satisfaction now. One of the first principles is that if any fast trains are run there must be a distant signal. And if real safety is what is desired —regardless of tradition—the term "fast" must be interpreted strictly. Any train approaching a switch too fast to be stopped in season if the switch is wrong, is a fast train as far as that switch is concerned. Thus if provision is to be made for running at full speed when the view is shortened by fog, there is no escape from the requirement of a distant signal at every facing point switch—which on single track means every switch. The alternative is to require enginemen to slacken speed at facing points in times of fog, a requirement which it is exceedingly hard to enforce. In practice we have in the past put this requirement in the rule books, more or less blindly worded, and then have trusted to luck. This requirement really has nothing to do with the number of trains run each day or the profit made from the passengers. If there is only one fast train a day, and it is run, not to meet a public need but only to get a few through passengers away from a rival line, still it demands protection. Safety and rivalry are often incompatible. If you have not the facilities to carry passengers safely you are making false pretenses when you bid for their patronage.

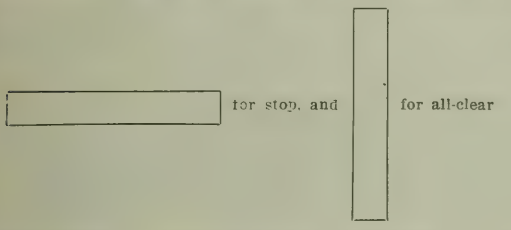
A very useful principle that we ought to adopt at outlying switches is that of height. For fast running we may reasonably employ three heights: 24 ft. for semaphores, with full interlocking and complete signaling; 3 ft. or less for dwarf signals and stands for trailing points (if any stand is used at such switches), and about 8 ft. or 10 ft. for facing point stands. To put this latter 20 ft. high is making a radical change and a considerable expenditure for a very small return. We give the runner a longer view in clear weather, yet help him none at all in foggy weather when he most needs help. By having a difference of 10 ft. or more in height between the switch stand and the semaphore we provide a simple and convenient guide by which to differentiate them quickly.

A principle which is not fully utilized is that of transverse position or distance from the track. It is used in bracket signals, but this use at night is often imperfect by reason of the poor quality of the blue light used on dummy posts. This principle is not an essential in designing protection for an isolated switch, but we mention it because of its simplicity. Two lights, or two targets or disks, side by side, make a distinctive signal, which is reasonably simple and inexpensive. The idea will not be attractive to signal engineers who have to spend their nights and days in reducing expenses to the last degree; but scientific simplicity is likely always to be at variance with that class of economists.

A fourth principle is consistency between night and day signaling. At night we can give three indications by color. By daylight we can give three shape indications (usually called position indications) to correspond with the three night indications. The principle of height and that of transverse situation (as related to the track) have about the same effect in the day as in the night. What advantage do we gain by giving any more information in the day time than in the

night? Practically no advantage, except to new men learning the road; and that is not a feature of much importance. This being so, the principles which we have recounted are not only the most fundamental ones of the matter in hand, but are the only ones that need be carefully considered.

Bearing in mind our first-mentioned principle, that a distant signal is an essential adjunct to any signal (or any danger-point indication, such as a facing point switch or switch target or light) if trains are to be run fast, we have a simple solution of the isolated switch problem; for a corollary of the distant signal principle is the principle that the distant signal is more important than the home. The distant gives the vital information that the train must stop, while the home gives the less important information *where* to stop. Our isolated switch on a slow road is well equipped if it have a 10-ft. stand. That height answers equally well for a fast road because there it will have a distant signal. A target showing



is fully adequate for slow speeds, and for high speeds is made adequate by the aid of the distant. Thus we conform to the semaphore principle of visibility and to our conventional use of the semaphore (horizontal for stop and vertical for proceed); while still maintaining a difference from the semaphore helping to emphasize the difference in function. This difference in function cannot be done away with; the switch stand only indicates the position of switch rails, while the semaphore indicates stop or go ahead. Our 10-ft. day signal might indeed be a semaphore, and with it we should have as good a distinction from the interlocked semaphore as we have at night; but the oblong rectangular disks fixed, at right angles to each other, on a vertical rod, turning on its axis, have the advantages of cheapness and of adherence to past practice. There is no reason why we should not retain these advantages. The only advantage in using the semaphore in place of them is to make the day indication as poor as the night indication, for no other reason than to secure a useless theoretical consistency.

June Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of June, printed in another column, contains accounts of 18 collisions, 35 derailments, and three other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
1st	Stillwater Junction, Ohio	2	0
6th	Pewamo, Mich.	7	0
7th	Colfax, Wis.	7	0
8th	Davison, Mich.	1	10
13th	Golden Gate, Ill.	2	10
16th	Wilcox, Pa.	2	3
16th	Birmingham, Ala.	0	14
17th	Patapsco, Md.	26	20
20th	Newington, Conn.	3	1
21st	Mentor, Ohio	19	15
26th	Vine Grove, Ky.	3	12

The wreck at Mentor, Ohio, is, no doubt, fairly well fixed in the memory of everybody in the United States who reads the newspapers, and it has taken its place in railroad history as a notable disaster; and yet here in the very same month we have another wreck which caused a third more deaths and which 99 per cent. of the aforesaid newspaper readers have probably already forgotten; if indeed they ever read of it; or read with sufficient care to remember the fact more than a half day. Truly, those Europeans who say that we are heedless and are not troubled about these defects in American railroad service, can not be blamed for coming to that conclusion. How could any one reason them out of it? Patapsco and Mentor combined are responsible for 45 fatalities, but the Government report of collisions and derailments will probably show as many more from other accidents of that class in June. Our own list of only eleven accidents (preceding this paragraph) shows 27 other fatalities, making 72 in all, in this list.

How the Mentor switch came to be misplaced on the night of June 21 is still unexplained. The coroner of Lake county, the coroner of Cuyahoga county, and the State Railroad Commissioner have yet to give the public a report of their inquiries.

The cause of the Patapsco collision is all too familiar; eight men killed on those two freight engines, all of them, presumably, responsible for knowing that they were running on the time of the passenger train! The other nine accidents in the list are notable by reason of circumstances which appear in the record and call for no special comment in this place.

The number of electric car accidents reported in the newspapers in the month of June was 24, in which four persons were killed and 139 were injured.

International Mercantile Marine.

According to the statement just issued, during the year ended Dec. 31, 1904, the company lost $1,750,858 in gross (voyage) earnings, $2,190,427 in total earnings, and $2,194,115 in net earnings. This made a deficit for the year of $2,039,150 against a surplus of $355,295 in 1904. Total gross earnings for 1904 were $27,926,908, and net earnings $1,806,407. Net earnings in 1903 were $4,000,522. The figures for deficit and surplus do not, however, take into account the surplus insurance account, which reduced the deficit for the past year to $1,142,098 and increased the surplus for the preceding year to $1,797,797. The poor showing for the year is attributed to the steamship rate war and the resulting depression in freight rates during the latter part of 1904, and also to the fact that grain crops in the United States were not large enough to provide much export business in grain. The company carried to and from all European and American ports 26.51 per cent. of the total passenger traffic. The report seems especially discouraging from the fact that no allowance appears to have been made for depreciation, for which certainly not less than 5 per cent. annually should be allowed in the steamship business. The company's poor balance for the year is thus really understated. The Cunard Line has also recently made a very unsatisfactory showing for the year, while the German lines have had, on the whole, a very prosperous year. The President of the Mercantile Marine Company states that the outlook for 1905 is more favorable, the forecast of earnings for the first six months showing a large gain over the corresponding periods in both 1903 and 1904.

Dr. C. D. Goodrich, the oculist for the Lake Shore Railroad, will next week make a series of vision tests on the passenger engines over that road, the purpose being to ascertain just how acute the vision of engineers ought to be. He will begin with the slower runs and end with the runs on the fast trains, and then determine on a standard test for vision. The tests are made at the request of the Brotherhood of Locomotive Engineers and with the approval of the Lake Shore officials. The test now required of the engineers is a very rigid one and they are insisting that it should be modified. It requires a practically perfect or "twenty-twentieths" vision without the aid of glasses. The engineers already have obtained a number of concessions along this line but they are demanding more.

The foregoing item comes from Indiana, the state whose Legislature once on a time, it was rumored, passed a law fixing the ratio of the diameter of the circle to its circumference as 1 to 3.20; the purpose being, we suppose, to ameliorate the tasks of the Hoosier school boy. The purpose of the Brotherhood of Locomotive Engineers in the present instance is, no doubt, equally laudable; to make it as easy for a partially blind man as for one with perfect eyes to draw money from the pay car every month. But the present effort will, or ought to be, as futile as the other. The only eyes suitable for a locomotive runner are perfectly normal eyes. To "determine on a standard test" at this date would be like redetermining to have round wheels, straight cylinders and resilient springs in the locomotives. That the oculist goes through this performance at the "request" of the Brotherhood may be readily believed, for the Brotherhood—presumably, we charitably assume, to please a few unreasonable members—has many times before asked railroads to try to set aside natural laws. That the officers of the road approve, is also credible, for officers have to approve all sorts of foolishness to keep the peace with narrow minded employees who "insist" that the company shall take risks with fast trains for the purpose of keeping unfit runners on the engines. If a superintendent is determined to tolerate a runner with defective vision, there is no unsurmountable obstacle in his way, except in states where there is a statute on the subject and a prosecuting attorney endowed with the unusual degree of vigor necessary to enforce such a statute; but there is no reason why the superintendent should try to deceive himself into the belief that he can safely weaken his standard. The standard remains immovable, howsoever much we violate it.

NEW PUBLICATIONS.

Constitution of Hydraulic Mortars. By Henri Le Chatelier; translated by Joseph Lathrop Mack. New York: McGraw Publishing Co.

This book is a translation of the thesis prepared by M. Le Chatelier in 1887 for the degree of Doctor of Science, and has served ever since as the starting point for numerous studies on the subject. It is divided into three parts, in which are successively taken up

Plaster, The Silicates of Barium and Cements and Hydraulic Limes. The chief object of the work is the study of the chemical reactions which are produced in the limes and hydraulic cements either during their calcination or their hardening. Starting with plaster and the silicates of barium as presenting less difficulty in solution and study, a brief historical sketch is given of the work of previous investigators such as Lavoisier, Berthier and Payne, followed by the researches of the author on the calcination and set of plaster, in which the chemical reactions as well as the physical peculiarities of the material are carefully studied. The same method is followed in the other two parts of the book, the third being by far the longest of the three. The whole study of the cements is based upon the idea that all of the phenomena which reside in those bodies are of a purely chemical character, by the thorough understanding of which it should be possible to formulate a theory of the hardening of the hydraulic mortars that would be definite and distinct. In conclusion it is shown that a cement of good quality has a perfectly definite composition and the reciprocal should be assumed. In the elaboration of the chemical reactions, and the suggestions as to the action and manipulation of cements the book cannot fail to be of great value to those manufacturers and engineers to whom the original French has not been accessible.

Osborn's Tables, Fifth Edition; Osborn Engineering Co., Cleveland, Ohio.

This publication is an engineer's handbook containing tables of the moments of inertia and radius of gyration of various forms of girders and columns built up of plates and angles, as well as the working strength of steel and timber columns. In addition to these there are a number of other tables, among them one of square roots, of reactions, shearing stress and bending moments of bridges; of weights of standard railroad bridges; of Cooper's standard loading; various impact formulæ; the moments of inertia and section moduli for various standard and usual sections; concluding with a list of some of the longest bridges of the world.

The tables are arranged for quick and ready reference. Taking those on bridge stresses as an example, they are based on the assumption of a special panel load and panel length of unity, so that actual shear and stresses can be obtained by multiplying the actual panel load by the tabular shear, etc. In this way the table is applicable to any system of measurement whether British or metric.

Suitable explanations accompany all of the tables to make them perfectly clear, thus making the book available for instant use without prolonged study and investigation as to the sources and methods by which the data are obtained.

TRADE CATALOGUES.

Exhaust Fans.—Catalogue No. 180 of the American Blower Co., Detroit, Mich., is entitled Exhaust Fans. It describes the "A B C" fans intended for the removal and conveying of shavings and dust, elevating and distributing of cotton and wool, removal of smoke and fumes, and for use in connection with special heating and drying plants. The book has 66 pages and covers the subject fully both by illustration and text. An eight-page pamphlet accompanying the catalogue is devoted to "A B C" electric disc fans, illustrating and describing different types and showing them driven by different makes of motors.

Atlanta Terminal Station.—The Southern Railway has issued a handsome souvenir showing views of the new terminal passenger station at Atlanta, Ga., which it shares jointly with the Central of Georgia and the Atlanta & West Point. The station was formally opened for use on May 14 last, and is perhaps the handsomest and most commodious station in the south.

Frogs, Switches, Crossings, Etc.—The Weir Frog Co., Cincinnati, Ohio, sends its catalogue No. 7. This is handsomely bound in red cloth and contains upwards of 375 5 in. x 8 in. pages. In it is described and illustrated numerous designs of frogs, switches and crossings made by the company, as well as switch stands, switch fixtures, rail braces, etc.

Air Lift Pumping.—The Ingersoll-Sergeant Drill Co., New York, sends a neat little pamphlet descriptive of its air-lift pump. This is a device for lifting water from wells by compressed air. It operates without shock, jar or noise, and it is claimed that more water can be lifted from a given well by this system than by any other method of pumping.

Steam Specialties.—The Schaeffer & Budenberg Mfg. Co., New York, sends its April catalogue of steam specialties and automobile, brewery and distillery supplies, comprising a full line of valves, gages, counters, whistles, small pumps, indicators, lubricators, etc.

Steam Packings.—The Crandall Packing Co., Palmyra, N. Y., sends its catalogue and price list of its improved steam, ammonia and hydraulic packings. Illustrations and descriptions are given of the various forms of packing made by this company, including "Rte-into-ced" ring and sectional packing, waterproof hydraulic packing, "Hero's" locomotive throttle steam ring packing and asbestos metallic sheet packing.

Paints and Roofing.—The Standard Paint Co., New York, sends its June issue of *The Exchange*. The contents of this issue are devoted to describing Ruberoid colored roofings and floorings and Flexite metal preservative paints.

Car Lighting.—The Consolidated Railway Electric Lighting & Equipment Co., New York, sends its bulletin No. 1, which illustrates and describes in detail the "Axle-Light" system of car lighting.

Motor for Turntables.—The Case Mfg. Co., Columbus, Ohio, sends a nicely illustrated folder descriptive of its "electric mule" for locomotive turntables.

Rail Benders.—Bulletin 14 of the Buda Foundry & Mfg. Co., Chicago, is devoted to rail benders, including "Jim Crow" and roller styles.

CONTRIBUTIONS

Treated Ties.

Nice, France, May 16, 1905.

To the Editor of the Railroad Gazette:

Prof. Dr. Hermann von Schrenk in his article published in your issue of May 5, says (page 422): "There is a tendency towards not only using preservatives, but preservatives of a better grade than have hitherto been employed. This is showing itself in the consideration of processes which use a combination of zinc chloride and creosote."

The results of good and bad work in using zinc or creosote, or zinc and creosote, are sufficiently known in the United States and in Europe; but the difference in opinion as to choosing the best of these methods is the same as heretofore. Both of these preservatives give excellent results as long as they are not washed out. It would certainly not answer the purpose to reduce the quantity of zinc and it remains somewhat doubtful whether reducing the quantity of creosote will or will not do. On the other hand, it is a well-known fact that sulphate of iron is not only a good but by far the cheapest preservative. The quantity of ties used in the United States and their proportionally low price require a cheap treatment and a large turnout per cylinder. The only means tested up to date in the United States for the purpose of keeping sulphate of iron in the timber is the Hasselmann system. It does not, of course, protect rotten ties (Texas test track), but it keeps ties from rotting, provided they are impregnated to the very core.

A temperature of 130 deg. to 140 deg. Celsius tends to destroy the fiber of some kinds of timber, and free sulphuric acid destroys them all. The problem therefore consists in considerably reducing the temperature, at the same time securing thorough impregnation and absolutely preventing the deleterious formation of free sulphuric acid. How this is done is apparently not known to Prof. Dr. von Schrenk, but it will be made known to him in case he is inclined to take up the discussion *coram publico* by answering the question: Why the testing of the Hasselmann system in the United States does not justify its consideration as well as for instance the Rüping process?

MAX BARSCHALL.

Failure of a Concrete Sea-Wall.

BY GEORGE W. BLODGETT, C.E.

Point Allerton, in the town of Hull, Mass., is a promontory or headland about 150 ft. high situated at the north end of Nantasket Beach, which is about three miles long. The hill at Point Allerton is composed of gravelly clay containing numerous boulders and is joined by a narrow strip of beach of coarse gravel to a somewhat similar headland a mile away to the southwest, on which the village of Hull is built. This isthmus is scarcely more than 100 ft. wide for a considerable distance, and on it are built the county road and the Nantasket Beach branch of the New York, New Haven & Hartford, by means of which Hull is connected with the main land at Hingham and Cohasset, five miles away.

The great storm in November, 1899, which caused destruction of life and property along the New England coast, nearly washed away this narrow strip of land which divides Boston harbor from Hull bay and which is exposed to heavy seas from the north. Had the sea broken through, it would have converted the end of the peninsula into an island and destroyed the fine achorage in the bay where yachts and small boats are usually moored in perfect safety, no matter how heavy the seas may run outside. To prevent

further damage, the State of Massachusetts soon after built a breakwater of Portland cement concrete on the harbor side. This breakwater is about 1,450 ft. long and was built in sections by building a mould of boards and timber and ramming the concrete in place. It is greatly strengthened and the stability of the beach in front largely increased by a series of 12 wing walls 110 ft. apart extending out towards the sea about 50 ft. and sloping down to the water level at a slightly greater angle than the beach. A general view of the breakwater and the wing walls is shown in Fig. 1.

The main wall or breakwater is 3 ft. wide at the top with a batter of 2 in. to the foot, and is 6 ft. high at the shallowest point.

Fig. 1—General View of Sea Wall and Wing Walls at Hull, Mass.

The wing walls are 2 ft. wide on the top and are practically one piece with the main wall, being joined to it by a curve of 1-ft. radius at the angles; in fact, all of the angles and corners are rounded so as to offer but slight resistance to the waves which sometimes dash to the very top of the wall.

The breakwater extends out 50 ft. beyond the last wing wall on the south end and has been undermined by the heavy waves. It was, therefore, in the condition of a beam supported through most of its length but at the free end acting as a cantilever. The wall, being of concrete without steel reinforcement, had not sufficient tensile strength to support the weight of the overhanging part, which was 16 ft. long, and as a result this much of the wall broke off nearly square across. A second break occurred 31 ft. farther in as the undermining action of the waves continued. This break is of the same general character as the first, but shows more clearly the effect of the longitudinal shearing forces which are well known to exist in beams when broken transversely but which in a material like concrete are not easy to demonstrate. Fig. 2 shows the two breaks and illustrates their different character, and Fig. 3 is a closer view of the second break, which shows the curve of the junction of a wing wall with the main wall. Fig. 2 also shows the appearance of one of the wing walls and the effect of the buffeting it has received on the end next the water from the heavy seas which wash over it during every storm. It is submerged for part of its length at nearly every tide, but only the highest tides with wind from the north or west cause the waves to dash against the breakwater itself with any considerable force. Except for the undermining and the breaks at the outer end the breakwater shows no signs of deterioration. The wing walls are none of them seriously impaired after five years of exposure. They are worn away only at the ends for a short distance, on most of them for not more than 2 or 3 ft., although in one case the top has been broken away to a depth of about 3 in. for a distance of 7 ft.

At this time it can only be conjectured whether, when the breaks occurred, the end of the wall hung free and unsupported for the whole 16 ft. between the first break and the end of the wall, or whether it was gradually undermined for this distance, bringing more and more tension on the upper layers of concrete until fracture occurred. A rough calculation made on the assumption that the whole weight was unsupported for the whole 16 ft., gave as the approximate tensile stress at the extreme top of the section, 551 lbs. per sq. in. This is not an impossible value for the unit stress at the instant of rupture as tests by the Boston Transit Commission in 1895 1896 gave, according to Trautwine, a maximum value of 531 lbs. per sq. in. in beams 6 in. square of 30 and 60-in. span, tested when from 29 to 37 days old, 24 hours in air and the rest of the time in water. Making the same assumptions regarding the other piece which broke off, would give as the extreme tensile stress 2,083 lbs. per sq. in., which seems much too high although test pieces from the concrete used in the bridge over the Danube at Munderkingen, Germany, broke at from 2,000 to 4,560 lbs. per sq. in., varying with the age of the specimens (which, however, Trautwine does not give).

The writer thinks that it may be supposed with reason that these breaks occurred on account of a violent shock due to a wave of more than usual magnitude and force; which brought a sudden and momentary stress (due to its impact) far greater than the mere weight of the wall itself so that it cannot be positively determined what the actual strength of the concrete was but only that it was not *strong enough* to resist whatever stresses were imposed upon it.

From the perfect state of preservation and the excellent appearance of the rest of the breakwater and the wing walls there is good ground for stating that Portland cement concrete, well made and well laid, will resist the action of the sea under all ordinary conditions if the mass of the masonry is sufficiently large and the masonry is carried deep enough to prevent undermining for any considerable distance. Wing walls, reasonably close together and carried out at right-angles for 50 ft. or more, will prevent any extensive displacement of the material immediately in front of the wall and perhaps altogether remove any danger from undermining in nearly all situations. For the most extreme cases, stone masonry would probably be better, as this material has a crushing strength of from three to twelve times that of concrete.

Fig. 2—View Showing Two Breaks in Main Wall.

Fig. 3—Appearance of Second Break.

Comparative Cost of Repairing Steel and Wooden Cars on the Harriman Lines.

In order to determine definitely what it is costing the Harriman Lines to maintain their steel cars and cars of composite construction as compared with all-wood cars, Mr. Julius Krutschnitt, Director of Maintenance and Operation, last fall arranged to have kept separately the repair accounts of all of the steel cars and an approximately equal number of wooden cars. The cars of steel construction comprise practically all kinds, including gondola, coal, flat, ballast, oi., stock and box. The wooden cars were chosen so as to be comparable in age, capacity and kind to the steel cars, only the newest lots being represented in the list. It was desirable to have the number of wooden cars chosen from each line equal, approximately, the number of steel cars from that line, but this did not work out very well in the case of the Union Pacific and the Oregon Short Line, the latter having only a small number of wooden cars that could be compared fairly with its steel cars. This discrepancy is balanced by the excess in wooden cars for the Union Pacific, which include a lot of 3,000 box cars bought on one order.

HARRIMAN LINES. COMPARISON OF COST OF REPAIRS OF STEEL AND WOODEN CARS FROM OCTOBER, 1904, TO MARCH, 1905, INCLUSIVE.

	October.		November		December		January		February		March		6 months.
Steel Cars.	No. of cars.	Average cost per car.	No. of cars.	Average cost per car.	No. of cars.	Average cost per car.	No. of cars.	Average cost per car.	No. of cars.	Average cost per car.	No. of cars.	Average cost per car.	Average cost per car.
Union Pacific	2,825	$2.94	2,826	$2.09	2,826	$2.41	2,826	$2.78	2,826	$2.72	2,826	$2.98	$2.65
Oregon Short Line	2,326	1.80	2,326	1 28	2,326	1.62	2,326	1.97	1,326	2.43	2,326	1.92	1.84
Oregon R. R. & Nav.	120	1.64	120	3.69	120	1.40	120	1.25	120	1.01	120	4.32	2.22
Southern Pacific Co.—Pacific System	4,603	1.36	4,637	2.08	4,636	1.63	4,636	1.97	4,634	2.61	4,633	2.40	2.01
Southern Pacific Co.—Atlantic System	1,250	.16	1,250	.40	1,350	.40	1,350	.46	1,350	.53	1,350	.57	.42
Total, all lines	11,124	$1.72	11,159	$1.74	11,258	$1.85	11,258	$1.99	11,256	$2.33	11,255	$2.25	$1.98
Wooden Cars.													
Union Pacific	5,360	$4.44	5,360	$3.57	5,355	$4.02	5,353	$4.15	5,346	$3.75	5,343	$4.45	$4.06
Oregon Short Line	361	4.47	361	2.45	361	2.49	361	2.87	362	2.21	363	4.02	3.08
Oregon R. R. & Nav.	214	1.96	214	1.32	213	3.18	213	1.85	213	1.53	213	1.77	1.93
Southern Pacific Co.—Pacific System	3,966	2.14	3,966	2.40	3,962	2.16	3,959	2.34	3,954	2.74	3,952	2.36	2.36
Southern Pacific Co.—Atlantic System	800	1.10	800	1.65	785	2.18	785	1.76	785	2.02	785	2.30	1.83
Total, all lines	10,701	$3.29	10,701	$2.91	10,676	$3.13	10,671	$3.22	10,660	$3.15	10,656	$3.45	$3.19

The accompanying table exhibits the record for six months. It shows the number of cars from each line, the average cost per car for each month of the six, both for each line and for all lines, and also the averages for the six months period. It will be seen that the average monthly cost per steel car for all lines for the six months is $1.98, while the corresponding figure for the wooden cars is $3.19, a saving of $1.21, or 38 per cent., in favor of the former.

Considerable variation in the cost of repairs on the different lines will be noted, particularly the high figures for the Union Pacific and the low figures for the Atlantic System of the Southern Pacific. The causes for this are being investigated at the present time at Mr. Kruttschnitt's direction. However, in general the higher costs on the Union Pacific are attributed to the relatively greater age of a considerable proportion of the cars and to the somewhat higher miles run per car. This latter is due to the preponderance of through business on the Union Pacific, which is greater per car than on the other lines. The steel cars of the Union Pacific include a number of coal cars and ballast cars built at a much earlier date than the cars of the other lines with which they are compared. The Atlantic System cars are comparatively new, and most of them are flat cars, which, of course, cost much less for repairs than box cars.

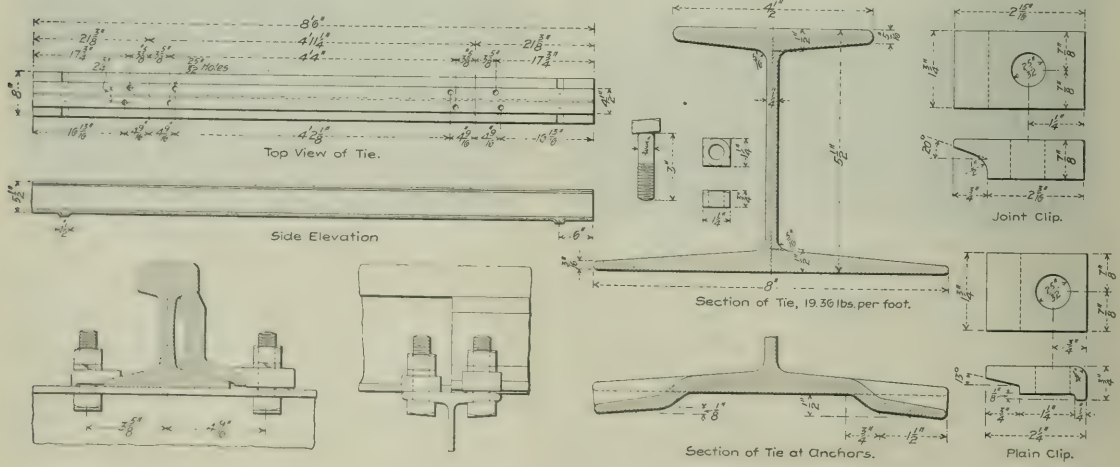
The intention is to continue the record until satisfactorily accurate data on the comparative costs of the two kinds of construction have been secured.

Steel Cross Ties.

The accompanying illustrations show a new steel tie made by the Carnegie Steel Company, Pittsburg, Pa. As shown, the cross section of the tie is a modified form of the well-known I-beam.

Application of the Carnegie Steel Cross Tie.

This section combines ample bearing surface of the proper shape for bedding and tamping; sufficient surface for seating the rail; the greatest rigidity and transverse strength for a given weight of material, and an easy means for securing the rail to the tie. The tie, as shown in the illustrations, has a top flange 4½ in. wide; a bottom flange 8 in. wide; a web ¼ in. thick, and a depth of 5½ in. The length over-all is 8 ft. 6 in., and the weight per foot is 19.7 lbs., or a weight of 167.4 lbs. per tie, exclusive of the fasten-



Details of the Carnegie Steel Cross Tie.

ings, which weigh about 6 lbs. The rail is secured to the tie with four ¾ in. bolts, by means of rolled steel clips fitting accurately on the flange of the rail, having a bevel exactly the same as that of the flange and carefully punched so that the shoulder of the clip gives proper and positive rail alinement. The necessary insulation when automatic block signals are in use is provided for by wooden shims placed between the rail and the tie; fiber bushings around the bolts, and fiber washers under the nuts. A number of these ties have been in service for the past two years on lines carrying fast and heavy traffic. The New York Central & Hudson River has them in use near Castleton, N. Y., and they are also in use on the Duluth & Iron Range Railroad and on the Lake Shore & Michigan Southern. The Bessemer & Lake Erie, after a six months' test of one-half a mile of track equipped with these ties, has placed an order for about 2,100 tons of the ties, this being sufficient for the equipment of 10 miles of track.

Locomotives at the Liege Exhibition.

BY C. R. KING.

(*Continued from page 48.*)

The 16-wheel articulated locomotive of the French Nord Railway mentioned in the previous article is well worth a more extended description. The principal original feature in this engine is the central girder frame which supports the boiler and takes all the strains of the train couplings, in this respect differing from most articulated locomotives in which the motor truck takes the pull of the couplings. This is not the case, however, with the Mallet system unless the engine is running with the cab in front. When running on short radius curves the long boiler and central frame form a tangent with the outside of the curve, and with the ordinary coupling arrangements this lateral displacement would have a strong tendency to derail the car next to the engine. To obviate this difficulty the coupling hook is free to slide from side to side in a wide slot in the bumper beam and the coupling bar is attached far back on the central frame to minimize the lateral pull.

The motor trucks are unaffected by the extreme lateral displacement of the boiler and central frame. The pivot itself is a large hollow spherical casting resting in a cup bearing contained in the heavy cast-steel frame which serves to brace the plate frames of the motor truck. It has no lateral displacement. The pivot is bolted to the under side of the box-girder central frame, which is in turn secured to the heavy smokebox saddle at the front end of the boiler. The truck has thus universal rotation about its pivot. The boiler, which has a high center of gravity, cannot roll for there are outwardly projecting arms on the saddle casting which bear against the upper sides of the pivoted motor truck frame through the intermediary of a buffing spring whose central pin carries a steel roller which turns with the swiveling of the truck.

At the firebox end the boiler is rigidly supported. The mud ring rests directly upon the central frame in the middle, and at the sides it is carried on the usual expansion brackets through the intermediary of side rests which allow the free radial movement of the rear motor truck. Midway between the two end supports of the boiler there are two other supports on the central frame which consist of double metal sheets, allowing as usual for contraction and expansion. The central frame being placed so high up under the boiler necessarily leaves but little room for the ash pan under the full width of the firebox. The ash pan is therefore forked at its front end, and to provide for cleaning without detriment to the axle boxes, etc., on the rear truck, open troughs lead out from the extremities of the side ash pans to drop the ashes clear of the rails.

With the adoption of two instead of one swiveling truck the number of flexible joints required has been augmented. These are (1) the high pressure steam pipe which is carried from the dome to the back end of the boiler (below the foot plate), where the vertical axis of the pipe corresponds with the pivotal axis of the truck—from whence the pipe is led forward to the high-pressure cylinders. (2) The exhaust pipes from the high-pressure cylinders to the low-pressure cylinders. These pipes, which lie in a direct line between the two groups of cylinders, have been made to allow for the aggregate radial movement of the two motor trucks. They consist of sliding sockets with spherical ends similar to the type adopted in the Mallet locomotives for the vertical connection of the low-pressure exhaust with the blast pipe. It remains to be seen if such an arrangement will stand the wear of time and keep tight. (3) The high-pressure steam pipe running from the dome to the low-pressure cylinders for use when it is required to work all cylinders with boiler steam direct. In this case, as the pipe is of small diameter, a short length of steel-braided metallic hose is used without recourse to a swivel joint. (4) The exhaust from the low-pressure cylinders. This consists of two large rubber pipes connecting each low-pressure valve chest pipe with a large Y-pipe at the back of the smokebox. This rubber piping is tightly wired and takes the place of the spherical-joint, sliding pipe of the Mallet system, already referred to. The other flexible connections on the engine are of minor importance. It will be seen that the numerous flexible joints correspond closely to those in the Meyer system, notwithstanding that after competitive trials of the Meyer and Mallet engines on the Saxon railroads the Mallet was selected for its greater practicability.

The lateral pipes between the high-pressure and low-pressure groups are fitted with the de Glehn intercepting valves for making the change from simple working to compound. When the valves open the high-pressure exhaust to the air, the steam thus discharged passes by a short branch pipe cast upon the low-pressure exhaust pipe—this being neatly and simply designed—and as the intercepting valve is immediately behind the low-pressure cylinders no flexible joint is needed.

The water tanks are supported above the plate frames on each side and are divided into two sections, front and back. The forward tank reaches beyond the front of the boiler, but this causes no inconvenience in cleaning the smokebox as pipes are carried through the tank bottom through which the cinders are discharged. Nor do the tanks interfere with the view of the track immediately in front of the engine, as they are of triangular cross-section, which allows a lookout between their sides and the sides of the boiler. The engine is "double ended" in respect to its trucks, so that it can be run equally well with its cab at the front end. The coal bunker behind the foot plate holds five tons of coal, but it allows a clear view from the rear windows of the cab.

The following table gives the principal dimensions of this peculiar locomotive:

Fuel	Bituminous coal
Weight of engine, loaded	224,880 lbs.
Weight of engine, empty	171,960 "
Wheel loads, axles 1, 2, 7 and 8, fully loaded	30 865 "
" " " 3 and 6, fully loaded	33,071 "
" " " 4 and 5, fully loaded	17,039 "
Weight for adhesion, half load coal and water	176,368 "
Co-efficient of adhesion, working simple with full load	4
Co-efficient of adhesion, with full load working compound	5.3
Driving wheels, diameter	57½ in.
Bearing wheels, diameter	33½ in.
Wheel base of each truck	19 ft.
Wheel base of engine	41 ft. 3½ in.
Length of engine	51 " 7¼ "
Width of engine	9 " 5 "
Height to center of boiler	9 " 2¼ "
Maximum theoretical tractive effort, compound	41,021 lbs.
Maximum theoretical tractive effort, simple	53,052 "
Boiler pressure	228 "
Pressure in receiver pipes	92½ "
Grate area	32.29 sq. ft.
Heating surface, firebox	129.0 "
Heating surface, tubes (Serves)	2,503.30 "
Total heating surface	2,632.30 "
Diameter high pressure cylinders	15¾ in.
Diameter low pressure cylinders	24¾ "
Common stroke of pistons	26¾ "
Capacity of water tanks	3,400 gals.
Capacity of coal bunkers	5 tons.

Superheaters on Belgian Locomotives.

The accompanying drawings show two recent types of superheaters with which a number of the Belgian locomotives at the Exhibition are fitted. Fig. 1 shows the Cockerill system with extended smokebox door, and Figs. 2 and 3 show the details of the latest design of the Schmidt superheater, which is a much simpler arrangement than previous designs of the same inventor. The main feature of both superheaters is the placing of the steam tubes within the fire tubes of the boiler, a number of which are made large enough to receive them. This entails in consequence a loss of evaporative power in the steam generator. The Schmidt device is the simpler of the two, as it is intended solely for single expansion engines, and the only regulating device it requires is a trap door in the smokebox to cut off the passage of hot gases through the upper fire tubes when steam is not circulating in the superheating tubes. The Cockerill superheater is for compound engines and provides for several modifications in the distribution of the heat in the superheating tubes.

In both the Cockerill and Schmidt arrangements, the location of the superheating tubes is a more rational one than in the many superheating systems current on the European continent, for in both of these arrangements the heat is absorbed from the gases in their passage from the firebox to the smokebox instead of as in previous arrangements, the heat being specially carried to the coldest part of the boiler to there perform its work at a serious loss to the thermal efficiency of the whole generator. In the United States the attention of inventors is now particularly concentrated upon the firebox end of the boiler as the proper location of the superheater, and if a practical and durable device can be put in there it will probably replace the European types of smokebox superheaters by reason of its immense superiority in effectiveness.

The results in economy attained by the use of superheaters on locomotives, when published by interested or even remotely interested parties, have been received with extreme caution by locomotive designers ever since the superheating locomotives introduced on the Chemin de fer du Nord in 1862 by M. Jules Petiet, were abandoned, but they are coming more and more into use and are fully justifying the claims made for them. The Belgian State Railways have applied Schmidt superheaters to 25 locomotives of five

different types. So far, the best results obtained have been from 12 to 13 per cent. saving in coal and 16 to 18 per cent. saving in water, these results confirming those obtained by other systems of superheating employed on the State Railways of Austria and Saxony. With the apparatus applied to new engines, these Schmidt superheaters are said, in some cases, to have required no special attention in 1½ years. Those who have seen locomotives equipped with the old form of Schmidt superheaters lying at the Borsig Locomotive Works at Berlin awaiting repairs will consider this a fine record. This most important question of repairs and the difficulty of repairing those parts only indirectly connected with the superheating apparatus, are items of great importance in the ultimate adoption of superheaters in general locomotive service, and to overcome these difficulties nothing but persevering trials of the best and latest types and the rejection of old types will avail.

The Schmidt superheater of the Belgian State Railways is clearly shown in Figs. 2 and 3. A steam receiving box or collector is placed in the smokebox and from this two 1¼-in. steel tubes run back into each of the three upper rows of 4⅝-in. fire-tubes. A short distance in front of the firebox they are bent back and return to that division of the collector from which the cylinder steam pipes lead. The reheating tubes are protected from the action of the fire at the back end by U-bends of steel castings. The extremities of the tubes at the smokebox end are flared out and the flanges are screwed into the cast-steel receiver or collector. Asbestos is used in packing the joints. Instead of copper, which is the usual practice, the smokebox steam pipes are of iron and the large fire tubes holding the reheating tubes are also of iron. These large fire tubes are screwed in the firebox flue sheet and are plugged with iron ferrules, but in the smokebox flue sheet they are expanded as usual. A hinged flap below the collector box serves to cut off the draft through the large fire tubes and also to prevent the ingress of heat from the lower fire tubes when the cylinders are not taking steam. The usual expedients are resorted to to prevent damage where superheated steam is employed. The degree of superheat is shown on a scale in the cab by means of a pyrometer placed in one side of the collector box and a thermometer placed in the other. The piston valve segments, of cast-iron, are three in number, and steam is admitted behind the central or principal segment. The valves and pistons are lubricated with a six-way lubricator actuated by a force pump. Cast-iron or white metal packing rings are used. With the Stephenson valve gear employed, the reversed position required for giving inside admission to the piston valves is effected by the introduction of rocking levers. The piston valve chests are fitted with air suction valves having their orifices placed over cups on the running board to prevent the entrance of foreign matter.

In the first trials made with this form of superheater, two engines exactly alike in all other particulars except the superheater were employed. It was found that moderate superheating resulted in little or no economy, but that superheated temperatures of from 570 deg. Fahr. to 660 deg. Fahr. were essential to obtain the saving previously mentioned; of 12 to 13 per cent. in coal and 16 to 18 per cent. in water. How far the economy in coal will pay for the additional first cost of the apparatus and its upkeep in serviceable condition remains to be determined. The coal economy is equal to that obtained by compounding which itself costs greatly for maintenance. The heat thrown out of the stack by the exhaust is so great that double stacks have been provided to prevent burning of the metal, and consequently the heat waste is greater than with saturated steam. A desirable economy remains to be effected in extracting more of the heat from the exhaust steam before it leaves the cylinders.

The new Cockerill superheater shown in Fig. 1 has three reheating tubes in one fire tube instead of four as in the Schmidt system, and the three upper rows of the fire tubes are employed for this purpose. The collector boxes are differently placed, however. In the Cockerill device, the reheating tubes extend forward to the point of the smokebox where the collector is located. At the firebox end the fire tubes stop at a receiver box for the steam drawn from the regulator. A number of fittings are provided to enable the steam to be superheated both before and after it enters the high-pressure cylinders, and also to superheat the steam only after it has passed through the high-pressure cylinders, the object being to ascertain by trial which is the most economical method for compound engines before adopting a standard design for compounds.

To make the following explanation clear, reference is made to the diagram, Fig. 1, which shows the superheater as applied to one of the engines at the Exhibition. The throttle at B has three pistons permitting a duplex movement. It allows steam to pass by

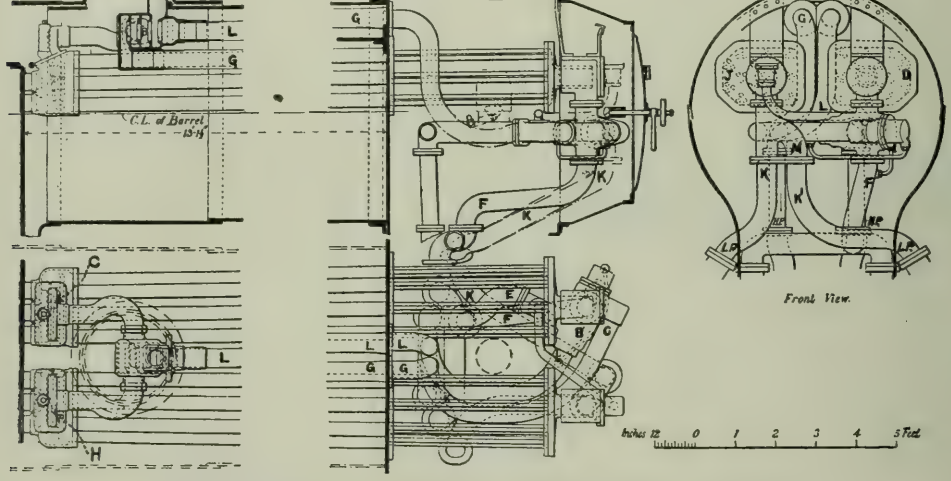


Fig. 1—Details of Cockerill Superheater as Applied to Belgian Locomotives.

the pipe L, direct to the high-pressure cylinders or by the pipes C into the superheater receivers at the firebox end of the large flues, the object of the two receivers being to divide the reheating tubes into two groups. The left-hand group reheats the steam in its passage to the high-pressure cylinders. The right-hand group reheats the steam passing from the high-pressure to the low-pressure cylinders. This steam is brought back to the rear end of the tubes by the pipe G, and passes forward through the right-hand group of reheating tubes into the front collector J, then to the pipe K and so into the low pressure valve chest. The steam pipes from the collector D to the high-pressure cylinders pass down through a valve B' and the pipe E into the valve chests. Valve B' is similar to the throttle valve B, and the movements of the two are connected so that the various changes in the direction of the movement of the steam are governed simultaneously at both ends of the reheating tubes.

When only the exhaust steam from the high-pressure cylinders is to be superheated, the throttle B admits boiler steam to the main dry pipe L from which it passes through valve B' and pipes E into the valve chests of the high-pressure cylinders. The exhaust from the high-pressure cylinders passes by the pipes F through the valve B' into the collector D, thence back to the firebox end through the left-hand group of reheating tubes and into the receiver on that side. It then passes up the pipe C, through the throttle B and enters the receiver of the right-hand group of tubes. From there it passes forward to the front receiver J, through the pipes K and into the low-pressure valve chests. With

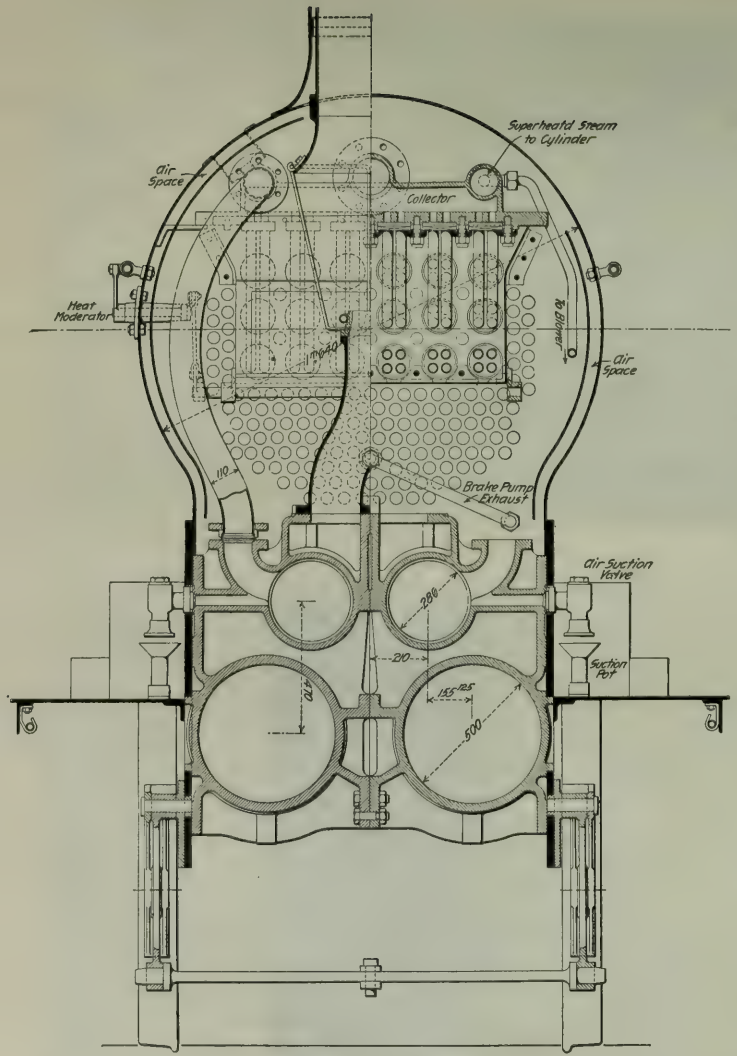


Fig. 2—Section Through Cylinders and Smoke Box of Belgian Locomotive Equipped with Latest Type of Schmidt Superheater.

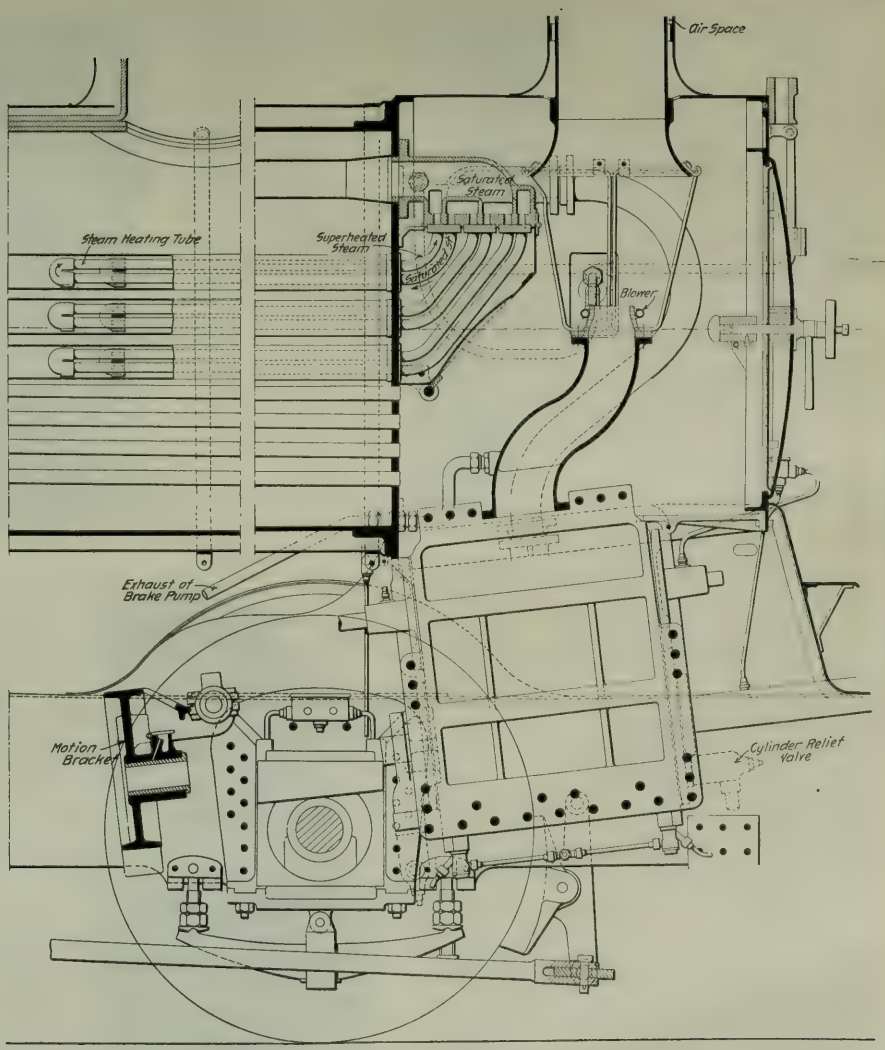


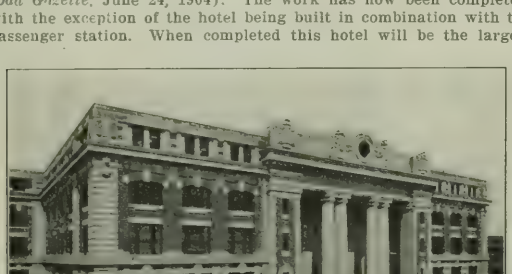
Fig. 3—Longitudinal Section Through Smoke Box of Belgian Locomotive Equipped with Latest Type of Schmidt Superheater.

saturated steam such a tortuous passage would result in excessive [illegible] with superheated steam this need not be taken into account. A number of accessory arrangements are indicated on the drawing, the object of which is to facilitate the movement of the steam through the apparatus, and they need not be described here. The following table gives some of the principal dimensions of the Belgian State Railway engines fitted with superheaters which form a part of the Exhibition:

Type	0-6-0	4-4-0	4-6-0
Simple or compound	Simple	Simple	Compound.
Service	Freight	Passenger.	Express Passengr.
Builder	St. Leonard	Hawthorn Leslie	Cockerill.
Cylinders, diameter	21.65 cm.	19.68 cm.	14.17 & 24.41 in.
Piston stroke	26.0 "	26.0 "	26.77 in.
Diameter of drivers	50.84 "	77.95 "	70.87 "
Boiler pressure		191 lbs.	228 lbs.
Heating surface, tubes		967.68 sq. ft.	1,696.40 sq. ft.
" firebox		131.34 "	196.98 "
" total		1,098.99 "	1,893.38 "
Grate area		21.6 "	32.29 "

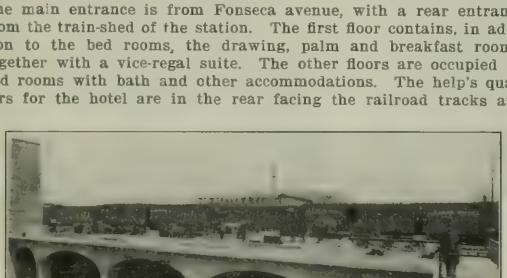
Canadian Pacific Improvements at Winnipeg.

The Canadian Pacific yard, shop and terminal improvements at Winnipeg, Man., were described in these columns a year ago. (*Railroad Gazette*, June 24, 1904). The work has now been completed, with the exception of the hotel being built in combination with the passenger station. When completed this hotel will be the largest



Main Entrance to Waiting Room, Winnipeg Station.

in Canada, with 315 guest chambers, 14 ft. x 16 ft., and 63 bedrooms for the staff. Of the 315 guest rooms, 175 have bath rooms attached, and can be divided off into suites. The hotel has a ground area of 236 ft. x 190 ft. and is eight stories high. The ground floor, which is finished with marble tile and carved wood, is occupied by a large rotunda and reception, dining and service facilities. The main entrance is from Fonseca avenue, with a rear entrance from the train-shed of the station. The first floor contains, in addition to the bed rooms, the drawing, palm and breakfast rooms, together with a vice-regal suite. The other floors are occupied by bed rooms with bath and other accommodations. The help's quarters for the hotel are in the rear facing the railroad tracks and



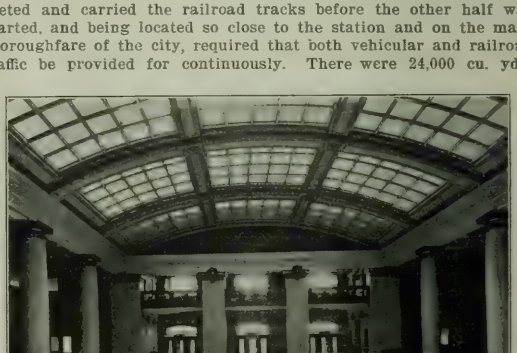
Main Street Subway and Viaduct.

are carried up two stories above the ground floor. The building is of fireproof construction throughout, the Roebling system of concrete floors being used with terra-cotta partitions and furring. On account of the character of the clay it was found necessary to build the hotel on a pile foundation, whereas this clay was considered sufficiently solid to carry the station building, which is only half the height. There are 1,500 piles in the hotel foundations. The total cost of the building will be about $750,000.

The hotel and station cover an area of 84,000 sq. ft., the station being 171 ft. x 136 ft. and the express and baggage rooms 54 ft. x 300 ft. The station is four stories high and is of steel and brick construction. The ground floor has a main waiting room 94 ft. x 102 ft., with a large vestibule and portico entrance, also a ladies' waiting room, 38 ft. x 43 ft., with retiring and lavatory accommodations. There are cafe, lunch and smoking rooms, and telegraph and telephone facilities. The basement under the express and baggage rooms contains storage rooms. The three upper stories of the building are divided up into offices, which are occupied by the general staff of the Western Lines. The building rests on concrete footings thoroughout and the foundation walls are of rubble masonry. The basement walls are furred with terra cotta and the exterior finish is of cut stone and pressed red brick laid in cement mortar. The station cost approximately $450,000. The contractors for it and the hotel were P. Lyall & Sons, Montreal.

The buildings are steam heated by the Webster system, supplied from a 800 h.p. battery of Babcock & Wilcox boilers. Electric light and power are supplied by four 75 h.p. simple engines and four compound-wound 75 k.w., direct-current, 250-volt generators. All wiring is run in iron conduits. Telephone connection and electric fire bells of the continuous ringing type are installed throughout. There are three direct-connected electric passenger elevators, two for the hotel and one for the station. There is also an electric baggage hoist for the hotel and hydraulic elevators in the baggage, express and boiler rooms.

The Main street subway was described and illustrated in detail in the previous article. A view of the finished viaduct is shown herewith. It is a reinforced-concrete groined-arch structure 100 ft. wide east and west over sidewalks, 140 ft. north to south, and carries eight tracks. There are three main elliptical arches over the roadways and two semi-circular arches over the sidewalks carried on four rows of reinforced concrete columns and two abutments. The central span is occupied by street railway tracks, the other two large spans being used as driveways. The street has a grade of 1 in 20 and is paved with cedar blocks. The sidewalks and retaining walls are of concrete. One-half of this structure was completed and carried the railroad tracks before the other half was started, and being located so close to the station and on the main thoroughfare of the city, required that both vehicular and railroad traffic be provided for continuously. There were 24,000 cu. yds.



General Waiting Room, C. P. R., Winnipeg Station.

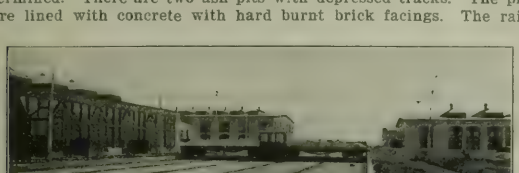
of excavation, and 16,000 ft. of piling to support the 4,900 cu. yds. of concrete. The structure is reinforced with 315 tons of structural steel and steel rails. There are a number of skylights to light the subway, as well as electric lights for night use. The cost was approximately $190,000. Deeks & Deeks, Chicago, were the contractors.

The freight sheds and roundhouse were described and illustrated in the former article, which also gave a plan of the entire yard with all improvements located. Before the improvements were undertaken the yards had 48 miles of track. They now contain 109 miles, an enlargement of 61 miles, which included a complete rearrangement. In addition to their size, these yards are said to be remarkable for the excellence of their construction and the neat, clean condition in which they are kept. The driveways at the freight sheds and team tracks have been paved with asphalt on a concrete foundation, which is in marked contrast with the recently abandoned team tracks which were approached during the wet season through mud axle deep. The stock yards are long enough to load and unload a 30-car train without spotting. These yards are floored with 3-in. plank and fully 25 per cent. of their area is under roof. The passenger coach yard contains 10 tracks, each of which is equipped with water, steam, air and gas. These tracks are placed 20 ft. centers so that cars may be washed and cleaned at any point in the yard. In the center of the yard is a

thawing-out house having capacity for four coaches. An acetylene gas plant, 30 ft. x 90 ft., is located close by, adjoining which are the passenger car repair shops and car cleaners' quarters.

At the passenger station there are three stub tracks on each side of the midway and four through tracks, all of which are arranged in pairs with 12-ft. platforms between each pair of tracks. The umbrella sheds which protect these platforms are connected to the concourse roof. All platforms are of concrete at rail level.

There are two modern coaling stations of the McHenry type, one for switching engines and the other for road engines. Each has four 25-ton pockets and a storage capacity underneath of 200 tons. Each pocket is provided with a dynamometer weighing device to enable the quantity of coal landed on each tender to be determined. There are two ash pits with depressed tracks. The pits are lined with concrete with hard burnt brick facings. The rails

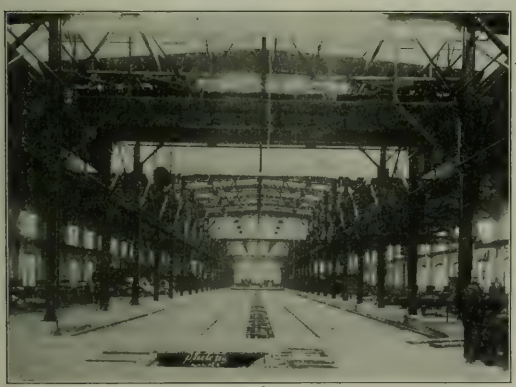


Canadian Pacific Shops at Winnipeg.

on the pit side are supported on cast-iron columns to permit the ashes being shoveled from the pit direct into the cars.

The water is supplied by the company's own pumping at Red river, about two miles distant. A 50,000-gal. water tank acts as a reservoir from which supply pipes lead to the water columns and to hydrants between alternate stalls in the engine house. The piping system in the engine house is quite complete, providing for hot and cold water and steam and air. The steam pipes connect with the domes of locomotives in each stall, the steam from which can be used in the Sturtevant heater, for heating water for washout purposes, or can be transferred to the boiler of any other locomotive in the building. The engine house also contains a water-changing plant, and the turntable has lately been equipped with an air motor.

The new shops west of the main yard are in operation. They comprise a locomotive shop, 165 ft. x 794 ft.; blacksmith shop, 102 ft. x 217 ft.; foundry, 92 ft. x 122 ft.; pattern shop, 25 ft. x 104 ft.; passenger car shop, 100 ft. x 241 ft.; dry kiln, 42 ft. x 86 ft.; planing mill, 102 ft. x 217 ft.; freight car shop, 102 ft. x 313 ft.; oil



Interior of Shop, Showing Fixed 100-Ton Crane and Transfer Table.

house, 40 ft. x 80 ft.; power house, 100 ft. x 100 ft.; and a general store and office building.

The boiler and engine rooms of the power station are each 48 ft. x 124 ft. There are five 250 h.p. Babcock & Wilcox boilers with a working pressure of 125 lbs. Soft coal generally is used, although the shavings from the planing mill are fed by an exhaust system to the boilers. The boilers are equipped with a Sturtevant induced draft system and Green economizers. The ashes are conveyed by small cars on a 22-in. gage track through a tunnel under the boiler room and hoisted by jib crane to a cinder car outside of the power station. The engine room contains two Rice & Sergeant 900 h.p. cross-compound, non-condensing engines, direct-connected to 600 k.w., three-phase, 600-volt a. c. generators, built by the Canadian General Electric Company. There is also a duplex compound air compressor delivering 1,700 cu. ft. of free air per minute, built by the Canada Rand Drill Company. Other equipment includes two 1,000-gal. Underwriters' fire pumps, two duplex water pumps and two boiler feed pumps, built by the Canada Foundry Company.

An unusual arrangement is found in the locomotive shop, a 50-ft. transfer table being installed in the middle of same as shown by the accompanying illustration. The wheeling and unwheeling of locomotives is done by a stationary 100-ton electric crane, which consists of two 50-ton trolleys on a runway formed of two girders fastened to the frame of the building in a fixed position directly over the transfer table pit. The engine is brought into position by the transfer table and is lifted off of its wheels by this hoist. The wheels are then taken away and shop trucks placed beneath the locomotive, which is then lowered and removed to an erecting pit. There are 30 erecting pits, and the remainder of the building forms the machine shop.

All of the shop buildings have concrete foundations, with brick walls laid in cement mortar, steel posts and trusses and slow-burning mill construction roofs. These roofs consist of 3-in. plank supported every 8 ft. and are covered with four-ply tar and gravel roofing. Each building is equipped with lockers, lavatories and Sturtevant heater fan rooms. The skylights throughout the buildings occupy fully 25 per cent. of the total roof area. The total cost of the shops was about $585,000.

Rapid Transit in Great Cities.*

One of the outcomes of modern civilization has been to collect populations into large centers, and with such segregation there has arisen a series of problems of which our forefathers took no heed at all or at most but little thought. A large city entails the supply of its people with light, heat, power, food, water, drainage, housing, pavements, and means of intercommunication. All of these problems, except the last, increase in difficulty and importance, substantially in direct ratio to the size of population. With transportation, however, the increase is as the square or even as the cube. Double the size of a city and you have not only twice as many people to carry, but you must carry them twice as far; and as the minute and not the yard is usually the proper unit of distance, doubling the distance means a doubling of speed. In New York, with its population of three and three-quarters millions, there are being carried now on the surface, elevated and subway systems paying passengers, exclusive of so-called transfers, 1,200,000,000 per annum, a number very much greater than the number of passengers on all the steam railroads of both the American Continents from the Atlantic to the Pacific, and from that most northern of all railroads, the Wild Goose Railway† near Nome, Alaska, within the Arctic Circle, to the most southern one in South America, the State Trunk Line of Chili. London with its population of over six millions, but with inferior intra-urban railway facilities, carries about the same number as New York; while Paris, Berlin, Hamburg, Boston, Chicago and St. Louis are fast following in the leaders' tracks. Such figures need no further comment or explanation to indicate the dimensions of the problems of transit in great cities, and the difficulty of properly meeting the continual demand for increase in facilities as cities grow.

The subject of the discourse and available time limit our consideration to *rapid* transit. We therefore pass by that other phase of urban transportation represented by the surface car. The present electric trolley car is a development of and evolution from the old omnibus, through the horse car, cable car, overhead trolley to the conduit trolley car to be found in New York, Washington and some foreign cities. Great as is the function of the surface cars as a means of short-distance local distribution, they cannot, by their very nature, be a factor in *rapid* transit. The frequent stops, and delays by other traffic in congested streets, necessitate a low average speed. To secure high speed the roadbed must be free from interference by other vehicles, and this requires that it must be elevated above the surface or be placed beneath it.

The elevated railroad is essentially an American design, having been suggested first by Colonel Stevens, of Hoboken, N. J., as early as 1830, only five years after the first steam passenger line was opened in England, and two years after a similar event occurred in America. It was not, however, for 40 years that the suggestion was given practical application, and then to avoid in New York the difficulties experienced in London of working an underground line by steam locomotives. This form of construction was extended in New York, or what is now the boroughs of Manhattan and the Bronx of that city, during the following ten years, resulting in the present elevated system, with a length of 38 miles of route. With the engineering details of elevated railroads every one is so well

*From an address delivered at Purdue University, by William Barclay Parsons, C. E.

†The Wild Goose line is the most northern railroad on the American Continent, but it terminates nearly 100 miles south of the Arctic Circle. The most northern railroad in the world runs from Lulea, at the head of the Gulf of Bothnia, in Sweden, to Narvik, or Victoriahavn, Norway, behind the Lofoten Islands, 135 miles north of the Arctic Circle.—[EDITOR.

acquainted that I will not take more of my limited time to refer to them here. This form of railroad, based on New York experience, has been reproduced in Brooklyn (now a borough of New York), in Boston and Chicago in our own country, and in Europe, in Liverpool, Berlin and Paris; although in the two last places the elevated lines are but super-surface portions of sub-surface railroads. When first built in New York, they were constructed on the general legal theory that as the courts had held that surface railways were a legitimate use of public streets without incurring damage to abutting property owners, so elevated railroads were but another form of surface railway and could claim the same immunity. After a long legal battle the converse of this proposition was finally established, and it was held that such railroads interfere with the so-called easements of light, air and access to abutting property, and therefore cause a damage. In streets already built up, and where no great corresponding benefit can be shown, such railroads have to pay large sums for land damage, sufficiently large in a city like New York to almost, if not quite, equal the difference in construction cost between the less expensive elevated and more expensive subway, which latter does not injuriously affect property.

The various elevated railroads above referred to are all of the type familiar to you. There is, however, another type for which its advocates claim special advantages, a specimen line having been constructed in Germany running through the contiguous cities of Barmen and Elberfeld. This railroad is a double line with a single rail for each track. The cars, instead of having their trucks beneath, have them on top, and are thus suspended from the single rail. Each truck consists of two wheels, the car riding therefore on four wheels, any of which can be made motor wheels according to power required.

We will now take up the other form of rapid transit railroad, the one beneath the surface. The first line of this character to be constructed was in London in 1865, but there the results of operating by steam locomotives were so disagreeable that no other similar move was made until another kind of motive power was possible. The next contemplated power was the cable, and the line built to receive it was the City & South London, the first of the so-called "tubes." But before it was completed in 1894, the practical feasibility of electricity as power on a large scale for transportation purposes had been amply demonstrated, so that an electrical and not a cable plant was installed. The attending success showed that it had become possible to use, with comfort and cleanliness, the great sub surface for transit purposes, a space hitherto considered of value only as a place wherein to bury sewers, water and gas mains in haphazard and disordered confusion. It is especially this use of the ground beneath our streets to which I desire particularly to direct attention.

As stated above, the first, and for 30 years the only, sub-surface underground railroad for local transit purposes was the combination of railroads in London known as the Metropolitan and District railways. To an engineer engaged in similar problems this first line is exceedingly valuable as a lesson or lessons of what not to do. The first lesson is the use of steam locomotives, filling the tunnel with smoke and noxious gases, though such use was then unavoidable as there was no other means at hand. Efforts were made to diminish the nuisance by condensing the exhaust, burning coke instead of coal, and a liberal use of ventilating shafts opening into back yards or streets, but without much success. At present an electrical plant is being installed* which will completely banish steam locomotives. The second lesson is the choice of building material, but for this the constructors were again in no way to blame. At that time steel, as we have it now, was unknown, and wrought-iron was too expensive for general use. The roof and walls were therefore made of masonry, usually brick work, and the roof given the regular arch form as common with tunnels. This resulted in depressing the rail level several feet, with corresponding extra cost and with an unnecessarily great distance to platform level. Occasionally at critical points a flat roof was resorted to, using cross-girders of cast iron. This work was, however, heavy and cumbersome. The third lesson is a mistake based on an error of judgment, and well illustrates a fundamental principle involved in the location of all rapid transit lines. The first idea in projecting the railroad was to connect by a sort of belt line several of the important railroad termini, whence the line was extended to encircle the business and commercial district of London. It was argued that, by giving a circular location it would be possible to reach or closely approach more of the important points than would be possible by any direct line. The result was one of those unfortunate compromises that pleases nobody. People do not want to be taken near a great number of points; they want to be taken directly to all if they can, if not, then to a few. The residents of London soon found that the existing means of slow communication by omnibus following direct lines of travel, going usually from point of origin to that of destination, gave better results than by a railroad underground with higher speed, but on a longer route and with usually a long walk at both ends. This fallacy of circuitous location is one that still finds adherents among the optimistic non-reasoning class to whom a compromise always appeals, and therefore is a fallacy that you may be called upon to meet.

*Now in operation.—(Editor.)

While this first underground railroad system has never been a great financial success, some business, after 40 years, has developed along the route, and it is hoped that the application of electricity, with higher speed and greater comfort, may give a more satisfactory return.

The construction of the City & South London, with its electric installation, established a new order of things in two ways. First, it showed the feasibility of the new form of power application. Second, it showed the feasibility of tube construction. From this success a rapid development of underground construction began, and railroads of this character have since been built in Buda Pesth, Paris, Berlin and Glasgow in Europe, and in Boston and New York, with one now building in Philadelphia. Constructively speaking, these railroads are of two quite different types, the very deep, and the very shallow. The former is represented by the tubular construction. Although this form of construction was first put to a practical completion in England, it is really of American origin, a short sample line having been constructed some 40 years ago in New York by Mr. A. E. Beach, which sample still exists. In England it was developed by the late Mr. Greathead, in the City of South London, and afterwards by other engineers on three other lines, with two more now building.

These tubes have an internal diameter varying from 10 ft. 2 in. to 16 ft., according to the type of equipment it is proposed to employ. They are lined with cast iron plates, flanged on the inside. The thickness of the shell varies from 1 to 2 in., and the depth of the flanges from back to front from 4 to 8 in. The length of each ring of plates is about 1½ to 2 ft. In construction the rings of plates are put in place by the aid of a shield. These shields are cylinders of riveted steel plates, with an internal diameter very slightly in excess of the external diameter of the tube, and with a length of about 12 ft. About midway is a diaphragm of plates, with a horizontal platform in front, and with iron doors. The shield in front of this diaphragm is called the cutting edge and that behind, the hood. If the ground is firm like clay, partial excavation in front of the shield is made by hand, and then the shield is shoved forward by hydraulic jacks pushing against the completed tube and cutting the excavation exactly round. The jacks advance the shield the length of one ring. As the tail of the shield reaches back at least three rings, the cast-iron plates are put in place, bolted to each other and to the preceding ring through holes in the longitudinal and circumferential flanges, and then the operation is again repeated. The annular space outside of the tube left by the forward passage of the shield is at once filled with cement grout pumped from within.

If the material through which the tunnel is driven is not good, such as clay, but is sand or silt under water pressure, the operation remains substantially the same, except that an air lock is built within the tube and the space between it and the shield filled with compressed air to balance the external hydrostatic pressure. If the material be very soft, the doors in the diaphragm are partly or alternately closed; while if it is inclined to be fluid, like mud, all doors are tightly closed, and the shield, as a whole, shoved forward through it, the mud flowing to the sides. This last feat has been accomplished in the Hudson river tunnel at New York, now building.

The stations in tube railroads are constructed in a manner quite analogous to the tube itself, except that they have a diameter great enough to accommodate one track with a platform. The cars nearly fill the whole tube, for, of course, each tube contains but one track, and so act like a loose piston expelling the air in front, and drawing in other air behind. This action was expected to effectively ventilate the tubes, as it was believed that the expelled air would pass upward through the station entrance to the street. Tubular construction has the advantage of permitting construction to be carried on without disturbing the surface, and at a depth to avoid all interference with sewers and house foundations or other sub surface structures. The advantages are, however, offset by the great expense in construction of the iron lining and the large stations with their shafts, the cost of installing elevators and the expense of running them, and the failure of the ventilating system. This latter is due to the desire to avoid duplications of elevator service, so that the station tubes are cross-connected, both stations leading to the same elevator shafts. As these shafts are filled with the elevators, the air expelled by the trains finds the line of least resistance into the adjoining tube rather than upward, where it is drawn back again by the suction action of trains in the parallel tube. For these reasons other cities, except Glasgow in one instance, have adopted the shallow type.

This type had its first actual application in the subway at Buda Pesth, Hungary, where the walls were made of masonry in the usual manner, but the roof consisted of cross steel beams with concrete arches between them. Such construction permits the roof to come close to the surface and the cars to approach the roof with the minimum of clearance, thus decreasing excavation and the dis-

tance from the line of the street to that of the station platforms, and, in short, avoids many of the defects in the design of the original London underground lines.

The Buda Pesth design has become the prototype of the subsurface lines in Berlin, Paris, Boston, New York and Philadelphia. In Boston and New York the first work done carried the principle of the use of steel beams one step further by placing them in the side walls as well as in the roof, and in New York they were introduced in the floor whenever there was an upward hydrostatic pressure, thus avoiding the use of heavy masonry to resist pressure by mere mass. Instead, such pressures are taken up by the steel beams, the thin masonry arches between them acting only to distribute pressure. A flat roof with steel beams on a two-track railway has a total thickness of about 2 ft., including clearance above the tops of the cars, while an arch of even flat section requires 5 ft., thus effecting a saving of at least 3 ft. in depth to rail level and of excavation, while there is a similar saving in each side wall of at least 2 ft., or 4 ft. in total width.

This use of beams was found to work so well that in the New York subway the principle of reinforced concrete was applied, and the beams in roof, walls and floor gave place to steel rods spaced 4 to 8 in., center to center, and next to the surface where tension is to be expected. Except in cases where concentrated loads, such as elevated railroad columns, are encountered, or heavy existing surface traffic has to be supported on newly erected structures, such design has been found in practice to result in work more economical in cost and more rapid in erection.

We therefore see that, generally speaking, the modern underground railroad of most approved type is either one that is very deep, entirely out of the way of other structures, when it is best built as an iron-lined tube, or else one brought as close to the surface as possible, in which the roof, walls and floor are a combination of steel and concrete, the former as either beams or rods, but in either case subject to exact mathematical analysis to determine shapes and sizes.

This rule must, however, be accepted as generalization. There will be found in all great works of this character times and places where for some reason it will be best to depart from the adopted type, and to revert even to the early form of tunnel, that with a masonry lined arch and invert. This has been done in Paris, Boston and New York.

So much for construction details, on which subject I have dwelt longer on subway rather than elevated design as offering more novelty and embracing a greater variety of details. In the matter of operation, substantially the same general principles apply to all rapid transit railroads, where the problem is how to move the greatest number of people over a given distance with the minimum of expense. Unless the mono-rail systems possess sufficient advantages to overcome their disadvantages and compel their adoption, nothing better has yet appeared than the ordinary railroad track of standard gage. This track should be of the heaviest type regardless of the light rolling stock, especially if high speed is to be attempted. Curves should be carefully spiralled, and super-elevation given, not according to a fixed rule, but varying with each curve and adapted to the speed that trains will make at that particular point. With cars you will find a field wide open for fertility in design, and where there is a contest between advocates of end doors versus side doors. Except for the all-metal cars recently introduced in the New York subway to eliminate fire risk, there is not much of striking novelty advanced, and nothing that has any great bearing on economy of operation except the facility to unload and load passengers. Every second's delay at a station repeated by every train, say, four times per mile, and at train intervals of one minute, means an increase in the number of trains required to maintain a given service. In spite of many manifest advantages of side doors, the tendency of practice is towards the type of American car with end doors, such cars having been adopted on the several lines in London and on the recently constructed combined subway and elevated in Berlin.

In the matter of motive power, the greatest advance has been made, and there probably remains the greatest possibility for future improvement. The steam locomotive, quite apart from the objectionable features of smoke, has already been permanently relegated to the scrap heap. For the moment, electricity is the only form of power that satisfies the requirements of the problem, and it will so continue until disturbed by some other. In order to maintain speed with frequent stops, the motors must have a high power of acceleration. In this respect the steam locomotive is sadly deficient. The best rate that the engines on the New York elevated could reach on loaded trains was .6 miles per hour per second, while the electric motors can give in actual practice 1.5 miles per hour per second. That is, in the first case 20 seconds were required to develop a speed of 12 miles, while only eight suffice in the latter case. Furthermore, the elevated motors can be distributed throughout the train and so avoid heavy concentration. On an express train of eight cars in the New York subway there are five motor cars, with two axles each, equipped with 200 h.p. motors, so that the total power per train is 2,000 h.p. This is the nominal rating, but the actual power, during a possible period of overload when accelerating, is at least 25 per cent. greater. To equal this in steam locomotive practice would call for two locomotives of the heaviest passenger type. These motors thus distributed through the train are, of course, under simultaneous control by the motorman at the head of the train, or in case of emergency at any other point.

Power for these motors is produced in large central plants. The largest of such plants as yet constructed is that of the New York subway, where the main units have an output capacity of 10,000 h.p., and where the total capacity of the whole plant, including subsidiary engines, is 135,000 h.p. The current as produced is of the alternating variety, and is generated at a pressure of 11,000 volts. As such it is carried to nine sub stations, averaging about two and one-half miles apart, where it is transformed to direct current and reduced in voltage to about 600 and thus fed to the line. The total weight of copper in the transmission cables on 21 miles of road in operation is over 6,500 tons, which would have been much increased if direct current alone had been used, and could have been reduced if alternating current could have been used throughout. The advance in design of the structural parts of elevated railroads or of subways with reinforced concrete walls has substantially exhausted any great possibilities in economy of design. This, however, is not true in respect to power and its application. The cost of power per car mile by steam operation on the New York Elevated was 12.18 cents; by electricity, under methods employed to-day, it is 9.47 cents, a reduction of nearly 20 per cent., while at the same time the average speed through quicker acceleration has been raised from 13 to 15 miles per hour. It is possible that, by means of higher steam pressure, turbines in place of reciprocating engines, higher voltage for transmission, the use of alternating current motors working at 3,000 volts, this cost can be still further reduced without imagining any radical departure from existing standards in practice.

In regard to operation, all but one of the rapid transit systems so far built are an extension of the principles of the surface service, that is, cars in units or in trains stopping at all stations. In New York, partially on the elevated lines, but more particularly in the new subway, the principle has been established in differentiating between the short and long distance traveler, and in giving to the latter a special train service on separate tracks, stopping at stations about one and one-half miles apart instead of one-quarter mile. This marks to date the maximum development in rapid transit facilities, a development, however, that will probably soon be repeated elsewhere, and will eventually be exceeded in New York by an express service with even higher speed, that is, with fewer stops.

Let us now turn from the engineering consideration of the question and briefly take up the legal aspect. The first established lines of transit were the omnibuses, which differed so little from other vehicles that their use of the public highway without special charge or tax was considered an obviously proper use. When the omnibus gave way to the horse car, it was held that such use was still proper, as the horse car was but an omnibus running on fixed lines, and the right to use public streets without payment was granted by the public authorities to street railway corporations. To-day, in practically every city in the United States, we find electric cars, the successors in turn of the horse cars and of their privileges, using public streets without franchise payment or at most with small ones. Such a result was not foreseen when omnibuses were first started. Now our economists are agitating a reversal of policy and demanding either that a proper payment shall be made for the right-of-way or that the title shall remain in the municipality, and that the right to run shall not be under a fixed grant but under a lease.

The modern rapid transit railroad is an exceedingly costly structure. The tubular railroads for two tracks, including stations and equipment, are costing in London about £800,000, say $4,000,000 per mile. Portions of the New York subway, with four tracks but exclusive of equipment, cost $5,000,000 per mile, and the total cost of the structure for 24 miles, of which six miles are elevated and therefore comparatively much less expensive than the subway, cost $2,000,000 per mile, and the equipment will add $750,000 per mile in addition. A large modern urban railroad represents, therefore, a great aggregation of capital and the forming of a corporation with necessarily great power, both financial, social and political. In this respect some people see such danger that they are demanding that all such railroads should belong to the municipality in which they are located and be operated by it. In England, where this movement has progressed further than here, many of the surface railways have been bought by the public authorities. As to the success of the movement there are widely different opinions. The experiment has not reached a definite conclusion. While awaiting the outcome no municipality has as yet undertaken to own and operate a rapid transit railway, although such ownership, without operation, has been retained in three cases.

The existing lines maintain their corporate existence in two ways, either by proprietary right, or by lease from the municipality. As examples of the former, are the London railways and the elevated roads in New York, where special privileges have been con-

ferred by law on the corporations, and they own, in their own right, the lines they have built. As examples of the latter, are the railways in Paris, Boston and New York. In each of these cases the subways were built by the city itself, out of public funds, and then leased to a private company to be operated by it. In Paris the railroads are now built by the city at its own cost and by its selected contractors, and then turned over, as each piece is completed, to the same lessor company to be operated by it, the company paying to the city of Paris one-third of the gross receipts as rental. If this sum exceeds the interest on the cost, the city of Paris is the gainer, otherwise a loser. The authorities therefore see to it that the work is economically conducted to keep down the interest charges, and that routes are selected which will return heavy traffic receipts. So far the results have shown a profit to the city of Paris.

In Boston the system of subways was constructed admittedly to accommodate the cars and trains of the company owning the surface and elevated lines. After the work of construction was completed, under the direction of an honest and capable board, it was leased to the railroad company at a rental of 4½ per cent. on the actual cost. As Boston can borrow money at a considerably lower rate, this return is sufficient to repay interest and allow for depreciation and a small profit, besides developing the city.

In New York the law provides that a contract shall be offered to public bidding, and that the contractor shall be paid by the city the amount bid by him for construction, and that he shall then operate the railroad for a period of years, paying as rental such interest on the cost as the city pays, and in addition 1 per cent. as a sinking fund. Although differing in details, the plans of Paris, Boston and New York have in common the general principle of ownership by the municipality, and thereby the retaining of control of the public streets. The terms fixed by these three cities are moderate, being at most little more than interest on cost, and as such tend to invite capital to embark in the building of these railroads. Such development is the prime object, and not municipal profit. In following the examples already set, other communities will do well to pattern closely and not impose burdens that will hinder rather than assist.

In studying the problem for the building of a new line or the reconstruction or extension of an old one, the engineer should be sure he understands all phases of the question. While it is his business to supply the public with the facilities that the public desire, and not what he thinks they should desire, nevertheless he must be sure that there is sound and permanent logic in public demand. The traffic routes should be analyzed to determine the trend of travel and reasons for it. Frequently arguments are advanced that railroads should not be built along congested streets, because they tend to increase congestion, but instead they should be built along other and less frequented streets so as to draw travel away from the congested routes. Travel is usually concentrated along certain routes for well-established reasons, and frequently in spite of lack of transportation facilities. In this case it is idle to talk of drawing travel away. People that have become set in certain ways are hard to change, and a line built off a line of travel is of little public benefit and is doomed to failure or to a long wait for business to originate before attaining success.

People also wish to be carried quickly. As our cities grow and distances increase, this question of speed becomes more and more important, as people measure the distance by minutes occupied in travel. Railroads for rapid transit should, therefore, so far as possible, be on straight lines, and if one straight line cannot reach all the desired points, then other railroads must be built as soon as business warrants. The mistake should not be made of sacrificing the best individual results in the attempt to partially satisfy many. These were the errors in the location of the first underground railroads in London, where the attempt was made to avoid congested routes and give a circuitous location.

The general type of the railroad to be built will also require careful consideration, whether elevated or subway, whether shallow or deep. Here one must be careful not to draw hasty conclusions that, because a certain type or method of construction has succeeded in one place, it will succeed equally elsewhere. This mistake was made in Brooklyn and Chicago after the initial success of the elevated railroad in New York. Then when once a type and general design have been adopted as best suited for the locality under consideration, the engineer must be on his guard not to be so closely wedded to his design as to fail to recognize when to vary it or even when to depart entirely. The New York subway is called an example of shallow construction, that is, as close to the surface of the street as possible, and so it is, for such was the motive of the design to be followed as much as practicable. Yet of the 24.7 miles of which it is composed 5.7 miles are elevated, 1.4 miles are in iron-lined tubes, 3.4 miles in deep tunnel, 1.2 miles in arched construction, and only 13.0 miles, or but little more than one-half of the whole, are of typical shallow construction, with a flat roof of steel and concrete construction. These changes were made for local topographical reasons, whereby better operating results were obtained.

In laying out rapid transit lines, it is found that people will not walk far to reach even a superior means of transportation, but are inclined to take the first at hand. For this reason one such road will not serve a very wide belt of territory, and the danger of disadvantageous parallel competition does not exist in anything like the same degree as with ordinary railroads operating in the same territory. New facilities of this character create their own traffic. The chief question arising is whether any particular route possesses in itself sufficient possibilities to justify the expensive construction. As parallel competition is not to be much feared, so new lines, even of an opposition corporation, should always be so constructed as to be capable of physical connection to permit through running. The whole tendency of American experience is towards consolidation of a city's transit lines. Our friends, the newspaper editors, and some of our other friends engaged in political strife, at times write and talk bitterly of local transportation monopoly. As a matter of fact, the public are better served when all lines are thus gathered together as a monopoly, and thus give the people the benefit of through running or of transfer.

In this respect the city of Paris has set a wise precedent, in creating a single private corporation to which are to be awarded all the rapid transit lines as fast as built. The municipal authorities there have thus boldly prevented any so-called competition, and have even organized a private monopoly. On the other hand, they have secured the certainty of operation of lines which, independent, would not pay to operate, thus affording means of rapid travel to all parts of the city, and have secured for the inhabitants the privilege of making any journey in any direction of even the greatest distance for a single fare.

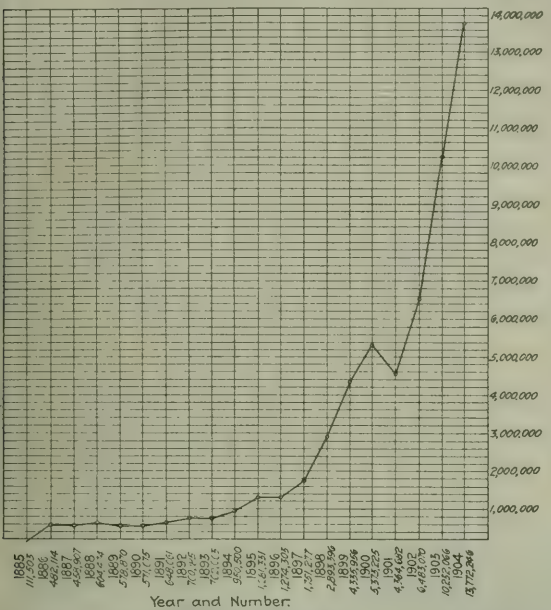
London, on the other hand, is an illustration of the opposite plan. Of the six tube railroads now built or building, there are five different sizes calling for entirely different standards of equipment; so that, if ever these lines should come together under a single management, uniformity of management and physical connection are out of the question. Even with the surface lines, some of which are owned and operated by the London County Council, and others by private corporations, antagonism is so great that physical connections are prohibited, and necessary extensions of private lines prevented, thus making passengers change cars and actually depriving the public of much needed facilities. In these two great cities we see, on one hand, monopoly working smoothly for its own advantage and the public benefit, and on the other, competition existing to the point of general injury, public as well as private. So acute have become the London conditions that the British Government has had in existence for two years, a Royal Commission studying the problem, with a view of proposing some remedial measures.

In judging of the value of traffic routes, two chief considerations must be kept in mind. First, mere density of population does not of itself signify great traffic returns. A certain portion of the population of great cities, and usually that which is densest, is not migratory, but being clustered around its work has little cause to go to other parts of the city. On the other hand, there are neighborhoods where the population is much more sparse, but where the residents leave their homes for business, shopping, visiting, school and entertainment. One must differentiate therefore between traveling and stationary population. This is well illustrated in New York, where one of the elevated lines traverses the celebrated tenement house district, where more people live per acre than in any other city of the world. The traffic returns are very low. Other portions of the line traversing districts where the population is not one-tenth of the former show receipts several-fold greater. Second, special points of occasional crowding are not so productive of traffic as they would seem to be. Recreation grounds and parks used occasionally or on certain days or seasons are illustrations, and even terminal stations of great railroads. To again quote from New York experience, when it is remembered that the Manhattan Elevated and Subway systems alone, on but a little over 50 miles of road, carry two-thirds as many passengers as do the steam railroads of the United States on over 200,000 miles, it needs no demonstration to show that the number of passengers interchanged with the Grand Central Station, the terminus not only of the New York Central system, but of the New England railroads as well, does not constitute a large percentage. Even in London, where the facilities are inferior to an American city, the Board of Engineers in their report advising the Royal Commission above referred to, show that one trolley terminus where the lines, through opposition, are compelled to stop short of ultimate destination, discharges and receives more passengers than are similarly handled at six large railroad passenger stations combined. A street passing through a commercial or shopping district, with places of entertainment in the neighborhood, is a much more desirable district to reach from the point of financial return, and more necessary from the point of view of public convenience, than the greatest railroad terminus or most popular ball ground.

Contracts for locomotives to be delivered in South America and Asia, to the amount of about $3,000,000, have been let recently, chiefly to German and Belgian works, so a Berlin newspaper reports. The German works are said now to have orders which will keep them busy for several months.

Treated Tie Data from the Santa Fe.

Mr. E. O. Faulkner, Manager Tie and Timber Department, Atchison, Topeka & Santa Fe, has prepared the accompanying diagrams, which present in graphic form information relative to treated ties. The first of these (Fig. 1) shows the number of treated ties laid in all of the railroads of the United States from 1885 to



Year and Number.

Fig. 1—Number of Treated Ties Laid Each Year by Railroads of the United States.

1904 inclusive. The ordinates represent amounts, increasing by 200,000, and the abscissae years, the number laid each year also being given under the year. The rapid increase beginning with 1897, the slight falling off in 1901 and the enormous and steady increase since that time are the notable features of the diagram.

The next two diagrams are Santa Fe records, the first (Fig. 2)

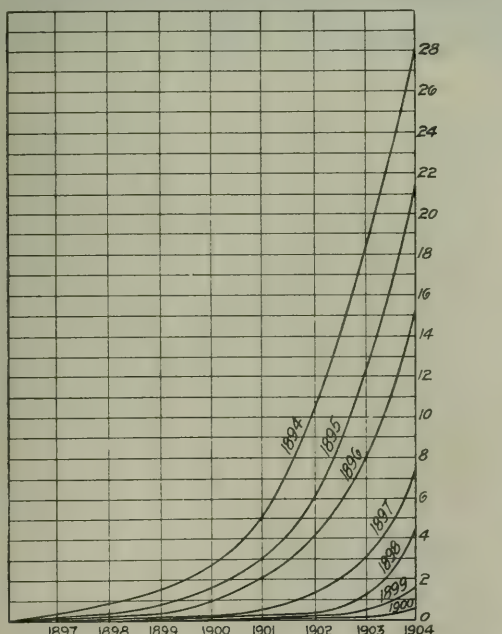
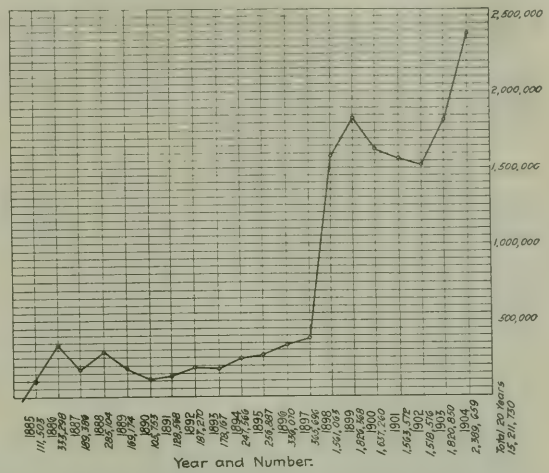


Fig. 3—Percentage of Treated Ties Removed on the Santa Fe, East of Albuquerque, N. Mex.

showing the number of ties inserted in track on the entire system from 1885 to 1904 inclusive. This diagram is similar in general form to Fig. 1. The greatest percentage of increase, however, was in 1898, although the greatest actual increase was in 1904. The total for the 20 years is 15,211,730.

The third diagram represents the percentage of treated ties removed on the divisions east of Albuquerque, N. Mex., 1897 to 1904 inclusive. The dates on the curves represent the year in which the ties were laid, the dates at the bottom the year removed on account of decay, and the ordinates represent percentages of removal.

The department has also issued a circular to show standard



Year and Number.

Fig. 2—Treated Ties Laid on the Santa Fe.

forms for piling ties, and piling poles in yards and on the right-of-way, before and after treatment, with the approved method of roof building to shed water. There are nine figures on the circular illustrating respectively a triangular pile, open crib pile (four ties each way), an 8 by 1 and an 8 by 2 pile (though the first figure may be made any convenient number), edged pile (the outside ties in each course being laid in edge), solid pile roofed, and a solid pile without roof (for cypress ties only). The two remaining figures show method for piling and poles, the butts and tops to be reversed in each course; and the proper way to lay sawed ties or timber, the year rings all pointing downwards. The following instructions are printed on the circular:

1. Ties must be piled in accordance with pile numbers best suited to local conditions.

2. Ground supports of sound stuff, giving less than 6 in. clear

Santa Fe.
Standard Forms for Piling Ties, Piling and Poles in Yards, and on the Right-of-Way, Before and After Treatment, with the Approved Method of Roof Building to Shed Water.
No. 1
Triangular Pile.
No. 2
Open Crib Pile (4x4).
No. 3
by 1 Pile.
No. 4
by 2 Pile.
No. 5
Edged Pile by
(Outside Ties in Each Course Laid on Edge.)
No. 6
Solid Pile by
No. 7
Solid Pile
For Cypress Ties Only.)
No. 8
Piling and Poles.
(Reverse Butts and Tops in Each Course.)
No. 9
Proper Way to Lay Sawed Ties or Timber.
(Note the Year Rings all Point Downwards.)

Fig. 4—Piling Diagram for Ties.

air space, must be used, and no rotten or decaying wood allowed to remain in any yard or near any pile. In piling ties, not more than two for each pile should be in contact with the ground, excepting in triangular piles, as shown in No. 1 above.

3. Where roof courses are required, particular care should be taken in constructing them so as to obtain the desired protection, sufficient material necessary for this purpose being used.

4. In storage yards, each pile should be plainly marked with the month and year in which received, these marks to be placed where they can most easily be seen, and a clear space, preferably 4 ft., left between each row of piles to facilitate seasoning.

5. Material must not be piled where any part is likely to come in contact with water, or where water can stand or run, on surface of ground, under the piles.

6. Tall weeds or high grass must not be allowed to remain near any material piled on the railroad company's property.

7. Treated ties must not be placed in service until they have seasoned the full time prescribed for that purpose.

Changing the Gage of the East St. Louis and Suburban.

The East St. Louis & Suburban operates 111 miles of single track city and interurban lines in East St. Louis and surrounding towns and has developed quite a large industrial switching business in its territory on the east side of the Mississippi river. Its lines have gradually been built up from the small system of electric street car lines originally built on a few streets in East St. Louis by interests allied with the St. Louis street car companies across the river. The St. Louis street car lines were laid out for a 4-ft. 10-in. gage, and in order to make it possible to run suburban cars over the Eads bridge and on the same tracks in St. Louis the electric roads out of East St. Louis were likewise built to a 4-ft. 10-in. gage. Some time ago, however, the East St. Louis & Suburban determined to change all of its tracks to standard gage, 4 ft. 8½ in., and to abandon the running of its cars on the St. Louis street railway tracks. Two reasons prompted making the change; one, that it was desired to make it possible to run the same work and line cars in use on the passenger lines over two freight lines operated by the company which were 4 ft. 8½ in. gage, and a more important reason was a desire to have all the tracks in East St. Louis of standard gage in order to be able to afford terminal facilities in the city and on the bridge for new lines which might be built from any direction to East St. Louis. It was first thought that the change would be made on the entire system in three or four days, but on mature deliberation it was decided to spread the work over a longer period, in order to interrupt traffic less.

There were three suburban divisions to be changed, one double-track running from East St. Louis to Belleville, one single-track running from East St. Louis to Edwardsville, and one single-track running from Edgemont to Collinsville (connecting the two first named divisions). Having made thorough preparation first, the Belleville double-track division was changed in one day, one track in the forenoon and the other in the afternoon. During the change of each track, cars were run at 20 minutes headway on the other track, passing at crossovers, so that service was practically uninterrupted on that division during the change. The Edgemont-Collinsville division was changed in one morning, and the East St. Louis-Edwardsville division in two mornings, one forenoon being used between Collinsville and Edwardsville and the other between Collinsville and East St. Louis. In this way traffic was interrupted but a few hours on even the single-track lines. In East St. Louis the detached divisions of the city railway lines—those from which transfers are made to through lines—have been changed one at a time. When this was completed the through lines were taken in sections, so that by transferring passengers, practically no interruption of traffic occurred.

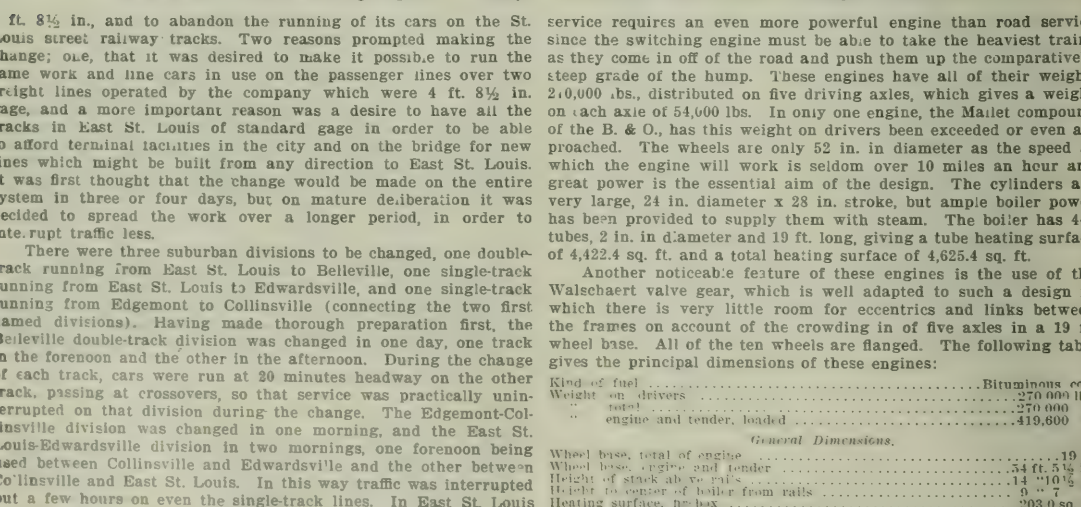
By reason of this gradual change, and the fact that the company was well fixed for surplus equipment, the shops were able to make changes of cars to keep pace with the requirements for 4 ft. 8½ in. cars. Much of this work in the shops, however, went on for several weeks prior to the actual change; that is, turning down of axles, arranging for changing brake rigging, etc., so that when the final actual change of cars was required, it was done in very little time. To facilitate this work the company purchased a considerable number of new wheels and axles.

The whole work of changing gage was made the subject of careful study and preparation, and proceeded with practically no interruption of service, and without the necessity of expensive night work, except gangs cutting special work, railroad crossings, etc., this latter work having been done mostly at night. A careful estimate was made of the probable cost before the work was commenced, and it was done at some saving on the original estimate.

Tracks in the shops were arranged so that standard gage cars could be brought in from the rear and wide gage cars in front, the wider tread of the wheels of the suburban cars making it possible to run them over the 4 ft. 10 in. pits after the gage had been changed to 4 ft. 8½ in. The few city cars on lines already changed are kept out on the line nights and not brought to the shops unless needing serious repair, which latter contingency has not yet arisen. These cars get nightly attention on their tracks for light repairs, oiling, etc.

Powerful Switching Locomotives for the Lake Shore.

The accompanying illustration shows one of the heavy switching engines recently ordered from the Brooks works of the American Locomotive Company by the Lake Shore & Michigan Southern. They are by far the largest and most powerful switching engines yet built and are intended solely for pushing trains over the humps in gravity yards of which the Lake Shore now has a number. This



Ten-wheel (0-10-0) Switching Engine for "Hump" Yard Service—Lake Shore & Michigan Southern.

service requires an even more powerful engine than road service since the switching engine must be able to take the heaviest trains as they come in off of the road and push them up the comparatively steep grade of the hump. These engines have all of their weight, 240,000 lbs., distributed on five driving axles, which gives a weight on each axle of 54,000 lbs. In only one engine, the Mallet compound of the B. & O., has this weight on drivers been exceeded or even approached. The wheels are only 52 in. in diameter as the speed at which the engine will work is seldom over 10 miles an hour and great power is the essential aim of the design. The cylinders are very large, 24 in. diameter x 28 in. stroke, but ample boiler power has been provided to supply them with steam. The boiler has 447 tubes, 2 in. in diameter and 19 ft. long, giving a tube heating surface of 4,422.4 sq. ft. and a total heating surface of 4,625.4 sq. ft.

Another noticeable feature of these engines is the use of the Walschaert valve gear, which is well adapted to such a design in which there is very little room for eccentrics and links between the frames on account of the crowding in of five axles in a 19 ft. wheel base. All of the ten wheels are flanged. The following table gives the principal dimensions of these engines:

Kind of fuel	Bituminous coal
Weight on drivers	270,000 lbs.
" total	270,000 "
" engine and tender, loaded	419,600 "
General Dimensions.	
Wheel base, total of engine	19 ft.
Wheel base, engine and tender	54 ft. 5½ in.
Height of stack above rails	14 " 10½ "
Height to center of boiler from rails	9 " 7 "
Heating surface, fire box	203.0 sq. ft.
" " tubes	4,422.4 "
" " total	4,625.4 "
Grate area	55 "
Wheels and Journals.	
Drivers: Number 10; diameter	52 in.
Drivers, material of centers	Cast steel
Journals, driving axles, size	10½ and 9½x12 in.

Cylinders.

Cylinders, diameter	24 in.
Pistons, stroke	28 "
Piston rod, diameter	4½"
Piston packing	Cast-iron snap ring

Valves.

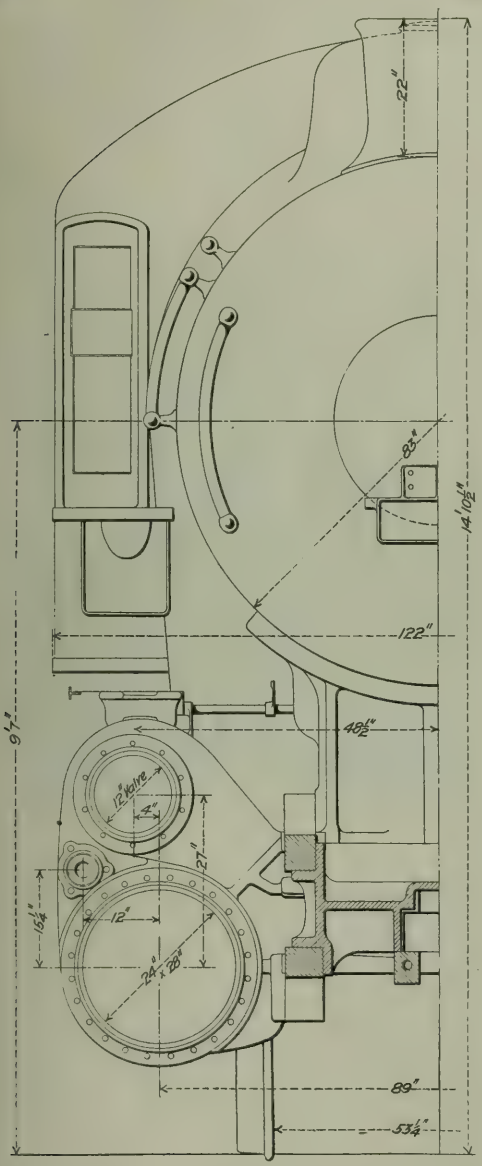
Kind of gear	Walschaert
Kind of valve	Piston, 12-in. diameter
Maximum travel	5⅝ in.
Outside lap 1 in.; Inside lap	None

Boiler.

Type of	Extended wagon top
Working pressure	210 lbs.
Diameter of barrel, first ring	80 9/16 in.

Firebox.

Length	108⅛ in.
Width	73¼ "



Half End Elevation of Lake Shore "Hump" Switching Engine.

Thickness of sheets	Crown ⅜-in., tube ½-in., sides ⅜-in., back ⅜-in.
Water space, width	Front 4½ in., sides 4½ in., back 4½ in.

Tubes.

Number	447
Material	Charcoal iron
Outside diameter	2 in.
Length	19 ft

Other Parts.

Exhaust nozzle, single or double	Single
Stack, diameter	20-in...

Tender.

Tank capacity	8,000 gals.
Coal capacity	12 tons

Connecticut's New Railroad Legislation.

BY CLARENCE DEMING.

For more than ten years and down to the Connecticut legislative session of 1903 the story of railroad legislation in the state had been mainly the tale of the conflict of steam and trolley interests centered on the construction of electric parallels. The long campaign of more than ten years opening with successes of the New York, New Haven & Hartford Railroad Company closed with several years of consecutive defeats; so that, at the legislative session two years ago the whole situation had changed. By that time profitable trolley territory in the state had become almost exhausted; and the New Haven Company itself, as it had acquired large electric properties, had found its own interests shifted largely to the side of its earlier foes. In the legislative session of 1905, lately closed, the same situation has repeated itself in a more accentuated form. Not a single contest of steam and trolley worth noting has been fought during the whole session; and the New Haven Company has centered its energies either on its great electric interests or on securing new privileges as a steam corporation.

In what may be called the electric direction the New Haven company accomplished its prime object of the session in carrying through a resolution "amending the charter of the Consolidated Railway Company," the holding corporation in which are vested its great system of electric lines. The amendment is, in fact, a new charter expanding lavishly the powers of the old charter—taken over from a corporation in eastern Connecticut—and already liberal, not to say excessive. The new charter even without reading between the lines, seems practically limitless in its scope of public service function and activity. Under it the big holding corporation, owned by the New Haven Company, can acquire "any property or instrumentalities, lawful and suitable for any such purpose or directly or indirectly connected with the business of transportation." Present location and construction are confirmed and new rights of extension given specifically on routes the brief description of which fill almost ten pages of the charter—this by way of pre emption rather than positive intention to build. Water power in the state for all kinds of electric purposes can be acquired indefinitely. Any other corporation engaged in transportation or development of electricity can be bought up and its franchises, rights, powers and privileges pass to the Consolidated Railway Company, and minority stock of one-third or less may be condemned. Unlimited power is granted to take up the liabilities of absorbed corporations and very free exercise of eminent domain in taking realty. The only checks in this "omnibus" charter relate to the construction of parallels and the infringement of local charter rights already granted to other steam and electric railroad corporations.

The size of the holding company to which these great powers have been granted by the Connecticut legislature is worth attention. It is made up of 20 constituent properties, owned, controlled or leased, and representing a much larger number of corporations originally independent. Of these constituent properties, 13 are in Connecticut and seven are in Massachusetts. In approximate figures they have 553 single track miles; $18,439,320 of stock; $24,109,900 of funded debt; and $1,925,784 of floating debt—these figures including the stocks of a holding sub-company by which the Springfield street railway has been financed. A large amount, however, of the stock, bonds and floating debt is held by the Consolidated Railway Company, acquired or issued in the various "deals" by which the merged properties have been obtained. In the hands of the public, including about $9,500,000 of the parent steam company's debentures, by which the Fair Haven & Westville system was bought, there are approximately $32,971,720 of securities connected with the Consolidated Railway organization now outstanding and probably still more to come. How far the sweeping new charter of the big electric holding corporation will hold as against Massachusetts law in connection with its lines in that state is an interesting question of the future.

But the grant of new powers did not end with the New Haven's holding corporation. The original charter of the steam company was itself amended so as to allow the New Haven to acquire directly by purchase, lease or otherwise the stock, property, rights and franchises of any railroad which it now operates, dispose of the same and in the transactions issue its own stock, bonds on notes; and, in case it acquires all the shares of any Connecticut railroad, it becomes vested with all the charter rights and privileges of the acquired line. A three-quarters stock interest can sell a railroad line to the New Haven and with the transfer goes condemnation rights over the minority stock—an existing law of the state, with some important additions, being thus made a part of the New Haven's charter. The extent to which the old but subtle stratagem of gaining new charter privilege by the device of vesting the central corporation with the charter powers of acquired roads has been used, will be marked in both the case of the New Haven and its electric holding company.

The middle of the session brought out a new and dramatic feature of railroad policy—the so-called "open air lobby" of President Mellen. Other and earlier presidents of the New Haven Com-

pany had from time to time and on specific bills addressed the railroad committees. President Mellen, in view of the largeness of his plans and policy, deemed the time ripe for a kind of "omnibus" address covering all the railroad questions before the General Assembly. It took the form of a sort of great legislative town meeting held in the hall of the house of representatives which was crowded by several hundred listeners. To them President Mellen, who is gifted with fluent and persuasive speech, expounded the policy and projects of his corporation in many phases—charter powers, consolidations, electric plans, demurrage, the general railroad law, freight rates and facilities and cognate themes—laying special and, as appeared in the sequel, effective stress on state protection against the newly surveyed line of the New York Central across northwestern Connecticut. A long and, at times, sharp, "quiz" followed from members of the legislature and others, the whole proceedings filling several hours and bringing out with singular clearness not merely Mr. Mellen's grasp of general situations but also his command of details.

It is hardly too much to say that one of the direct results of President Mellen's appeal was the securing of a point of vantage for his corporation in seeking which two years before his predecessor, President Hall, had signally failed. Not long before the meeting of the legislature of 1903 an outside syndicate had planned a long distance electric line from Hartford to New Haven via Middletown—the new line to be a competitor of the New Haven and a prospective link in a larger electric system between New York and Boston. The plan of the projectors was to build the new line under the general railroad law of the state—a statute which, along with some sane restrictions on capitalization, allowed a steam railroad or electric railway to be built without seeking new legislative powers. President Hall met the project—which ultimately fell through—with a bill to repeal the general law; but after a vigorous effort was forced to withdraw the measure, the "farm element" in the General Assembly, very friendly to electric enterprise, actively resisting him. In leveling the same shaft against the New York Central President Mellen hit his mark. His plea for "protection" for home interests and against "punishment" for connecting the state with the coal fields by the Ontario & Western purchase availed. The legislature promptly repealed enough of the general railroad act to compel a line crossing the Connecticut boundary to obtain special legislative sanction; so that now any project of the kind must carry the Connecticut Senate, long a fastness of the New Haven corporation. As a rivet of that company's territorial monopoly in the state and in southern New England this action of the Connecticut legislature is quite unique in its railroad annals.

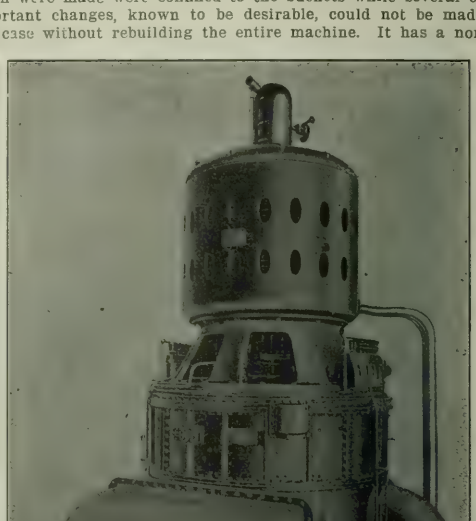
The New Haven Company carried through yet another measure of considerable importance to it in future financing of electric enterprises. This was the opening to savings bank and trustee investment of the debentures of the Consolidated Railway Company, the electric holding corporation already described. The debentures, of which some $14,000,000 are outstanding, are not a formal mortgage security although they must be provided for before additional mortgages can be laid on the properties of the Consolidated Railway. On the plea that it would be unjust to open to savings bank investment a debenture and refuse it to a mortgage bond the consolidated mortgage bonds of the Connecticut Railway & Lighting Company—some $11,000,000 outstanding and more to come—also obtained the savings bank legalization. In both cases is now presented the striking inconsistency of junior bonds of the two great Connecticut trolley systems legalized for investment of savings banks and trustees while most of the much more highly secured underlying bonds of the constituent properties are denied that investment vantage.

At one point and one point only during the session was the New Haven Company worsted. Before the meeting of the legislature it was expected that a strenuous effort would be made by the company for the repeal on modification of the Connecticut four-day car detention law which has been costing the corporation upwards of $1,000,000 a year. A bill was actually introduced and, as a "compromise" measure, received the approval of the Connecticut Manufacturers' Association. But it met with vigorous opposition from the rural legislators and was finally withdrawn—possibly on the theory that it was overloading and imperiling other legislation asked for. In the legislature two years hence this demurrage matter promises a more active contest. Meanwhile, by enforcing orders for quicker return of foreign cars, the New Haven company has succeeded in cutting down detention costs some 40 per cent.

Many minor bills aimed at the railroad and street railway companies—measures for third rail protection, abatement of smoke, more train hands in ratio to cars, street cleaning from snow, jury trials in damage cases, lower trolley fares and others—went to defeat, usually in the Senate; and in the session, as a whole, the grant of railroad privilege has far exceeded that at any law-making period in the history of the state. For the first time "community of interest" between steam and the trolley has been well nigh complete—partly because the New York, New Haven & Hartford Railroad Company has itself become so extensive an owner of electric roads, partly because rival territory has either been used up or pre-empted in existing charters, and partly because destiny has pointed to the early absorption by the great steam corporation of the large Connecticut Railway and Lighting system. With that final step in electric railway consolidation accomplished and nine-tenths of the street railways of the state under the New Haven's control, Connecticut railroad law making will be interesting, perhaps, but hardly polemical.

Tests of a Curtis Turbine Generator.

On May 3, 1905, Messrs. Louis A. Ferguson, Vice-President of the Commonwealth Electric Company, and Frederick Sargent, of Sargent & Lundy, Chicago, Ill., made an efficiency test at the Schenectady works of the General Electric Company of a 2,000 k.w. steam turbine generator unit of the Curtis type, which surpassed all previous records for economy in steam consumption for turbine generators. The turbine was a four-stage machine designed in 1903 and recently changed in a few particulars as a result of experiments made during the past year. The machine as tested conforms as nearly as possible to the standard four-stage machines now being produced, but is less efficient since the changes which were made were confined to the buckets while several other important changes, known to be desirable, could not be made in this case without rebuilding the entire machine. It has a normal



2,000 K. W. Curtis Turbine Generator Unit.

full-load capacity of 2,000 k.w. and operates at 900 r.p.m. The remarkable results here reported were determined by the most accurate methods and have been verified by repeated tests made subsequently in which the same conditions of steam pressure, vacuum and superheat were maintained.

The following is the full text of the report of the engineers, Messrs. Sargent and Ferguson:

"We sent our assistants, Messrs. Clark and Eastman, to Schenectady to prepare the apparatus for making these tests, and they made several preliminary trials before our arrival and the results of each of the trials very closely approximated the results of the official tests herein mentioned. We had all the instruments carefully tested and standardized during the trials; the electrical instruments being tested by the New York testing laboratory in the presence of Mr. Eastman. The surface condenser showed practically no leakage. We took every precaution to satisfy ourselves that the tests were reliable and accurate, and we beg to certify that the results obtained were as follows:

	Test—			
	Full load.	Half load.	Quarter load.	Zero load.
Duration of test, hours	1.25	0.916	1.0	1.33
Steam pressure (gage), lbs.	166.3	170.2	155.5	154.5
Back pressure,* in. of mercury	1.49	1.40	1.45	1.85
Superheat, degrees Fahr.	207.0	190.0	204.0	156.0
Load in kilowatts	2,023.7	1,066.7	555.0	.....
Steam consumption per K.-W. hr., lbs.	15.02	16.31	18.09	1,510.5

* Absolute

It will be seen from this summary of the results that the generator unit gave an electrical horse-power on 11.205 lbs. of steam per hour at full-load, which, assuming 85 per cent. combined efficiency, is equivalent to 9.52 lbs. per indicated horse-power per

hour for a reciprocating engine. This figure has been surpassed in one or two instances, notably with a triple expansion, four-cylinder horizontal Sulzer engine using steam at 180 lbs. pressure superheated 230 deg. Fahr., which under a load of 2,860 h.p. gave a steam consumption of 8.97 lbs. per hour. But in commercial service the usual figure for the best reciprocating engines is from 12 to 15 lbs. per hour. The high economy of the turbine tested is, therefore, apparent.

Output of the United States Steel Corporation.

The Bulletin of the American Iron and Steel Association publishes a table in which the percentage of the total shipments of iron ore from the Lake Superior region by the United States Steel Corporation as compared with the shipments of iron ore from the same region by all other companies, firms and individuals, and the percentage of the total production of iron ore, coke, pig iron, steel ingots and castings, finished rolled iron and steel and wire nails by the Steel Corporation and by all independent producers, both for the years 1902, 1903 and 1904 are given. In the three years covered by the table production of iron ore by the steel corporation fell from 45.1 per cent. of the total in 1902 to 43.8 per cent. in 1903, and to 38 per cent. in 1904. The considerable decrease in 1904 was due principally to the large stock of iron ore carried over from 1903. The production of Bessemer steel rails by the corporation declined from 65.4 per cent. in 1902 to 57.2 in 1904. The decrease in the latter year was caused mainly by the competition of the Lackawanna Steel Company, an independent concern which was an active competitor for Bessemer rails in 1904, its new plant having at that time only recently been put in operation. The increased production of open hearth steel rails from southern rail mills also influenced the result. The production of the Steel Corporation also shows a decrease of 3 per cent. during the three years in the total of all kinds of finished iron and steel, including rails. The table for 1904 follows:

Percentage of Shipments and Production by the United States Steel Corporation and by Independent Producers.

	1904	
	United States Steel Corporation.	Independents.
Shipments of iron ore from Lake Superior	53.8	46.2
Total products of iron ore	38.0	62.0
Production of coke	36.6	63.4
Bessemer, basic, forge, foundry; all other pig iron	44.3	55.7
Spiegeleisen, ferro-manganese and ferro-phosphorus	70.5	29.5
Total pig iron, including spiegeleisen, etc.	44.6	55.4
Bessemer steel ingots and castings	69.0	31.0
Open-hearth steel ingots and castings	50.4	49.6
Total steel ingots and castings	61.0	39.0
Bessemer steel rails	57.2	42.8
Structural shapes	55.1	44.9
Plates and sheets, excluding nail plate	58.0	42.0
Wire rods	71.3	28.7
Bars, skelp, nail plate, open-hearth, iron rails, etc	28.6	71.4
Total of all finished rolled products	47.8	52.2
Wire nails	67.0	33.0

The Cost of Locomotive Operation.

VIII.

BY GEORGE R. HENDERSON.

(*Continued from page* 11.)

EFFECTS OF BAD WATER.

If the natural waters are poor and no methods of purification are adopted, there will be contingent expenses created which may be briefly summed up as follows:

Waste of fuel, by blowing hot water from the boiler, in order to reduce concentration.

Waste of fuel, by incrustants fouling the heating surface, and preventing the ready transmission of heat to the water.

Time and labor necessary to wash out the boilers frequently, and waste of heat.

Time and labor in making frequent and elaborate repairs to the boiler.

Detention of trains on the road, due to poor steaming and foaming, as well as possible accidents to fire-box, cylinders, pistons, valves, etc.

When the water has a natural foaming tendency, or such is caused by the addition of soda ash, the concentration must be kept down by frequently blowing off. Some of the instructions issued in connection with the use of soda ash prescribe that at the end of each trip, at least two gages of water shall be blown out of the boiler, and special blow-off cocks, operated by air from the cab are provided for this purpose. For a locomotive of moderate size, this means that about 4,000 pounds of hot water are to be ejected from the boiler, to each pound of which in the neighborhood of 340 heat units have been added, or a total of, say, $340 \times 4,000 = 1,360,000$ B. T. U. As the efficiency of the boiler will permit, perhaps a utilization of only 7,000 heat units per pound of coal, we find that this

$$\frac{1,360,000}{7,000} = 194$$

represents an amount of fuel of pounds, or about one-tenth of a ton of coal! Besides, it is frequently necessary to blow out while on the road, and this represents further losses.

Consequential losses have also sometimes resulted, by persons or property being damaged while blowing off, when the attachment is on the side of the fire-box. If directed back under the train, it is apt to throw sand, gravel, etc., into the journal boxes, causing hot bearings.

If scale is allowed to accumulate on the heating surfaces there will be a loss of heat, as was referred to in Chapter 1, in the discussion of the condition of the boiler. This, of course, depends entirely upon the water used, and the thickness of incrustation. The Illinois Central tests showed only 1/32 inch average thickness of deposit after running the engine 21 months. Many waters would produce this much in a month or less. Professor L. P. Breckenridge, who reported the tests, estimated that approximately one-fifth per cent. of the fuel burned was wasted or lost for each month that the engine ran between cleaning of the boiler; thus, in ten months the average loss would be about two per cent.; in 20 months, four per cent. This, however, would be very little guide to conditions existing on other railroads, except in the general way, that the dirtier the boiler is allowed to run the greater is the heat loss, and this is chargeable directly to the impure water used.

The cost of washing out boilers is quite considerable, especially if it is thoroughly done, as should be the case, and we may estimate it about as follows:

One hour for boiler washer	25 cts.
One hour for helper	15 "
3,000 gals. water (worth 10 cts. pr 1,000 under press)	30 "
2,500 gals. water for filling up	25 "
½ ton coal, to get up steam at $1.00 a ton	50 "
Total	145 cts.

or, say, $1.50 for material and labor. Washing out has been accomplished with a detention of little over an hour, but we do not think it ordinarily wise to consider less than three hours needed for cooling, washing out and firing up. In oil burners, where the internal brickwork stays hot for such a length of time, it cannot be done under from 6 to 10 hours. If the locomotive costs $15,000, the interest at 5 per cent. will amount to 8 cents an hour, which ought, perhaps, to be considered in addition to the above. However, $1.50 will probably represent the actual cost of this process under ordinary circumstances.

With many poor waters, boilers must be washed out every 600 or 1,000 miles' run, but in *bad* districts this must be done every round trip, say, for each 300 miles. If the engine ordinarily uses 300 gallons of water per mile, at a cost of 5 cents per 1,000 gallons, we should have for 300 miles, $\frac{300 \times 300}{1,000} \times .05 = \$4.50$ for the round trip, so that the expense of washing out would be equivalent to an increase of 33 per cent. in the cost of the water.

Sometimes it is only necessary to change the water in the boiler, in which case the cost would be about half as great, or 75 cents, as seen from our figures above.

The increase in boiler repairs due to bad water is enormous, but is seldom fully appreciated. As above referred to, some lines are able to run fireboxes for 10 or 15 years. There are other cases where they have been replaced within a year. As the cost of applying a new firebox will be between $500 and $1,000, it adds a great burden to the repair account. Again, in the Southwest, flues have been renewed regularly every 60 or 90 days, while in the East they will ordinarily run from one general repair period to another. To show what a difference in expense is caused by water, at Needles, on the Colorado river, the amount of boiler work was cut in half by the introduction of a treating plant at the principal watering point on the division. If these various items are totalized, and the interest for the time engines are out of service added to them, we will be in a position to say how much the water actually does cost, and instead of apparently costing about 5 cents per thousand gallons, it may be 10 or 15 cents.

But the most aggravating part of water trouble is caused by detentions to trains on the road. Poor steaming results from dirty boilers, as has been shown, and foaming causes delays by priming cylinders and steam chests, often causing breakage of the same. It is often necessary to close the throttle before the whistle can be sounded, and water is carried so low to prevent these difficulties, that occasionally a crown sheet comes down—if nothing worse. This is a very serious condition, but it confronts many of our Western lines to-day that have not taken up the purification of water. When these are duly considered, it will be apparent that we would be justified in going to any reasonable expense to obviate these difficulties and dangers, even to the financial disadvantage of the water department, as a judicious introduction of the proper appliances will not only reduce the cost of operation, but will give a much more satisfactory service, the value of which cannot always be figured in dollars and cents.

The Chicago & North-Western, since putting in treating plants,

has not only reduced the boiler work over 20 per cent., but has reduced engine failures 50 per cent. on the Iowa Division, which is a great indorsement for the treating system.

WASTE

That water is usually considered an article of small value may be traced to the fact that leakage from tanks and pipes is often allowed to continue for a considerable length of time. When the staves dry out, or the tank becomes rotten, it is sometimes months before the evil is corrected. As a rule, those losses on the locomotive which have been considered in connection with the fuel, also cause waste of water. Injectors, which continually waste at the overflow, as well as leaks in boiler and tank, may be small in themselves, but when many engines are doing the same thing, a large amount of water is lost daily. This all has to be paid for in some way or other, if not by the meter, at least in fuel for pumping, and prompt steps should be taken to reduce it to a minimum.

QUANTITY.

We have now to consider the amount of water used in doing useful work, such as propelling engines and trains on levels at various speeds, up grades, around curves and any combination of two or more of these conditions. In order to obtain such figures closely to theory, we should proceed in a similar manner to our treatment of the fuel problems, by calculating the cylinder volume at cut-off, weight at cut-off pressure, and number of strokes per minute. We could then construct curves in the same way, giving the maximum capacity of the boiler and any desired fractions of this quantity. But the curves which we have already drawn for coal (see *Railroad Gazette*, March 31) indirectly show the quantity of water, as this was first determined. Thus the curve of maximum power (Fig. 2) indicating 8,000 pounds of coal per hour, may also stand for 40,000 pounds of water, as we saw that at the rate of combustion here considered, viz., $\frac{8,000}{3,200} = 2.5$ pounds per square foot of heating surface per hour, the water rate by Fig. 3 would be 6 pounds, from and at 212 degrees, and allowing the evaporative factor of 1.2, we obtain $\frac{6}{1.2} = 5$, so that $8,000 \times 5 = 40,000$ pounds of water would correspond to 8,000 pounds of coal. As the rate of combustion is reduced, the water rate increases. Thus at 6,000 pounds per hour, the rate of combustion would be $\frac{6,000}{3,200} = 1.87$ pounds, and from Fig. 3 again we find an *actual* rate of $\frac{7.2}{1.2} = 6$ pounds, or $6,000 \times 6 = 36,000$ pounds of water per hour.

If we wish close figures, we have merely to proceed as outlined, but as water is perhaps always cheaper than coal (and usually very much cheaper), when considering the quantities consumed by a locomotive, it will generally be close enough to use a simpler method, and obtain approximate results.

We see from Fig. 3 that curves a, c and d lie quite close together, that is, the water rate is not very different for the three kinds of coal represented by these curves, and that for the rate of combustion usually obtaining in locomotives—from 1 to 2.5 pounds of coal per square foot of heating surface per hour—the water rate (from and at 212°) is between 6 and 9 pounds, or from 5 to 7½ pounds actually evaporated at boiler pressure. If we take the mean figure, 6¼ pounds, the greatest possible error, under the conditions which we have assumed, would be 1¼ pounds of water per pound of coal burned, or if 10 tons of coal were consumed in, say, 100 miles, the quantity of water used during this run might exceed the 6¼-pound assumption by 25,000 pounds, or, say, 3,000 gallons, which, at 10 cents a thousand gallons, would make a possible error of 30 cents in this distance. As a train-mile will cost at least one dollar, the error could not be over 3/10 per cent.—too small to notice.

This brings us to a very simple method of determining approximately the quantity of water used, viz., take it as a direct proportion of the amount of fuel. The average actual evaporation for a number of tests of simple coal-burning locomotives was ¾ gallon per pound of coal; but $.75 \times 8.33 = 6.25$ pounds of water per pound of coal, which is precisely the figure obtained above as a mean of the probable extremes observed in practice. (It is also interesting to note that the highest and lowest results of these tests were .9 and .6 of a gallon, respectively, or 7.5 and 5.0 pounds of water per pound of coal, also agreeing with our previous determination of extremes.)

From the results of a number of tests made with fuel oil in California, we may safely allow 1¼ gallons of water evaporated to a pound of the oil.

Compound engines usually show a better evaporative performance than simple locomotives for several reasons—the tests used as a reference suggest ⅞ gallon of water to a pound of coal. With oil, as there is little change in the evaporative rate, compounding should not change the constant 1.25 selected above.

When a superheater is applied, the ratio of water and fuel changes for variations in the degree of superheating, and we have tabulated the approximate water rate to be used. The constants for all the cases above considered are here repeated for convenience:

Approximate Quantity of Water Used in Gallons per Pound of Fuel.

Type.	Fuel.	Water.
Simple	Coal.	0.75, or ¾
Compound	Coal.	.87, or ⅞
Simple	Oil.	1.25, or 1¼
Compound	Oil.	1.25, or 1¼

Superheater.

Superheat.	Coal.	Oil.
100 degrees Fahr.	0.70	1.17
200 " "	.66	1.10
300 " "	.60	1.00
400 " "	.50	.83

The application of these tables is so obvious that no example is necessary at this time. Later, when complete runs or trips are calculated, the effect of grade, curvature, speed, etc., will be determined for water consumption, along with the other expenses of operation.

(To be continued.)

The Paper-Process for the Protection of Iron and Steel Structures.*

BY L. H. BARKER,
Chief Assistant Engineer, Pennsylvania Railroad.

About eleven years ago experimental investigation was begun with numerous well-known and established iron paint-preservatives, in order to ascertain by actual exposure tests the best one to resist the destructive action on steel structures of sulphurous gases in the form of smoke combined with the moisture of steam, and since

Experimental Bars Exposed Eight Months. Upper Half Coated with Three Coats of Paint, Lower Half Coated with Paper Process.

that time 50 or more paints and combinations have been tried. Among them were many kinds of asphaltum, rubber, graphite, carbon lead and iron paints, and though the results showed varying degrees of resistance, it is remarkable that even with three coats of paint not one was found that did not show rust, in less than a year. Of course, it is to be understood that the exposures were

*From a paper read before the American Society for Testing Materials, Atlantic City, June 30, 1903.

made so as to subject the test bars to the severest action possible in order to obtain the quickest results.

In making the first series of tests new steel plates 10 in. square were used. As, however, the adverse conditions we were trying to overcome related to rusty steel, which is more difficult to preserve than new steel, rusty plates were substituted in all tests thereafter. To still further endeavor to meet the existing conditions new plates were hung up and exposed to the smoke fumes until they became covered with sulphur scale. The thought being that an oxide scale due to atmospheric exposure might give different results. This scale or rust formation on these new plates apparently varied not only in amount, but also in the time of its formation, supposedly due to different chemical composition. As this might again give some variations in the experimental results, in order that all paints should be on as like footing as possible, angle bars 11 ft. long were made use of and as before hung in the smoke until rusted, then cleaned with wire brushes, each foot of the bar painted with a different paint and again hung up. The results, however, continued to be unsatisfactory.

In examinations of the test bars from time to time it was seen that upon many of them the paint was intact, but with protruding points which upon being pricked were found to be small rust formations pushing up the paint from behind, clearly indicating that it was not the failure of the paints but the rust action on the inner surface that caused the damage. As no rust can form without the presence of moisture, and as all paints are pervious to moisture (as Dr. Dudley's careful investigations of the subject have proved) this led to the conclusion that it would be necessary in some way to tightly seal the surface. Many kinds of materials for doing this were tried, with as many different results, until three years ago it was decided that a cheap paraffine paper answered the purpose best of all and since that time all experimentation has been along that line. The few test bars shown in the accompanying illustration indicate the results. The paper covering has been tried in a small practical way against smoke action, and after two years and three months exposure an examination showed the outer paint, the paper and the first or adhesive coat all intact and in many places where paper was removed for examination the adhesive coat not yet dry and the surface of steel the same as when painted. With such satisfactory results from this paper-process in the smoke tests, it was concluded to make a large-scale application and severe test on a large number of eye beams supporting a floor over and within a few feet of salt water and upon which the rust was due not to smoke but to the almost continuous dampness and presence of sewer gases. This was done over a year ago and up to this time indication of damage of no kind is apparent.

The mode of application of the paper is as follows: After the rust is carefully cleaned off by means of stiff wire brushes, a certain kind of tacky paint is applied, the paper then covered over and tightly pressed upon the painted surface, the joints of the paper slightly lapping. As soon as the paper is in place, it is ready for the outside coat of paint. It will be observed that by this process, the first coat of paint, the paper and the coat of paint over the paper can be applied with one scaffolding, thereby greatly reducing the cost, especially in high and dangerous places.

These experiments, extending over only three years, are of too short a duration to determine the value of paper as a protection for iron and steel, but they certainly bring out the fact, at least in the case of smoke and gases, that the action begins from behind the paint and not from in front by the disintegration of the paint.

Train Accidents in the United States in June.[1]

unf, 1st, 11 p.m., Southern Pacific, Sulphur, La., passenger train No. 8 was derailed by running over a cow and the engineman and fireman were badly scalded.

*o, 1st, Pennsylvania Lines, Stillwater Junction, Ohio, passenger train No. 28 struck an oil wagon at a crossing, tearing open the oil tank and spreading the oil so that it was ignited by the fire of the engine; and the engineman and fireman were burned to death.

eq, 2d, Delaware, Lackawanna & Western, Passaic, N. J., a freight train was derailed by a broken axle and 12 cars were wrecked. A trespasser riding on the train was killed.

bc, 5th, Pennsylvania road, Newport, Pa., collision between a passenger train and a freight train, wrecking three engines, four freight cars and two express cars. Three passengers and three trainmen were injured.

unf, 6th, Pere Marquette, Ionia, Mich., a freight train was derailed at a washout; the engineman and fireman were killed and two brakemen were injured.

unx, 6th, Norfolk & Western, Bedford, Va., a freight train drawn by two engines was derailed, and both engines and 17 cars fell down a bank. One fireman was killed and four tramps were injured.

unx, 6th, San Pedro, Los Angeles & Salt Lake, Caliente, Nev., a special passenger train, heavily loaded, was derailed, and three passengers were injured.

dn, 6th, Grand Trunk, Pewamo, Mich., an extra engine was derailed at a washout and the engine, four cars and a pile driver were wrecked. Six employees were killed and one fatally injured. It is said that the extra engine had been properly flagged but that the flag was not heeded.

unf, 7th, Wisconsin Central, Colfax, Wis., passenger train No. 1 broke through a bridge, the center span of which had been undermined by a flood, and the engine and first two cars fell into the river. The engineman, fireman and five tramps were drowned.

fdr, 8th, Grand Trunk, Davison, Mich., passenger train No. 3 was derailed by spreading of rails and three cars were ditched. Eleven passengers were injured, one of them fatally.

bc, 9th, Texas & New Orleans, Athens, Tex., butting collision of freight trains, wrecking both engines and several cars. One engineman was scalded to death and one fireman was killed by being buried under coal.

ur, 10th, 2 a.m., Southern Railway, Del Rio, Tenn., passenger train No. 35 was derailed by a defective rail or switch, and four passenger cars were overturned. One passenger was injured.

xc, 10th, Mobile & Ohio, Pritchards, Ala., collision between a freight train and a switching engine; one engineman killed.

o, 10th, New York, New Haven & Hartford, Wollaston, Mass., the locomotive of a freight train was wrecked by the explosion of its boiler, and a brakeman was injured. The explosion was severe, yet the engineman and fireman escaped without serious injury.

unf, 10th, 3 a.m., Chicago, Burlington & Quincy, Farnam, Neb., a freight train drawn by two engines was derailed at a washout, and the second engine was ditched. One fireman was killed.

dn, 12th, Central of New Jersey, Dover, N. J., a freight train which had become uncontrollable on a descending grade ran into an open drawbridge at the Morris canal, wrecking the bridge and badly damaging two cars and a canal boat. A child sleeping in the cabin of the boat was injured.

bc, 13th, Albany & Hudson, East Greenbush, N. Y., butting collision between a passenger train consisting of one electric car, and a special train consisting of one motor car and one car loaded with horses. One passenger was injured. The collision is said to have been due to a misunderstanding of orders.

unx, 13th, Southern Railway, Georgetown, Ind., a freight train was derailed and five cars were ditched. Three trespassers were injured, one of them fatally.

unx, 13th, Southern Railway, Golden Gate, Ill., a special passenger train was derailed on a bridge and four cars fell down into Little Wabash river. The engineman and fireman were killed and 10 passengers were injured.

dr, 14th, Southern Pacific, Mescal, Ariz., a passenger train was derailed at a defective switch and the engine and several cars were wrecked. Three tramps were killed and a mail clerk was injured.

unx, 14th, Mobile & Ohio, Selmer, Tenn., a freight train was derailed and the engine was overturned; engineman killed.

15th, Boston & Maine, Walpole, N. H., passenger train No. 12 was derailed at a defective or unfastened switch, and the engine fell down a bank, followed by the mail car. The engineman and two other trainmen were injured.

unx, 15th, Central of New Jersey, Wilkesbarre, Pa., the engine of a passenger train was derailed and overturned and the fireman was injured.

unx, 15th, Southern Railway, Kings Mountain, N. C., the engine and first two cars of passenger train No. 40 were derailed, and the engine was ditched. The engineman and fireman were injured, the latter fatally.

*bc, 16th, Pennsylvania Railroad, Wilcox, Pa., butting collision between westbound freight train No. 97 and eastbound freight train No. 83, wrecking both engines and several cars. The wreck took fire and three cars of oil and 12 other cars were burnt up. One fireman and a trespasser were killed and three trainmen were injured. It is said that the watch of one of the enginemen was 10 minutes slow, and that this was the cause of the collision.

xc, 16th, Birmingham, Ala., collision between a passenger train of the Louisville & Nashville and a locomotive of the Central of Georgia, at a crossing of the two roads. Fourteen employees were injured, most of them being passengers in the passenger train riding to their work.

bc, 17th, Western Maryland, Patapsco, Md., butting collision between westbound passenger train No. 5 and an eastbound freight train drawn by two engines. All three of the engines, the leading cars of the passenger, and many cars of the freight were wrecked. On the passenger train was a large gang of roadway employees and many of the men were sitting on the steps of the cars; 18 of these employees and eight trainmen were killed, and four trainmen, 13

[1] Derailments in which injuries are few or slight and the money loss is apparently small will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc Rear collisions.
bc Butting collisions.
xc Miscellaneous collisions.
dr Derailments: defects of roadway.
eq Derailments: defect of equipment.
dn Derailments: negligence in operating.
unf Derailments: unforeseen obstruction.
unx Derailments: unexplained.
o Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

laborers and three passengers were injured. The men in charge of the freight train had misunderstood the schedule of the passenger train.

xc, 14th, Chicago & North-Western, Gilbert's, Ill., collision between a southbound passenger train and a westbound freight; passenger engineman fatally injured. It is said that the collision was due to a misplaced switch.

xc, 14th, Boston & Albany, West Pittsfield, Mass., a car in a westbound freight train was derailed and fell in front of an eastbound passenger train, badly damaging the engine and two passenger cars. The engineman and fireman of the passenger were severely scalded.

unf, 14th, Baltimore & Ohio, Philadelphia, Pa., the engine and baggage car of a fast passenger train were derailed and wrecked by a plank which had been thrown upon the track, immediately in front of the train, from an overhead bridge, by mischievous boys. Three persons were injured. The engine ran against a signal tower, wrecking it and injuring two men inside.

unx, 14th, Gulf, Colorado & Santa Fe, Rogan, Tex., a passenger train consisting of nine cars, carrying 317 passengers, was derailed and a porter was fatally injured.

unx, 15th, St. Louis & San Francisco, Oklahoma City, Okla. T., the tender of the locomotive of a passenger train was derailed and, with the baggage car, was wrecked. The engineman and fireman were killed.

eq, 15th, Chesapeake & Ohio, Maysville, Ky., a passenger train was derailed by a broken flange and four passengers were injured.

o, 19th, New York Central & Hudson River, St. Johnsville, N. Y., the locomotive of a freight train was wrecked by the explosion of its boiler, and the fireman and one brakeman were badly scalded.

bc, 20th, 3 a.m., New York, New Haven & Hartford, Newington, Conn., butting collision between an eastbound freight and an empty engine westbound, making a bad wreck. Both firemen and one brakeman were killed and both enginemen were injured, one fatally.

xc, 20th, Louisville & Nashville, Middlesboro, Ky., a freight train broke in two and the rear portion afterwards ran into the forward one, wrecking four cars. The conductor was killed and one brakeman injured.

unx, 20th, Northern Pacific, Seattle, Wash., a switching engine was derailed and the foreman of the crew with his stepdaughter, who was riding in the engine with him, were killed, and the yardmaster was injured.

xc, 21st, Philadelphia & Reading, Locust Summit, Pa., an inspection engine collided with a yard engine and was badly wrecked. The engineman, fireman and two physicians riding on the inspection engine were injured.

*†21st, 9 p.m., Lake Shore & Michigan Southern, Mentor, Ohio, the eastbound Twentieth Century Limited express, running at high speed, was derailed at a misplaced facing-point switch and the engine and first car (a combination baggage and smoking car) were wrecked. The engine fell against the freight house; this building took fire, and, with a good part of the wreck was burnt up. Fifteen passengers and four trainmen were killed and 15 passengers and trainmen were injured. All of the passengers killed were in the first car (the smoking car). This accident was reported in the *Railroad Gazette* of June 23 and 30.

dr, 22d, 3 a.m., Denver & Rio Grande, Thomson Springs, Utah, westbound passenger train No. 5 was derailed by a broken frog and the baggage car and three passenger cars were ditched. Six passengers were injured.

bc, 23d, Louisville & Nashville, Appalachia, Tenn., butting collision of freight trains, badly damaging both engines and several cars. One trainman was killed and two were injured.

dr, 23d, 4 a.m., Seaboard Air Line, Santos, Fla., a sleeping car at the rear of a passenger train was derailed and overturned at a defective switch. The conductor and three passengers were injured.

unf, 23d, Richmond, Fredericksburg & Potomac, Summit, Va., a freight train was derailed at a washout, making a bad wreck. Two tramps were killed.

dn, 24th, Chicago, Rock Island & Pacific, Iowa City, Iowa, a passenger train was derailed at a misplaced switch and the engine and first two cars were overturned. The engineman was killed and the fireman injured.

unx, 25th, West Jersey & Seashore, Sea Isle Junction, N. J., an excursion passenger train was derailed and the engine and one passenger car were ditched. The fireman was injured.

†rc, 26th, Illinois Central, Vine Grove, Ky., northbound passenger train No. 122 was run into at the rear by following freight train No. 14, and the three rear cars of the leading train (a dining car and two passenger cars) were wrecked. Three passengers were killed and 12 injured. The passenger train was running about six miles an hour when it was struck. The freight train had been running at the rate of 25 miles an hour.

xc, 27th, Pennsylvania Lines, Lima, Ohio, an eastbound passenger train ran over a misplaced switch, colliding with a switching engine on the side track; four employees were injured, one fatally.

xc 27th, Atchison, Topeka & Santa Fe, Castle Rock, Colo., a freight train ascending a steep grade broke in two and the rear portion, consisting of 33 cars, ran back down hill and into the head of a passenger train of the Colorado & Southern, wrecking the passenger engine. The fireman of the freight was killed and many passengers were injured.

unf, 28th, Illinois Central, Patoka, Ill., a freight train was wrecked by running into a washout, and the engineman was killed. The fireman was seriously injured.

bc, 29th, 1 a.m., Buffalo, Rochester & Pittsburg, Oscar, Pa., butting collision of freight trains, wrecking both engines and five cars. One engineman was killed and three other trainmen were injured. There was a dense fog at the time. It is said that the southbound train had passed a red signal set against it at Echo.

xc, 29th, 3 a.m., Union Pacific, Ellis, Kan., collision between passenger train No. 101 and a freight which was entering a siding but had not cleared the main track; the engineman of the passenger and two trespassers were killed.

†xc, 29th, Atchison, Topeka & Santa Fe, San Antonio, N. Mex., a northbound passenger train collided with some freight cars which had been accidentally run from a siding on to the main track, and one passenger car was wrecked. One passenger was killed and several were injured.

xc, 29th, Atchison, Topeka & Santa Fe, Kansas City, Mo., collision between a passenger train and a freight; two trainmen killed; two trainmen and one passenger injured.

unx, 29th, Pennsylvania Lines, Atwater, Ohio, an eastbound passenger train running at high speed was derailed and ditched, and the engine and several cars were wrecked. One passenger was killed and several persons were injured.

bc, 30th, Central Vermont, Monson, Mass., a southbound freight standing at the station was run into in front by a northbound freight approaching on a descending grade at uncontrollable speed, both engines and several cars were wrecked. One fireman was killed.

eq, 30th, 11 p.m., Queen & Crescent, Jackson, Miss., an eastbound passenger train was derailed by the breaking of the flange of a wheel of the engine, and the engine and three cars were badly damaged. Seven trainmen were injured.

unx, 30th, Texas & Pacific, Longview, Tex., a car in a freight train was derailed on a high bridge and, with two other cars, fell 60 ft. to the stream below. Two men were killed.

A New Plan for Operating Street Railways in Chicago.

A few weeks ago we discussed editorially Mayor Dunne's proposal of municipal ownership for the Chicago street car lines, and expressed the belief that such a plan was inadvisable in Chicago. This point of view has received rapid confirmation in a message addressed to the Chicago City Council week before last, in which the Mayor abandons any attempt at securing immediate municipal ownership, but offers a contract plan as a substitute. The Council has not yet given this plan consideration, but has adjourned until September 25, so that nothing can be done in the meantime. The plan proposed is printed below in abstract:

1. The incorporation of a company under the laws of Illinois by five persons possessing the confidence of the people, for their personal integrity, their business ability, their pronounced sympathy with the policy of municipal ownership of street-car service. This company to be incorporated for the express purpose of building, acquiring and operating street-railroad lines in Chicago in the interest of the city, and to have the power to issue capital stock to secure the money necessary. The capital stock to constitute the only incumbrance upon the property, and its amount to be limited to the actual cost of the property. Dividends upon the capital stock to be limited to 6 per cent. per annum.

2. The granting by the city council to such company of duly guarded franchises on designated streets between fixed termini for a period of 20 years, at 5 cents car fare, with appropriate transfers, and with a reservation on the part of the city of the right to take over all or any part of such road, at any time, at the price and upon the terms to be contractually specified in execution of this plan.

3. The directors, president and manager of the company to be compensated, until the city takes over the property, with salaries to be approved by the city council.

4. All expenditures, contracts and specifications for the building, or other acquisition of street railroad properties by the company to be approved by the city council before being incurred or executed by the company.

5. During the operation of the lines by this company the city council to have the right at all times fully to inspect its business, and also to reduce fares below the franchise rate to the extent of one half the net earnings of the property, in excess of operating expenses and dividends: all net earnings to be set aside as a purchase fund for the acquisition of the property for the city, or to be used in the betterment of the property, as the city council may from time to time direct.

6. In order to secure to the directors the control of the property and to preserve to the city the unobstructed right at any time to acquire such property in accordance with this plan, the capital stock of the company should be issued in trust to a trust company, to be selected by the directors, with the approval of the city council, which trust company should issue on the basis thereof an equal amount of marketable trust certificates to the company for the purpose of obtaining capital by sale thereof, and hold the capital stock in trust to preserve the control of the aforesaid trustees for the management of the said street-car lines and the consummation of this plan for securing municipal ownership and operation.

The said trust company should be required to sell the stock of the said company, as represented by said certificates, by public subscription, duly advertised. In the event of over subscription it should be required to make allotments in the order of the receipt of subscriptions. In the event of undersubscription the directors should be authorized to contract for the underwriting of the entire offering at a cost not to exceed 2½ per cent., and the chosen trust company and any of the directors should be at liberty to become underwriters.

7. Upon the payment to the aforesaid trust company by the City of Chicago of an amount equal to the cost of the property less the accumulated amount of the sinking fund hereinabove provided for the said trust company should be required by the preliminary contracts to use said sum so paid, together with said sinking fund, in such way as to redeem all outstanding certificates issued by it, upon the security of the capital stock of said proposed street-car company, and to use the said capital stock held by it in trust in such way as to transfer all the street railroad property of the said street-railroad company immediately to the City of Chicago, for direct municipal ownership and operation.

Railroad Shop Tools.

(*Continued.*)

LATHES.

The accompanying illustration, Fig. 1, shows a new 16-in. engine lathe made by the Fosdick Machine Tool Company, Cincinnati, Ohio, as fitted with compound rest and Emmes' patent feed box. These machines are made in 6 ft., 8 ft., 10 ft. and 12 ft. lengths, with cabinet or regular legs, and can also be fitted with oil pans when desired. The spindle bearings are 2¾ in. and 2⅛ in. in diamter and a 1¼ in. hole is provided in the spindle. The spindle bearings are bushed with bronze and constant lubrication is provided by an endless chain and large oil pockets. The machine is strongly made and if desired a three-step driving pulley may be used in place of the five step cone, thus insuring a more powerful spindle drive as required for high speed steel work. The carriage has wide and long bearings on the shears and the apron is of box section, which insures strength and stiffness. The taper attachment is of an approved design and is easily applied. All screws necessitating adjustment can be operated by the tool post wrench. The general dimensions of the 16-in. machine shown in the illustration are as follows: Swing over bed 16¼ in.; swing over carriage 10¼ in.; 6 ft. bed takes 34 in. between centers; face of five-step cone pulley 2⅝ in.; face of three-step cone pulley 3⅜ in.; weight 2,000 lbs. Friction counter shafts are furnished with each machine. These are provided with self-oiling bearings and the friction pulleys are provided with large oil wells. The counter speed for five-step cone is 120 r.p.m. and for the three-step cone 250 r.p.m.

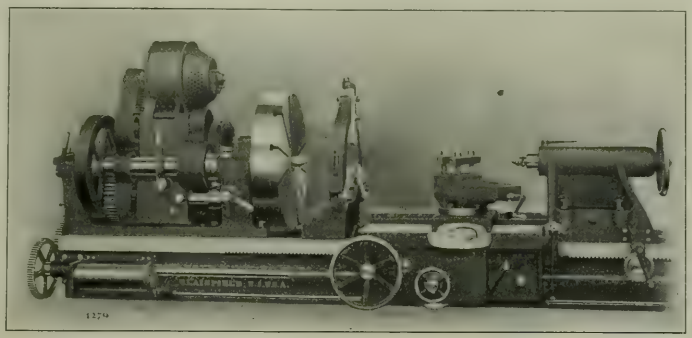


Fig. 2—Niles-Bement-Pond 42-in. Engine Lathe.

The 42-in. engine lathe shown in Fig. 2 is made by the Niles-Bement Pond Company, New York. This machine is driven by a 15 h.p. motor, which is controlled by a handle attached to the lathe carriage. The motor has a slight speed variation by means of field control. The machine will swing 43 in. over the bed and 34 in. over the carriage, and fitted with a 16-ft. bed it will turn 7 ft. between centers. The spindles are of hammered steel and the face-plate spindle is mounted in bronze bearings. The tailstock has a set over for taper turning and is adjusted by gearing engaging in the steel feed rack, as shown. The bed is made wide, so that the tool-slide will not overhang when turning the largest diameters. The carriage has long bearings on wide flat tracks, but if desired V tracks can be furnished. It is gibbed to the outside edges of the bed and can be securely clamped in position when cross feeding. It is provided with a tool-slide having compound swiveling movements; also with screw-cutting attachment and automatic-friction longitudinal and cross-feeds. If either of the feeds or screw cutting attachment is in use it locks out all the others. The direction of the feeds can be changed at the carriage and the screw-cutting attachment and the feeds are connected to the live spindle by three gears and a sliding-key, giving three changes without changing gears. The carriage-gearing is driven by a spline in the steel lead-screw, the thread of the lead-screw being used only for screw cutting. The gear engaging the feed rack can be disengaged when cutting screws, thus preventing any uneven motion that might be caused by revolution of the feed-gearing.

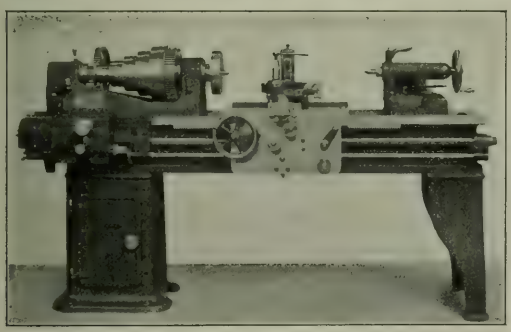


Fig. 1—The Fosdick 16-in. Engine Lathe.

PLANERS.

Fig. 3 shows a 36-in. x 36-in. switch and frog planer made by the G. A. Gray Company, Cincinnati, Ohio. This machine was designed for the heaviest kind of switch and frog work and its characteristic features are its great power, weight and stiffness. The bed is 2 ft. deep, and is strongly cross-ribbed by box girders. The table is 32 in. wide and is gibbed underneath, both on the front and rear sides, to prevent direct lifting. In addition to the gibs the table is provided with vertical inside bearings extending its entire length. These counteract the side thrust, thus making it impossible to lift the table even under the heaviest cuts. The housings are of box form and are 10 in. wide at the cross rail bearing, thus giving ample rigidity to resist the strain of the side tools which are used almost exclusively in frog and switch work. The cross rail is 18 in. wide, and in addition to being very deep and stiff is "double-gibbed"; that is, it is fastened to the housings not only by the regular set of gibs, which grip the housings at the outside, but also by an additional set of gibs, which are bolted to the inside flanges. The cross rail elevating gear is provided with ball-bearings, thus insuring ease in operation. The saddles are made right and left-handed and each has a bearing of 24 in. on the cross rail. The tool boxes are 11 in. wide and are provided with two steel clamps and 1¼ in. bolts for holding the tools. A positive locking device is attached to the shifter-lever, which prevents the belts from accidentally starting the table. The gearing and rack are of crucible steel, cut from the solid. The bull-wheel and rack are 9 in. face and 2 in. pitch. The pulleys are of large diameter and wide face and the locking pulley as regularly furnished gives a quick return of 4 to 1. The automatic feeds are all positive and independent in action. Conical rollers keep the Vs well oiled and all oil holes are threaded and covered with brass knurled-head plugs. This machine is self-contained, thus no expensive foundation is required, as there are no outside bearings requiring independent support. These machines are made in lengths from 8 ft. to 20 ft.

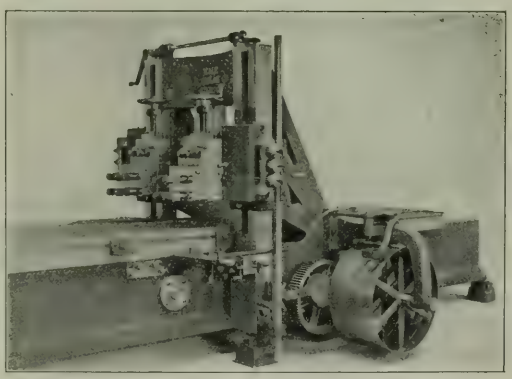


Fig. 3—The G. A. Gray Co.'s Special Switch and Frog Planer.

(*To be continued.*)

Tests of Riveted Joints.*

The Committee on Iron and Steel Structures appointed by the American Railway Engineering and Maintenance of Way Association made extensive tests of riveted joints with a view to ascer-

*Extract from Bulletin No. 62, issued by the American Railway Engineering and Maintenance of Way Association, April, 1905.

taining their behavior under strain. The material used for the punched rivets which were tested was basic open hearth steel of a quality in accordance with the specifications for materials adopted by the Association. The rivet holes were punched with a punch $^{15}/_{16}$ in. in diameter in a die 1 in. in diameter. No reaming was done before the rivets were driven, except such as was necessary to get fair holes. The contact surfaces were painted with graphite paint and the rivets had a diameter of ⅞ in. before they were driven. They were driven with a stationary pressure riveter operated by compressed air, direct, during the first part of the stroke of the up setting tool, and by compressed air acting on a piston in an oil chamber back of the up-setting tool toward the end of the stroke, exerting a pressure of about 70 tons on the rivet. Five specimens of 18 types of joints were tested, making 90 specimens in all. The specimens were furnished by the North Works of the Illinois Steel Company and the tests were made by the College of Civil Engineering, Cornell University. From the observations and results of these tests the following conclusions were drawn by the committee:

(1) That the resistance of a riveted joint against deformation by shearing forces, up to the yield point, is due to the friction between the surfaces held in contact by the rivets.

(2) That the yield point of a riveted joint is reached when the shearing forces are equal to the friction of the surfaces held in contact by the rivets.

(3) That the deformation of a riveted joint at the yield point is caused by the slipping on each other of the surfaces held in contact by the rivets, and is due to the diametral contraction of the rivets in cooling after they are driven, which leaves a space between the body of the rivet and the edge of the rivet hole.

(4) That after the slip at the yield point has occurred and the rivet is brought to bear against the edge of the rivet hole, a deformation of the body of the rivet takes place with an accelerating increase in the resistance until the entire side of the rivet has been brought to bear against the edge of the rivet hole, and that the deformation continues beyond this point with a diminishing increase in the resistance until the ultimate strength of the rivet in shear has been reached and the breakdown occurs.

(5) That lap joints, on account of the unsymmetrical distribution of the material, deflect sideways under strain, throwing the rivets in tension, and thereby reducing the shearing forces between the surfaces held in contact by the rivets.

(6) That fillers inserted between the main plates reduce the strength of a riveted joint, but that the full strength can be obtained by connecting the fillers to the main plates by additional rivets.

(7) That the number of rivets connecting the fillers to the main plates should, for each intervening filler, be about one-third of the number of rivets required in a similar joint without fillers, to obtain the same strength in both cases.

(8) That the strength of a riveted joint with rivets of larger grip than about four times their diameter is decreased, as the length of the grip is increased.

(9) That the number of rivets, in a riveted joint with larger grip of the rivets than four times their diameter, should be increased at least 1 per cent. for each one-sixteenth of an inch increase in the grip above this length, to obtain the same strength as a similar joint with the grip of the rivets shorter than four times their diameter.

(10) That a riveted joint, subject to forces always acting in the same direction, may safely be strained beyond the yield point up to a point where the rivets are brought to bear against the edges of the rivet holes.

(11) That a riveted joint, subject to forces alternating in opposite directions, may not safely be strained up to the yield point.

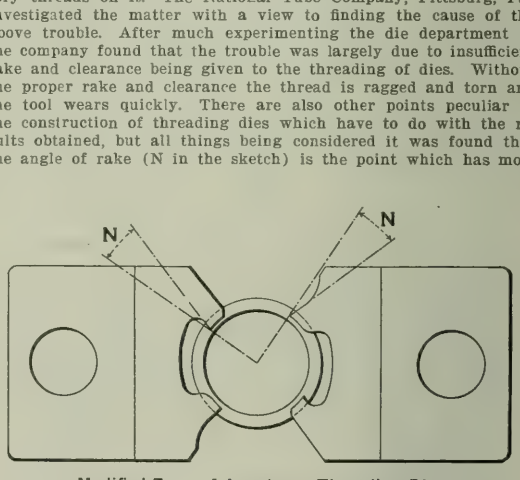
(12) That, to obtain a minimum slip at the yield point, it is necessary that the holes in the connected pieces should thoroughly match and that the driving tool should upset the rivet throughout its length so that it will thoroughly fill the rivet hole.

Obstacles to a Mexican Trans-Continental Line.

In spite of the influx into Mexico of American capital and engineers and the large developments which have resulted, there is as yet no railroad line in Mexico north of Mexico City which connects the Gulf of Mexico with the Pacific Ocean. The Mexican Central and the National Lines of Mexico furnish satisfactory north and south connections between the United States and the most important cities of Mexico, including the two principal ports on the Gulf, Tampico being reached by the Mexican Central and Vera Cruz by the National Railroad of Mexico. But the difficulties of getting to almost any point on the Pacific Coast are very great. The railroad journey, for instance, from Guaymas, on the Gulf of California to Chihuahua, distant 245 miles by an air line, is 1,033 miles long. One must go straight north from Guaymas by the Southern Pacific's Sonora Railroad to the Southern Pacific main line in Arizona, then travel east over the Southern Pacific through Arizona and New Mexico to El Paso, Tex., and from El Paso go south again 363 miles by the Mexican Central to Chihuahua, the capital of the state of Chihuahua. This is going around three sides of a square instead of one. It is therefore likely to be an easier and quicker trip to traverse by pack mule the 275 miles east from Guaymas over the plateaus and mountains to the inland capital. The tremendous difficulty of crossing the Sierra Madre mountains, which stretch practically the length of the country from 70 to 250 miles east of the Pacific coast, has heretofore prevented the building of a transcontinental line in northern Mexico. The Mexican International not long ago built an extension to the city of Durango in order to tap the rich mining country in that province. This road was built up to the edge of the Sierras, but as yet there have been nothing further than surveys for its direct extension to the Pacific. This, however, is understood to be the ultimate intention of the company. Instead of keeping on directly west the road as built turned sharply to the northwest at Durango and ran to Tepehuanes in another important mining district in Durango province. By building an air line less than 125 miles long from Tepehuanes through the mountains to meet the line of the Western Railway of Mexico, which runs from Altata on the Pacific Coast 38 miles inland to Culiacan, the Mexican International would reach the Pacific. This connection it is practically out of the question to build, as at this point the mountains are so high that the grades would be prohibitive. Nor can these grades be avoided by tunneling unless the company is willing to build tunnels for almost the whole distance, which would of course make the line far too expensive to be practicable. In the south, directly west of the City of Mexico, the Mexican National Construction Company's line runs from Manzanillo, on the Pacific Coast of the province of Jalisco, to Colima. The Mexican Central now has an option on this road whose terminus, Colima, is only about 40 miles distant from Tuxpan, the end of the Mexican Central's Zapotlan branch. Contracts are reported to have already been let by the Mexican Central for filling in this gap and if the option on the Construction Company's line is exercised, that road will soon have a through line from the Atlantic to the Pacific Ocean. In the north it looks as though the Kansas City, Mexico & Orient, which has taken over the Chihuahua & Pacific, would furnish the connection for the first trans continental line. The Chihuahua & Pacific runs in a general southwesterly direction from Chihuahua to Minaca, and the Kansas City, Mexico & Orient is to run in the same general direction from Presidio on the Texas border to Port Stilwell (Topolobampo) on the Pacific coast south of Guaymas. The road is in operation from Topolobampo northeast to El Fuerte, 62 miles, and construction is under way on several other parts of the line. Thus, in spite of all the difficulties of mountain railroad building which lie in the way of a Mexican railroad to the Pacific, there are several projects under way to build such a line, and it seems pretty certain that before many years there will be more than one rail connection through northern Mexico between the two oceans.

Cutting Threads on Steel Pipe.

Since the introduction of modern weldable Bessemer steel for pipe considerable trouble has been experienced in cutting satisfactory threads on it. The National Tube Company, Pittsburg, Pa., investigated the matter with a view to finding the cause of the above trouble. After much experimenting the die department of the company found that the trouble was largely due to insufficient rake and clearance being given to the threading of dies. Without the proper rake and clearance the thread is ragged and torn and the tool wears quickly. There are also other points peculiar to the construction of threading dies which have to do with the results obtained, but all things being considered it was found that the angle of rake (N in the sketch) is the point which has most



Modified Form of Armstrong Threading Die.

to do with efficiency, and is also the feature which is generally overlooked in the tools commonly supplied to the trade. A properly designed die is particularly necessary for threading soft steel pipe, but at the same time a correctly shaped die will work to better advantage on iron pipe than one improperly made, as truer threads and consequently tighter joints will be the result as well as lower cost of threading and less damage to the pipe and dies. A die to work properly and to give a clean true thread must have the proper amount of rake, as shown in the illustration; the chasers must be rigidly held and controlled close to the work with a due regard to chip room, and sufficient lubricating oil must also be employed. The following angles between a line through the center of the pipe and the cutting face of the chaser at the point of contact with the pipe, are given by Frank N. Speller, Metallurgical Engineer, of the National Tube Company, to whom we are indebted for the above information, as giving the best results in practice.

Size.	Angle N.	Size.	Angle N.	Size.	Angle N.
1-inch....	26 degrees.	4-inch....	23 degrees.	10 inch...	20 degrees.
2-inch....	25 "	6 inch....	22 "	12-inch...	18 "
3-inch....	25 "	8-inch....	20 "		

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 4. FRIDAY, JULY 28, 1905.

The progress of the block system in America has now reached that encouraging stage where a railroad introducing it issues an illuminated gratulatory circular apprising the public of the fact. The Southern Railway has just done this. The circular has half-tone pictures of a signal, a cabin, a fast train, and other things, and says:

> To accelerate the schedule performance and improve the service of passenger trains we are happy to announce that block signals of the most modern type, have been installed and are now in operation over the entire line between Washington and Atlanta. . . . The block system is also being installed on other parts of the system as rapidly as possible. . . . The most improved interlocking switch and signal apparatus has been installed at passing tracks, yards, and all grade-crossings, thereby greatly facilitating the handling of all trains.

No improvement in American railroad service is a more fitting subject for emulation, and it is to be hoped that many others will appreciate their opportunities as well as has the Southern. When the *Railroad Gazette* began preaching the virtues of the block system, 30 years and more ago, the most that American railroad men did in response to the preaching was to admire England—when they could spare the time from their regular duty of admiring the beauties of the "American despatching system." Then one road introduced the Sykes system, and two or three put in some automatic signals—both kinds being looked upon by most people as luxuries, to be enjoyed only by roads which were both bold and wealthy. The Pennsylvania, meantime, was using the simple telegraph block system, but not saying much about it. After some years of slow progress the Canadian Pacific adopted the space interval throughout its lines, but very incompletely and for passenger trains only. This also was published only in the most modest way; but after many long years it began to be recognized that a road need not wait until it was overcrowded with traffic before using block signals, and progress became quite rapid. One or more roads have on occasion bought whole newspaper pages in which to exploit with more or less close adherence to accuracy their more or less imperfect block signals; and various clumsy artists have illustrated colored folders with fearful and wonderful pictures of semaphores shaped in all degrees of deformity and giving an amusing variety of false indications. Passenger agents have in their admirably refined language told of impossible "automatic switches" with which they hoped to reassure prospective customers.

Looking back on these abortive efforts, the Southern Railway is to be commended for straightforwardness of statement; although the absence of any electrical controlling apparatus on its manual signals leads one to question the propriety of the use of superlatives. From certain comments which have appeared, we judge that some people will find difficulty in reconciling the present statement of the Southern Railway with the statement published in the *Railroad Gazette* for two years past, that that road had block signals on 6,260 miles of its lines; but those people evidently have overlooked the explanatory note which showed that these signals were used only for passenger trains. Moreover, they are used only for rear protection, leaving the chances of having butting collisions as numerous as before, except as the operators, communicating regularly with each other about trains running in the same direction, may thereby be made more careful in guarding against errors in the regulation of opposing train movements. The most hopeful view to take concerning this kind of block signaling is that it is pretty sure, by its satisfactory results, to lead the progressive railroad manager after a time to introduce more perfect methods.

The paper on "Slow Freight Rates in India," by Mr. William A. Dring, General Traffic Manager of the East Indian Railway, printed in this week's paper, brings out strikingly one phase of the evil which results from governmental control of rates. In 1903 there was a railroad mileage of about 26,955 in India, with gross receipts per mile of some £891. The railroads, generally speaking, are the property of the state, and are worked either directly by the state or by companies constituted for that purpose. These companies are paid for their services by means of a small share in the net profits. The way in which the government controls the rate is by laying down maxima and minima, the maximum rate on low-grade commodities being ½ pie per maund per mile; or, say, 1.38 cents per ton of 2,000 lbs. per mile. The minimum low class rate is 1/10 pie per maund per mile; say, .42 cent per ton-mile. Mr. Dring's complaint in brief is that the government requires the railroads to charge too much for their own and its own profit, and that the inflexibility of the minimum charge system hurts traffic greatly. On ordinary commodities there is no regular differential treatment of rates; that is to say, there is no graduated reduction, as is the case in France, in accordance with the length of the haul, but in place of this a series of station-to-station tariffs has grown up much as is the case in this country. Coal, however, has recently been given a differential scale, as it is termed. There have been two reductions in the scale of coal rates during the last fifteen years. Before the first reduction British coal was imported in Calcutta in considerable quantities, although coal of good quality was being mined within 130 miles of this port on direct railroad lines; while

such a thing as exporting coal from Calcutta was unknown. In other words, the government deliberately—or heedlessly—throttled its most important traffic by trying to make too much out of it. The solution which Mr. Dring suggests for the future is based partly in the reduction of this minimum rate of the present time, and in part on a differential system. The system suggested is that a line which is cheap to work shall be allowed to charge a lower rate than one which is expensive to work; that is to say, that the minimum rate which may be quoted by the different systems shall be based on operating cost. It is hardly necessary to point out that this is quite at variance with the American idea of a differential between lines. A line which is cheapest to work is apt to have such natural advantages in carrying low class freight that it not infrequently happens that the lines which cost more to work and which cannot give quite so good a service are the ones allowed to charge a lower rate, simply for the sake of getting a share of the traffic which they would not otherwise receive. The discussion leads around to the conclusion, often expressed in the *Railroad Gazette*, that there is no arbitrary, mechanical way of fixing freight rates, and the less restriction that is placed upon those who are concerned with making them, the better the results are likely to be, at least so far as moving traffic is concerned. In Mr. Neville Priestley's report on the organization and working of American railroads, he calls attention to the fact that while he was in this country the rate on grain was reduced from Buffalo to New York (and correspondingly to all other ports) from 4½ to 3½ cents per bushel of 60 lbs., as the traffic could not be moved at the former rate. He argued that this reduction of 1/120 of a penny per pound in the cost of rail transportation could not possibly have affected in any way the price of a penny loaf, yet without it the traffic was at a standstill, and with it some other market was shut out. He added that in India little attention is paid to the effect of rates on foreign markets, and he was under the impression that the grain rates from Delhi to the ports had not been changed for the past fifteen years, the effect of which could be seen in the violent fluctuations which take place in the Indian wheat trade. Mr. Priestley, on another page of his report, contrasted, to the advantage of our system, the American method of making income by small profit per unit and large volume, with that of the Indian railroads, which make their income by large profits per unit and small volume. Both these commentators on the situation in India lay the blame on the inflexible minimum rates established by the government.

THE UNION PACIFIC DIVIDEND.

Twelve years ago the Union Pacific went into the hands of a receiver, and eight years ago passed through foreclosure sale. On Thursday of last week a semi-annual payment of 2½ per cent. on its common stock was announced, which is understood to definitely place the stock on a 5 per cent. basis. In October of 1893, when receivers were appointed for all the roads under Union Pacific control, the Union Pacific system was an unwieldly aggregation of bankrupt railroads operating nearly 8,000 miles of line in what was then the very far West. When the receivership came on, five of the controlled companies, with a total of nearly 2,000 miles of line—the Union Pacific, Denver & Gulf, Denver, Leadville & Gunnison, Fort Worth & Denver City, Kansas City & Omaha, and the St. Joseph & Grand Island—were segregated from the system; the three former to become in 1899 the present Colorado & Southern; the Kansas City & Omaha to be absorbed by the Burlington, and the St. Joseph & Grand Island to remain up to the present time an independent road. The foreclosure sale came in 1897, and in that year the Oregon Short Line was also separated from the system, though with the arrangement that control should remain with the new Union Pacific company. The Oregon Short Line then, as now, owned a majority of the common stock of the Oregon Railroad & Navigation Company. The controlling interest in that company, however, was held jointly by the Great Northern, Northern Pacific and Union Pacific, through control of the preferred stock.

Not only was the old Union Pacific thus split and sundered, but the 1,850 miles of line assumed by the reorganized company were in every respect in thoroughly bad shape. Equipment was out of date and repair; forces were disorganized, and, in particular, the railroad's right of way itself was, as we think of through railroads to-day, practically a railroad only by courtesy. Curves and gradients were almost uniformly severe, rails and roadway were even more run down than is usual after a receivership, and in many cases the original location of the first transcontinental railroad had proved thoroughly unsatisfactory for heavy operation. In 1897 the Union Pacific was more of a possibility than a railroad.

The new management evidently saw clearly the possibilities and knew what makes a railroad. With unlimited faith in the future and an unsparing hand they spent money for improvements. New equipment and new men came to the Union Pacific. The roadway received thorough attention. Between March 1, 1899 and November 1, 1900, there were begun, finished and put in operation nine changes of line, amounting to a practical relocation and reconstruction of the main line through Wyoming. On this section alone, 159 miles of entirely new line were built in the period mentioned. This involved the actual abandonment of 198 miles, or 38 per cent. of the old main line between Cheyenne and Ogden, the saving of 30 miles in distance; of, in one case, 54 ft. to the mile in grade, and of 6,867 degrees in curvature. The system was at the same time expanded by the purchase of a large number of branch lines, many of them without the issue of additional securities, although no provision for buying them was made in the reorganization plan. Between June 30, 1898 and June 30, 1901, the directly operated mileage increased from less than 2,000 miles to over 3,000 miles of line. More than 96 per cent. of the capital stock of the Oregon Short Line had been acquired in 1899 and entire control of the Oregon Railroad & Navigation Company was also secured. The Southern Pacific owned the Central Pacific, which was the Union Pacific's western connection to San Francisco. In 1901 control of the Southern Pacific was acquired. The Union Pacific now owns or controls over 15,000 miles of line. Nor did reconstruction work end with 1901. Since that time similar and more extensive work has been carried on not only on the Union Pacific itself, but on its owned and controlled properties. The famous Ogden-Lucin cut-off is typical of the large expenditures in shortening, straightening and improving the main line.

Dividends were begun in 1898 by a payment of 1½ per cent. on the preferred stock. This was increased in 1899 to 3½ per cent. and in 1900 to 4 per cent., at which rate it has remained ever since. The first payment on the common stock was of 3½ per cent. in 1900, since which time 4 per cent. has regularly been paid on this stock also. Even when the common stock shall be increased to $196,000,000 by the conversion of the total issue of $100,000,000 convertible bonds and regular payments on the mysterious and as yet unissued increase of $100,000,000 in the preferred stock recently authorized shall be called for, the increased rate of payment on the common stock seems likely to be only a step in the upward progress of one of the greatest of our American railroads.

A NEW TRANS-CONTINENTAL COMPETITOR.

According to recent advices, the Tehuantepec Railroad, from Salina Cruz on the Pacific to Coatzacoalcos on the Gulf of Mexico, 180 miles, is about completed, and it is thought that within a year the harbors and wharfage for the landing of steamers and transfer of freights will be finished. Mr. E. L. Corthell described the interesting history of this project and gave an account of the building of the road in the *Railroad Gazette* of July 15, 1904. After a series of vicissitudes and many years of inaction following the early efforts to build a railroad across the Isthmus of Tehuantepec the Mexican Government entered into a partnership contract with T. Pearson & Sons of London in 1898. This contract was amended in 1902 and the partnership was given the name of the National Railroad Company of Tehuantepec. The contractors are the administrators or managers of the company's affairs. They believe that the Tehuantepec route will be in complete operation fully eight or ten years before the Panama canal can be, and they expect it to have an important part in reducing the time of slow transcontinental freight, some of which now goes by rail, some via Panama, and some through the Straits of Magellan.

Announcement has just been made that the American-Hawaiian Steamship Company, now operating a fleet of steamships from San Francisco and Hawaii to New York through the Straits of Magellan, has concluded a contract with this Tehuantepec road for the operation of connecting steamship lines on both the Pacific and Atlantic sides, and will use the seven vessels now operated in its service in addition to two new ships about to be built. The company expects to afford a service of 25 days by the new route as against the 35 or 40 days now taken to transport freight between New York and San Francisco by way of Panama and approximately three weeks for slow freight by rail lines across the continent. (The average time by the Southern Pacific, which trans-ships into steamers at Galveston, is in the neighborhood of 17 days.) In view of

this interesting development it is worth while to review the general situation as regards transcontinental freight at the present time. By a rough esimate, which is probably not far from correct, about one-eighth of the total freight business of the Atchison, Topeka & Santa Fe is trans-continental, and presumably some such proportion would apply on the other main trade lines across the continent. Without attempting any close calculation where no statistics are available, it may be that 10,000,000 tons of freight are hauled between the Pacific coast and the East (the Mississippi river, or points east of it) every year. Citrus fruits constitute the largest single item of trans-continental freight, though they do not predominate against the field. This kind of traffic, of course, will always go by rail, together with a great amount of other freight that is urgent or valuable. The average time for through freight from San Francisco to Chicago is in the neighborhood of eight days for perishable goods of this class, and the railroads need never fear the competition of the Panama canal or any other water route or part water route on a good proportion of the trans-continental business that they do. So far as slow freight is concerned, there has always been water competition around the Horn and through the Straits of Magellan, while the Panama Railroad has also carried a small share; but as the entire business of this road in 1903 amounted to less than 350,000 tons, it is evident that it has needed but little consideration in the past. Whether or not it had special inducements to keep its freight rates high is a disputed point.

For some time there have been three steamship services from New York to points on the west coast of South America. One of these, the American-Hawaiian Steamship Company, already referred to as the holder of the new contract, has despatched its steamers, which our shipping laws require to be American, from New York through the Straits to San Diego, San Francisco and Honolulu. The service has been approximately monthly in each direction. Two other lines, known respectively as the Merchants' Line and as the West Coast Line, send steamers from New York around to Chile, Peru and Ecuador through the Straits. From New York to Punta Arenas in the Straits of Magellan, by the most direct navigable route the distance is not far from 6,390 nautical miles, and from Punta Arenas to Guayaquil, Ecuador, is 3,316 nautical miles, while San Francisco is 3,608 miles beyond Guayaquil. Including sailing vessels, probably half a million tons, at the very outside, covers the sea-borne freight per year. That for San Francisco has to traverse approximately 13,300 miles in its journey from New York, and the trip takes upwards of two months, at best. By the Panama route, the total sea distance is 5,200 miles; by the Tehuantepec route, it is 4,290. The Tehauntepec Railroad, therefore, feels that it can compete for rail freight, for Straits freight and for Panama freight bound from the Atlantic coast to the Pacific coast of North America, besides the freight which formerly rounded Cape Horn on its way from west American and Oriental ports to Europe. This project has attracted comparatively little attention during the Panama agitation, but the recent notice of the ship contract shows that the Mexican route is about ready to begin operations, and to demonstrate whether or not the great hopes of its promoters are going to be realized, in whole or in part.

The war in passenger rates eastbound from Chicago which was begun by the reduction of $2 in the first class fare through to New York by the Michigan Central, does not progress with great speed, but it seems to be characterized by considerable persistency. Following the reduction from $20 to $18 by the Michigan Central the Grand Trunk made the rate $16. The M. C. then took off $2 more and now the Grand Trunk announces a rate of $14. The other differential lines follow each move, more or less closely. The reduction has now become so large that unless some one of the principal participants is bold enough to call (and actually secure) a prompt conference, serious demoralization is likely to ensue; for passengers from all over the country west of Chicago will want to take advantage of the saving, and the work of restoring the rates will be slow and difficult. The scalpers, too, will be likely to come in for a share of the spoils. When rates are changing every few days the passenger manager who refrains from calling these lawless outsiders to his aid must have a rigid backbone. Why the Michigan Central ever started this contest is somewhat of a mystery to the outsider. The arbitrators very wisely published nothing about their reasons for deciding in favor of a reduction, and nothing has been given out except that the Detroit ferry is a hindrance to first class service. It is no worse hindrance, however, than it has been for the past 50 years. The Michigan Central may have lost business because of the opening of the Wabash line to Buffalo or because of the through car arrangements of the Lehigh Valley, and other improvements which have favored other lines between Chicago and Buffalo; but why should these other lines now be made to reduce fares on this new business that they have got, as a penalty for having got it? Probably they can reply to the Michigan Central's appeal with the assertion that the passengers lost by it have been taken largely by a competitor in its own household—the Lake Shore—but whether that will have any weight with an arbitrator, is another question. Evidently it has thus far had no weight at all. One of the reasons mentioned by the reporters for making the Michigan Central a differential line is the fact that the Pennsylvania has a differential line between Chicago and Pittsburg—the Pan Handle; but with the Nickel Plate the New York Central now has two. Fortunately, the discussions and negotiations thus far—that is say, the arbitration proceedings—have not broken the law (though they were intended to regulate competition) for they have resulted in some benefit to the dear public; but when the time comes for restoration, look out for the Sherman law!

NEW PUBLICATIONS.

Plumbers' and Fitters' Pocketbook. A Reference Book on Plumbing, Steam Heating, Hot Air Heating, Hot-Water Heating, Ventilation, Gas-Fitting, Drainage and Sewerage. Scranton, Pa.: The International Correspondence Schools. 1905. Leather, 375 pages.

This little book, the first of the sort to be published, will undoubtedly fill a long-felt want in the field for which it is intended. The publishers explain that they have not tried to produce a condensed encyclopedia of the art and practice of the subjects dealt with, but have striven to anticipate the daily wants of the user and to give the information in the manner best suited to his needs. As an evidence of the care employed in doing this, wherever a rule, formula or process is given, only one is presented and not several from which to select, which often confuses the user. Of course, in each case of this sort whatever formula, etc., is given is the one which in the judgment of the compilers is the best suited to the needs of the case.

The first quarter of the book contains engineering data of the sort usually found in all such reference books. The rest of the book is about equally divided between heating and ventilation and plumbing. Both sections contain a large amount of useful information, concisely presented, but simple, and fully illustrated where necessary. The index is quite complete, covering 44 pages.

TRADE CATALOGUES.

The General Railway Signal Company, of Buffalo, N. Y., has issued a new catalogue and price list of electric interlocking, much larger and more elaborate than anything published by the company before. It is a book 6 in. x 9 in., of 314 pages, and everything made by the company, in the department named, is illustrated to the last detail. The descriptive matter contained in the company's first catalogue is omitted, the editor assuming that the principles of electric interlocking are now familiar to engineering and railroad men. The order numbers, which run from 02 to 18,003, are indexed at the end of the book, and there is also an index to pattern numbers with the corresponding order number. Electric interlocking is now in use on 41 different American roads, and a list of these roads is given. The Atchison has 16 plants; the Baltimore & Ohio, 15; the Lake Shore, 15, and the Southern Pacific, 10. The number of all-electric plants installed or contracted for in the United States in 1904 was 80; this was more than twice the number installed in any preceding year, and the same is true of each year's output since 1900.

Industrial Locomotives.—The Davenport Locomotive Works, Davenport, Iowa, is publishing a series of pamphlets describing the industrial locomotives which it makes. Two already have been issued, being devoted to Forney rear tank and to saddle tank types respectively. The pamphlet gives, in addition to an illustration and the principal dimensions, the tractive power and the hauling capacity on different grades. There will be about 12 pamphlets in the series and they will be furnished to any one interested in the subject with which they deal.

Concrete.—The Municipal Engineering & Contracting Co., Chicago, sends an interesting pamphlet entitled "Instructions to Agents." This pamphlet was published for distribution among the company's agents, so that they might be better prepared to talk to prospective buyers of the "Chicago improved cube concrete mixer." It explains in detail the construction and operation of this mixer and also gives interesting data in regard to concrete work, including figures as to approximate and actual cost of concrete per yard as made under varying conditions.

Ideal Power, the monthly magazine of the Chicago Pneumatic Tool Co., has for its leading articles this month "The Erection of the New Amsterdam Theatre, New York," "A Million Volts Current," being an account of the passage of electric currents of high

tension through the bodies of experimenters; "Industrial Europe," the second installment of a series by Lieut. Godfrey L. Carden, and "An Electrical Giant," which is a mammoth lifting magnet exhibited at the recent International Electrical Exposition in Boston.

Steam Turbines.—The De Laval Steam Turbine Co., Trenton, N. J., sends an interesting pamphlet descriptive of the De Laval steam turbine. A brief sketch of Dr. De Laval, the inventor of the turbine, is given as well as numerous views taken in the company's shops and offices at Trenton.

Renold Roller Chain.—The Link-Belt Engineering Co., Philadelphia, Pa., sends an interesting catalogue and price list of its "Renold" roller chain. Detailed illustrations showing the construction of the chain are given and the advantages to be derived from its use are tersely explained.

Pneumatic Hammers.—The Ingersoll-Sergeant Drill Co., New York, sends its catalogue, Form No. 6, which describes and illustrates in detail the Haeseler "axial valve" hammers, made by this company.

Springs.—The American Spring & Supply Co., New York, sends a neat little folder descriptive of its springs, including extension, compression and tension springs of all descriptions.

CONTRIBUTIONS

Disadvantages of the Railroad Clearing House Plan.

Chicago, Ill., July 23, 1905.

To the Editor of the Railroad Gazette:

The accounting officers of American railroads being familiar with clearing house needs and practices, and also with our method of settling interline accounts, thought that it was only necessary to explain the latter to demonstrate the uselessness of the former; that a clearing house would be at once an expense and a hindrance. It seemed to them to be only necessary to explain the simplicity, economy and effectiveness of present methods to demonstrate the inadvisability of any change. Hence the paper prepared by the American Railway Accounting Officers at their recent meeting in New York. Argument appeared to be unnecessary. The proposition of a clearing house was as if a specialist, looking for something to do, should propose to operate on a man in robust health. The accounting officers naturally thought it was only necessary to point out that the railroads were sound in both body and method, and needed no doctoring. They, therefore, caused to be prepared a clear and concise statement of the manner of settling interline accounts between railroad companies.

No advantage, it is apparent, either great or small, can be gained by the institution of a clearing house—or rather, a group of clearing houses; for it would manifestly need several, for the results of their work would have to be consolidated in still another or central clearing house.

The paper of the American Accounting Officers puts the case concretely, and in doing so demonstrates that a system of clearing houses is unnecessary in America and would occasion delay in the adjustment of accounts and, by duplication of work, long distance correspondence, and other hindrances add greatly to the present cost. It is impossible to point out a single advantage that clearing houses would have over present methods. The errors and omissions that have to be adjusted in settling interline accounts now occasion no delay or inconvenience in arriving at cash balance, as the companies interested have all the original records and facts at first hand to enable them to quickly right inaccuracies or omissions in their reports to each other.

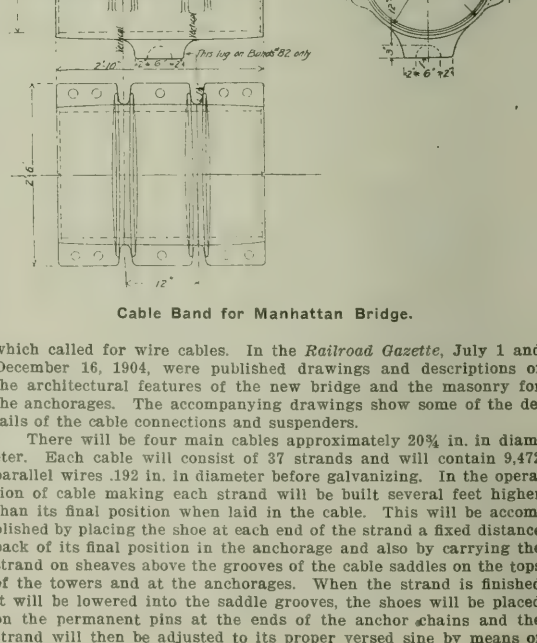
Balances (i. e., amounts due the creditor company) are based on the original statements exchanged between the railroads, and sight drafts are at once made therefor. If there are errors or omissions they are pointed out to the company at fault and the amount is added to or deducted from the next month's return. And while settlements between railroads are now made monthly they may be made daily or weekly if desired, with little or no additional expense.

It is obvious that if we had clearing houses the same returns would have to be made thereto that are now made to the companies interested; and with the same attendant errors. To correct the latter much long distance correspondence back and forth by the clearing houses would be required, involving interminable delay and expense. And if balances were not paid by the central clearing house until all the accounts were settled (so that one check would suffice as claimed) the railroad companies would not get what is due them for a year or more after the month's business was closed. As it is now, balances are struck as soon as the accounts are exchanged and the creditor company makes draft for the same. Thus, to illustrate, the accounting officers of the Burlington or North-Western collect, within 30 days, all balances due their companies for freight, tickets, extra baggage, car service and other interline accounts, and at a cost not to exceed $12 per month! On the other hand the correspondence and multiplicity of reports that would intervene if the work were done by clearing houses in settling the vast and intricate interline accounts of these companies would exceed such sum a thousand times, to say nothing of the delay and entanglements that would arise from the absence of original records and personal knowledge of the facts.

The paper prepared by the Association of American Railway Accounting Officers, referred to above, explains clearly the present method of settling interline railroad accounts. It shows, incidentally, that clearing houses are unnecessary and would involve not only great delay in settling cash balances but add immensely to the cost, to say nothing of the inconvenience and embarrassment to the companies interested of having their affairs taken out of their hands and delegated to third parties acting arbitrarily and in a purely perfunctory manner. RAILROAD ACCOUNTING OFFICER.

Cables for the Manhattan Bridge.

The Department of Bridges of the City of New York has issued the contract drawings and specifications for the superstructure of the Manhattan Bridge over the East river, connecting the boroughs of Brooklyn and Manhattan. This bridge, which is sometimes known as No. 3, is located between the Brooklyn Bridge and the Williamsburg Bridge, about a half a mile upstream from the former. The foundations for the piers are completed and work on the anchorage masonry is under way. It will be remembered that the original plans for this bridge contemplated the use of wire cables but former Bridge Commissioner Lindenthal caused a new set of plans to be prepared in which nickel steel eyebar cables were to be used. A change of administration in the city government, however, prevented him from carrying out such a method of building the bridge. There was a wide difference of opinion among prominent engineers as to the practicability and advisability of employing steel eyebar cables in a structure of such size, although it was pretty well established that it was possible to do it safely. The present Bridge Commissioner, Mr. Best, on taking office, threw out his predecessor's plans and had the department engineers finish the original plans



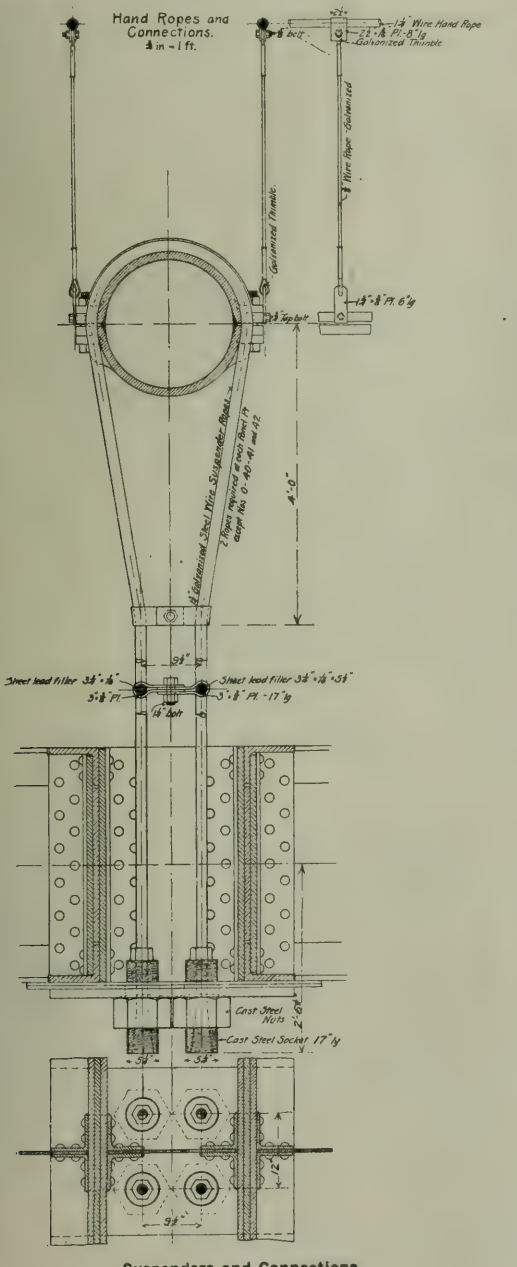
Cable Band for Manhattan Bridge.

which called for wire cables. In the *Railroad Gazette*, July 1 and December 16, 1904, were published drawings and descriptions of the architectural features of the new bridge and the masonry for the anchorages. The accompanying drawings show some of the details of the cable connections and suspenders.

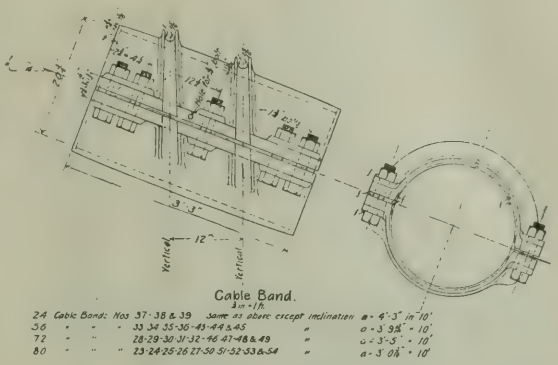
There will be four main cables approximately 20¾ in. in diameter. Each cable will consist of 37 strands and will contain 9,473 parallel wires .192 in. in diameter before galvanizing. In the operation of cable making each strand will be built several feet higher than its final position when laid in the cable. This will be accomplished by placing the shoe at each end of the strand a fixed distance back of its final position in the anchorage and also by carrying the strand on sheaves above the grooves of the cable saddles on the tops of the towers and at the anchorages. When the strand is finished it will be lowered into the saddle grooves, the shoes will be placed on the permanent pins at the ends of the anchor chains and the strand will then be adjusted to its proper versed sine by means of

fillers between the shoes and anchorage pins. When all the wires of a strand have been laid in place and before the strand is placed in its final position in the cable, it will be bound together by bands to keep the wires in their proper position parallel to each other. These bands will be composed of five or six turns of No. 10 wire securely locked and will be placed at intervals of 5 ft.

As the cables of this bridge will be much larger than any previously built, it will be necessary to assemble the strands in groups. The seven strands forming the center of the cable will be consolidated into a core cable by removing the temporary wire bands on each strand and squeezing the wires of these core strands together with heavy pressure bands and then winding this core with several turns of No. 16 plow-steel wire at intervals of 10 ft. The twelve strands next outside will then be assembled uniformly around the core cable and rounded and compacted about the core with pressure bands followed by wrapping at intervals to preserve the shape. Finally the remaining 18 strands will be assembled about the enlarged core and securely wrapped with No. 8 wire at intervals of 4 ft. When each cable has been fully compacted and banded, the cast-steel suspender bands will be accurately placed and thoroughly clamped on the cables. Before bolting on the cable bands, the cables



Suspenders and Connections.



Cable Band for Manhattan Bridge.

under the bands will be thoroughly cleaned of oil and will receive a thick coat of red lead paste.

The final protecting covering of the cables will consist of a continuous serving between the cable bands of galvanized round Norway iron wire applied under stress immediately following a thorough squeezing of the cables into compact cylindrical form by powerful clamps. This serving wire will be No. 9 gage before galvanizing. The wire wrapping will extend under the ends of the cast-steel cable bands counterbored at each end to receive at least two complete turns of the wrapping wire which will be secured under the bands in a suitable manner. The ends of the cable bands will then be made water-tight by caulking around the wrapping under the counterbore with lead and oakum or by pouring this joint with molten lead. After the wrapping is applied and the cables, suspenders, hand rail ropes and fastenings are completed they will receive one coat of red lead paint. The final serving of the cables will not be started until after the suspended superstructure is completed and most of the dead load is applied.

The following extracts from the specifications for the steel cable wires are of interest:

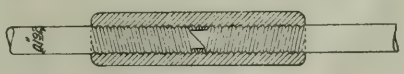
All steel for wire for the cables, suspenders and hand ropes shall be made in an open-hearth furnace lined with silica. The serving wire shall be of Norway iron.

No portion of the pig iron or acid open-hearth scrap stock used in the furnace shall contain more than .06 phosphorus or .04 sulphur. Ladle tests from the furnace shall meet the following chemical requirements: Carbon not to exceed .85 per cent, manganese .55 per cent, silicon .20 per cent, phosphorus .04 per cent, sulphur .04 per cent, copper .02 per cent.

At least 30 per cent. of the top of the ingot must be discarded to insure sound material and the billets rolled from the ingots shall be cut in uniform lengths weighing not less than 350 lbs. each.

The wire for cables, hand ropes and suspenders shall have an ultimate strength of not less than 215,000 lbs. per sq. in. before galvanizing and an elongation of not less than 2 per cent. in 12 in. measured while the specimen is in the testing machine. The bright wire shall be capable of coiling cold around a rod 1½ times its own diameter without sign of fracture. The cable wire before galvanizing shall measure .192 in. in diameter and shall not vary in gage more than .003 in. After galvanizing, the steel wire shall have an ultimate strength of not less than 200,000 lbs. per sq. in. of gross section. No machine straightening of wire will be allowed.

The cable wires shall be spliced as shown below. The splice



Wire Splice, Full Size.

shall have a strength of at least 95 per cent. of the ultimate strength of the wire so that it will resist any tendency to part during the operation of cable making. The splice consists of a sleeve ⅝ in. in diameter, with right and left-hand threads, the wires for shop splices having cold-rolled threads and mitered ends for locking the splice. All splices shall be carefully soldered. All field splicing of wires shall be done with thread cutting dies.

The suspenders shall be 1¾ in. in diameter and weigh not less

than 5.1 lbs. per lineal foot. They shall be composed of six strands of 19 wires each laid around an independent wire rope center consisting of 49 wires, left-hand lay. The suspenders shall preferably be of long lay.

The galvanizing shall consist of a coating of zinc 99.75 per cent. pure containing not more than .03 per cent. of iron. It shall be applied evenly in a molten state.

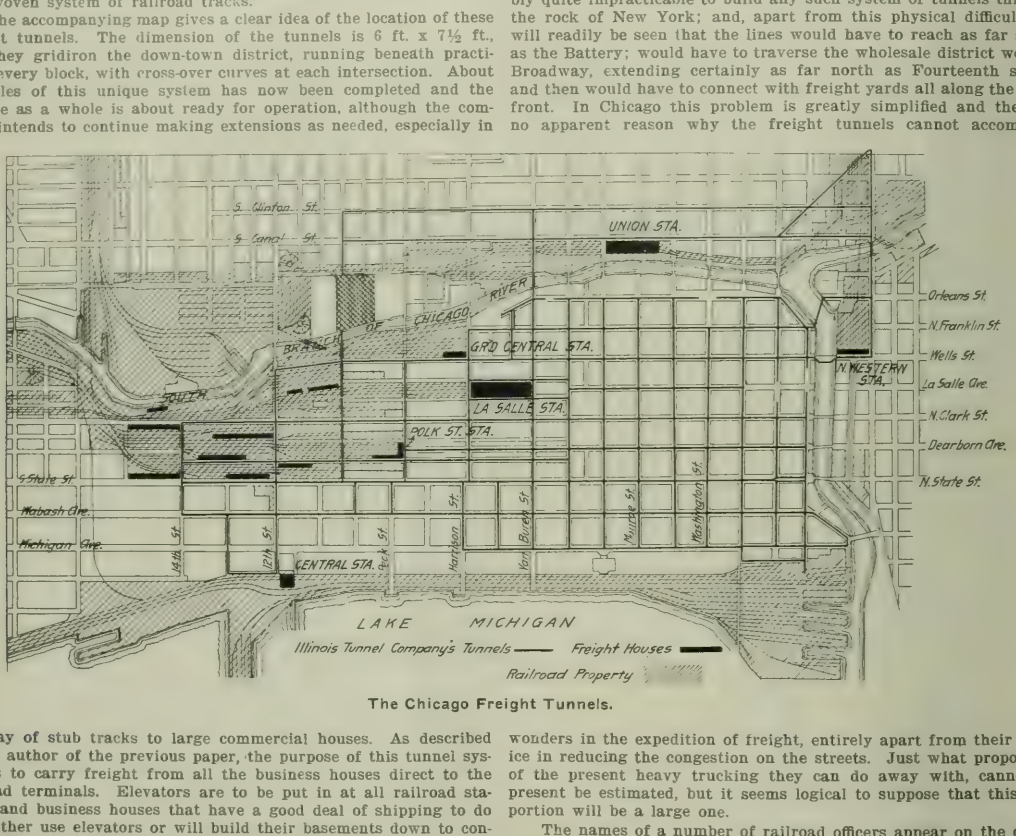
The maximum unit stress on the main cables under dead load, temperature stress, and congested live road will be 73,000 lbs. per sq. in., and in the suspender cables, 30,000 lbs.

The Chicago Freight Tunnels.

In the *Railroad Gazette* June 2 an account was printed of the remarkable circumstances that attended the construction of the Chicago freight tunnels, together with the tangle involved in securing their rights and franchises. The author called attention to the fact that down-town Chicago, with a tremendous wholesale and retail business, is but eight blocks wide by ten blocks long, while every outlet from this congested territory is blocked by the lake or by the interwoven system of railroad tracks.

The accompanying map gives a clear idea of the location of these freight tunnels. The dimension of the tunnels is 6 ft. x 7½ ft., and they gridiron the down-town district, running beneath practically every block, with cross-over curves at each intersection. About 32 miles of this unique system has now been completed and the scheme as a whole is about ready for operation, although the company intends to continue making extensions as needed, especially in anticipated. The operation in this respect will correspond more to that of street cars in the crowded portion of a city than it will to conditions on steam railroads. The entire system is, of course, single track, but certain stretches are to be always used for traffic in certain directions; and there are no sidings, except spur tracks built to reach stores and commercial establishments at points along the line. The company sees no particular limit to the number of these stub tracks that can be built. The different sections of the tunnel system are named for the streets under which they run and little bronze signs are placed at each corner. Except for this it would be very easy to become lost in the tunnels, as there are practically no landmarks, and all portions of the line are substantially uniform. There is one extremely small hill where two portions of the line were joined with a slight inaccuracy in calculation. Except for this the entire system is flat as a table.

Chicago was peculiarly well adapted to an enterprise of this sort; first, because of the nature of the ground to be excavated, which was simply firm clay without any rock or sand, and, second, because of the concentration of the industry of the city into such compact area as compared with other cities. It would be presumably quite impracticable to build any such system of tunnels through the rock of New York; and, apart from this physical difficulty, it will readily be seen that the lines would have to reach as far south as the Battery; would have to traverse the wholesale district west of Broadway, extending certainly as far north as Fourteenth street, and then would have to connect with freight yards all along the river front. In Chicago this problem is greatly simplified and there is no apparent reason why the freight tunnels cannot accomplish



The Chicago Freight Tunnels.

the way of stub tracks to large commercial houses. As described by the author of the previous paper, the purpose of this tunnel system is to carry freight from all the business houses direct to the railroad terminals. Elevators are to be put in at all railroad stations, and business houses that have a good deal of shipping to do will either use elevators or will build their basements down to connect with the tunnels, so that the cars can be loaded without loss of time. Where elevators are used, the cars are run right on the platforms and hoisted up to the desired level for loading.

The company has been making experiments with its rolling stock. At present it has not much on hand and is not sure where it will be kept, although one or two localities have been considered for storage yards. Five-ton electric locomotives are now the standard, but only a few have been built. The General Electric and the Jeffrey Companies have built the ones on hand so far. The locomotives correspond in general to those used in mines, taking their power from an overhead trolley wire and not from a conduit between the rails, as was stated in the previous paper. The height of the tunnel (7½ ft.) is such that there is no danger of workmen coming into contact with the live wire. The track gage is two feet.

It is proposed to run a slow service, by sight and hearing, as one of the company's officers expressed it. There will be no signals, at least for the present, and all the switches at the cross-over tracks will be worked by hand. The tunnel is brilliantly lighted with incandescent lights, and with cars running at a speed of three or four miles an hour, no trouble from collision at the numerous crossings is

wonders in the expedition of freight, entirely apart from their service in reducing the congestion on the streets. Just what proportion of the present heavy trucking they can do away with, cannot at present be estimated, but it seems logical to suppose that this proportion will be a large one.

The names of a number of railroad officers appear on the directorate of the company. It is understood that the stock has not been subscribed by the railroad companies direct, but rather by certain large owners of their stock. The Tunnels Company was anxious to have these names on the directorate to promote a spirit of mutual helpfulness, for without the co-operation of the steam railroads the work of the tunnels would amount to but little. No arrangements have as yet been perfected with regard to the scale of charges for carrying freight in the tunnels. The present intention is to charge about the same as the surface teaming companies do, although the development of faster and better service in the tunnels than is possible on the surface may perhaps enable a somewhat higher rate to be charged.

It is expected that a beginning will be made of using the tunnels for commercial purposes in about three months. At the present time, while arrangements are being perfected, the completed part of the system is used only to haul excavated material to the lake front.

The work of finishing the Simplon tunnel so that the trains may run through progresses slowly, great obstacles having been

met. The temperature of the rock where work is going on is 115 deg. It had been hoped that trains might run through next October; but now it is believed that it will not be till December, or perhaps later.

Bascule Bridge of the New Orleans Terminal Company.

The New Orleans Terminal Company recently completed across New Basin canal, New Orleans, a bascule bridge of the type shown by the illustrations. It replaces an old wooden drawbridge long used at that point. The bridge is a double-track through plate-girder design, 69 ft. 11 1/16 in. center to center of bearings and 71 ft. 11 1/16 in. end to end of girders, the depth of girders being 9 ft. ¼ in. back to back of angles. They were designed in accordance with St. Louis & San Francisco 1902 specifications, which are based on a loading of two consolidation locomotives carrying 180,000 lbs. on drivers, followed by 4,000 lbs. per lineal foot of track.

Each girder pivots at its inner end on a 7-in. pin, with bearings in a built-up shoe 5 ft. high from base to center of pin, and 4 ft. x 3 ft. 9 in. at the bottom. Each shoe is anchored to the pier by eight bolts 1¼ in. in diameter and 1 ft. 6 in. long.

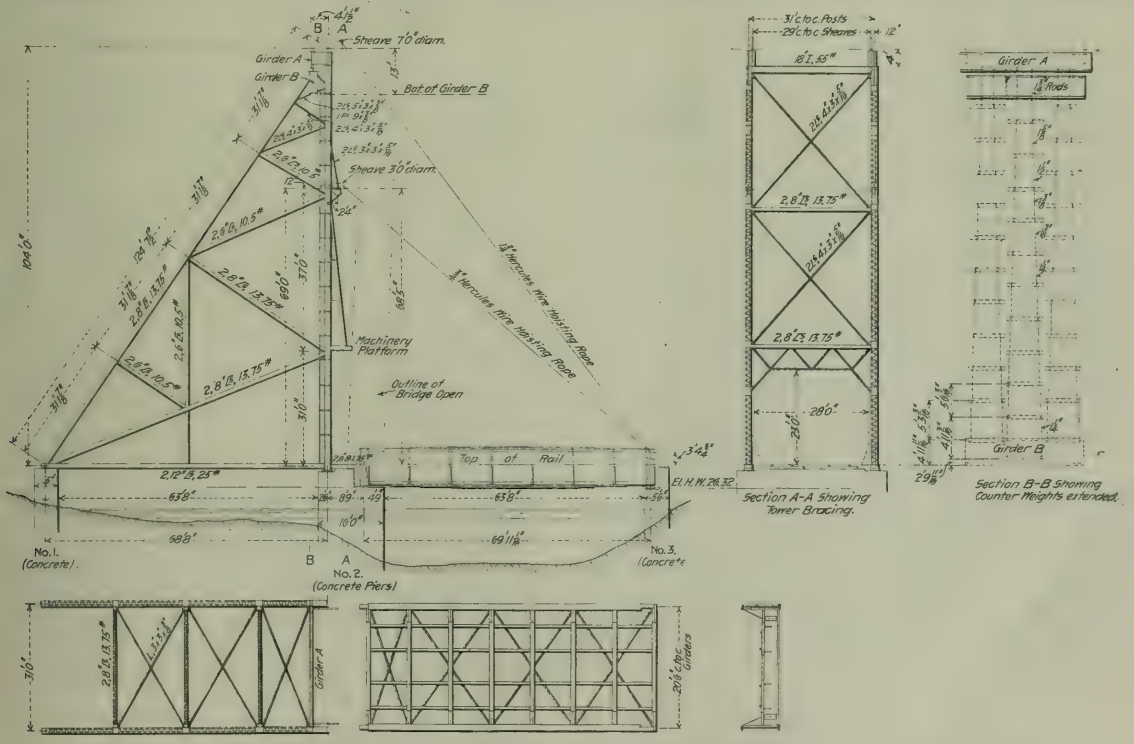
The tower is 104 ft. high to center of top sheave, 31 ft. wide, c. to c. of posts, and 68 ft. 8 in. long c. to c. of bearings. Pier No. 2, which is the center pier of the structure and 16 ft. wide, carries the pivot end of the bridge and the adjacent columns of the tower. These columns are latticed members formed from 15-in., 33-lb. channels. The construction of the tower is clearly shown by the drawings.

The counterweight system of the bridge is one of its most interesting features. It is arranged to take 90 per cent. of the weight of the bridge in any position, leaving 10 per cent. to be carried by the ¾-in. hoisting cables. The box girder "b" seen at the top of the tower in the general elevation, is suspended from the 1¾-in. cables passing over the 7-ft. sheave. In this position of the girder, corresponding to the closed position of the bridge, it holds three sets of 10 weights each, the weights being of special form and arranged for those of each set to nest one on another. They weigh approximately 3,000 lbs. each. When the bridge is in the raised position, girder "b" is at the bottom of the tower and the system of counterweights is extended in three rows as shown in one of the views (Section B B). It will be seen that the weights in each row are suspended serially, each from the one above, by short rods. These rods have each a conical lug on the bottom to support the weight when it reaches that position. The top pair of rods for each row is attached to girder "a" at the top of the tower. It is therefore evident that in the "open" position, with the weights extended, they are supported entirely from girder "a," exerting no effect on the bridge. As the latter closes, girder "b" rises, picking up the weights and thereby automatically increasing the counter-

New Orleans Terminal Co.'s Bascule Bridge over New Basin Canal.

weight as the bridge approaches nearer and nearer to the horizontal; the maximum being reached with the bridge closed an all of the weights collected in girder "b" at the top of the tower.

The hoisting machinery is driven by a 35-h.p. General Electric motor. A 10-h.p. Holliday gasolene engine is provided as an auxiliary. The piers are concrete on a piling foundation. The track be-



Details of Bascule Bridge over New Basin Canal—New Orleans Terminal Company.

tween piers 1 and 2 is carried on an earth fill retained by a creosoted sheet piling bulkhead.

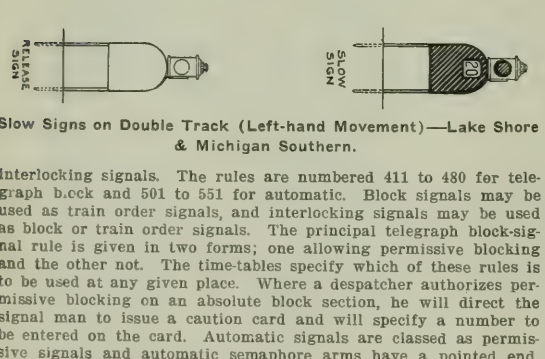
The bridge was designed and built by the Missouri Valley Bridge & Iron Company, Leavenworth, Kan. We are indebted to Mr. A. L. Phillips, Assistant Chief Engineer of the New Orleans Terminal Company, for the illustrations.

Lake Shore Signal Rules.

Mr. Azel Ames, Jr., Signal Engineer of the Lake Shore & Michigan Southern, has issued a new book of rules governing the use of interlocking, block and train order signals, and the rules are to go into effect on the first of August. The book opens with a "general notice" and "general rules," like the Standard Code of Train Rules. Following the definitions and "principles of location," come the interlocking rules numbered 301 to 388. Nos. 321 to 338 are for engi..emen and trainmen, and 341 to 388 for signal men. One of the "principles of location" is that the upper arm governs the main or superior route; the lower arm inferior diverging routes, and the "middle arm" (if any) any important branch or connection. Interlocking semaphores have a movement of 60 deg.

Enginemen must know the indication of all fixed signals before passing them—which must be a rather difficult thing to accomplish with distant signals when running at high speed in a fog. At railroad crossings, drawbridges, junctions and train order offices enginemen will "require" the fireman to observe and communicate the indication of all signals. Where fixed signals are in use trainmen must not give clear hand signals as against the indications of the fixed signals. Signal men report to and receive instructions from the division superintendent or chief despatcher; but to the signal engineer regarding the care and handling of the apparatus. Signals must be restored to normal "as soon as" the train or engine has passed them. Interlocking stations which have not a separate train order or block signal must have green flags and lanterns ready for immediate use.

Block Signals.—Under this head the principles governing location are, in so far as they apply, those governing the location of



Slow Signs on Double Track (Left-hand Movement)—Lake Shore & Michigan Southern.

interlocking signals. The rules are numbered 411 to 480 for telegraph block and 501 to 551 for automatic. Block signals may be used as train order signals, and interlocking signals may be used as block or train order signals. The principal telegraph block-signal rule is given in two forms; one allowing permissive blocking and the other not. The time-tables specify which of these rules is to be used at any given place. Where a despatcher authorizes permissive blocking on an absolute block section, he will direct the signal man to issue a caution card and will specify a number to be entered on the card. Automatic signals are classed as permissive signals and automatic semaphore arms have a pointed end. When such a signal indicates stop the train or engine must be stopped, and, "after having stopped" may proceed with caution, etc.

Slow signs are described in a short chapter by themselves. The slow sign is a low signal of banner type and a signal of similar shape is fixed at the point where trains may resume full speed. The slow sign is painted green on its face and has a numbered plate indicating the speed, in miles per hour, at which trains may run. The sign indicates that the track 3,600 ft. distant is unsafe for high speed. Release signs are painted white. The arrangement of slow signs on double-track (left-hand movement) is shown in the accompanying drawing. In the book the drawing is suitably colored. There are also about 20 pages of colored illustrations of high and low semaphores, pot signals, etc. The night stop indication in dwarf signals is a purple light.

Slow Freight Rates in India.

BY WILLIAM A. DRING,
General Traffic Manager, East Indian Railway.

Treating generally of the railroads in India, they are the property of the State, and are worked either directly by the State or by companies constituted for that purpose, and administering the lines under contract with the Secretary of State for India, who retains large powers of control. These companies receive remuneration for their services by means of a division of the net profits after payment of the working expenses, and the interest charges on the capital expenditure, the Government reserving to itself the lion's share. Thus in the case of the most prosperous railroad worked by a company, out of net or surplus profits for a year amounting to £1,400,000 sterling, the State received £1,260,000 and the company the balance of £140,000.

The following particulars for the railroads in India during the year 1903 are given in the form adopted by Mr. Harry Smart, Secretary of the Railway Clearing House, in his International Railway Congress paper on slow freight rates in the United Kingdom. The year taken is 1903, the figures for 1904 not being complete:

(a)	Length of railroads worked	26,955 miles.
(b)	Receipts per mile	£891
(c)	Cost per mile of maintenance of way, works, etc...	£100
(d)	Expenditure of all kinds, per mile	£424
(e)	Proportion per cent. of expenses to receipts	47.5

The receipts from coaching traffic are about one-third of the whole, and from merchandise and mineral traffic, taken together, about two-thirds. The total weight carried of merchandise and coal, including stores for consumption on the several railroads, was 47,684,000 tons, and the average distance per consignment carried, or the average lead of the traffic as a whole, was 160 miles.

It should be stated that in the year 1904 there was a great advance in the prosperity of Indian railroads, and it is estimated that when the detailed figures of working are published, they will show in gross receipts an advance over 1903 of not less than 10 per cent., with a reduction in the proportion per cent. of expenses to receipts. This prosperity has enabled the State to develop its program for the enlargement of the railroad system in India, and the improved equipment of existing lines.

The greatest average annual construction of railroads in India was during the first Viceroyalty of His Excellency Lord Curzon, from 1899 to 1903, when the average actual mileage opened per year was as nearly as possible 1,000 miles. During the last year of the series it was arranged to construct over 1,250 miles.

GOVERNMENTAL CONTROL OVER RATES.

The initial control exercised by the Government of India over rates for the carriage of merchandise and coal is by means of a scale laying down the maximum and the minimum rates which may be charged for the various commodities. The scale may be summarized as follows, it being premised that one pie equals one-twelfth of a penny, and a maund one-twenty-eighth of a ton of 2,240 lbs.

	Pie pr md., pr mile. Maximum.	Minimum.
Coal, wheat, other grain, oil-seeds, jute, salt & other articles of low value iron.	1/3	1/10
Ordinary commodities ..... Between	1/3 and 1	1/6

There are powers allowing special treatment of articles of exceptional bulk in regard to weight, such as loose cotton, heavy articles, such as boilers, and articles of exceptional value, such as specie or bullion.

The highest charge allowed is, therefore, twenty-eight-twelfths, or 2⅓ pennies per ton-mile of 2,240 lbs., and the lowest, 1/10 of this amount, or .233 of a penny, somewhat less than one farthing per ton-mile. The average actual charge made in 1903 on the total merchandise and coal traffic of all Indian railroads, taken together, was .47 penny per mile per ton of 2,240 lbs., or .41 penny per mile per ton of 2,000 lbs.

Confined within the maximum and minimum charges, there are separate standard classifications for ordinary merchandise and for coal. In regard to the great majority of ordinary items of merchandise, there is uniformity of classification on the different railroad systems, but for raw agricultural products, salt, iron, gunny, kerosene oil, etc., forming the bulk of the ordinary merchandise traffic, each principal system has its own scale.

The standard classification for ordinary merchandise has remained unaltered for a number of years, the requirements arising from time to time for reduction in charges having been met by the quotation of special, or station-to-station, rates, always within the limits laid down by the Government of India. The scale of charge to the consignor is in this way being constantly reduced.

For ordinary commodities there is no differential treatment or lowering of rates as the mileage is increased. With agricultural produce and other articles of low value this treatment is adopted. The following standard classification in force on the East Indian Railway, which carries a heavier traffic than any other line in India, may be taken as to "Special" class (principally agricultural produce) goods as applying approximately throughout the trunk lines of India, and as to ordinary commodities, as actually so applying:

Special Class.

	Pie per md. per mile.
For first hundred miles	.3333
For extra distances, about 100 up to 450	.17
For extra distances above 450 miles	.12

Ordinary Commodities.

	Rate— pie per md., per mile.
First class	1/3
Second class	1/2 " " "
Third class	2/3 " " "
Fourth class	5/6 " " "
Fifth class	1 " " "

The comodities included in higher classes than the second, which pays as nearly as possible 1 penny per ton-mile of 2,000 lbs., form a

very small proportion of the whole traffic. The rates given in the ordinary commodity schedule are the highest allowed by the Government control, for each class. The reductions below the respective scales, within the Government minimum of ⅛ pie per md. per mile, are, generally speaking, by means of station-to-station quotations.

Terminals may be added varying between, say, seven pence and half a crown per ton, the average probably being between one shilling and one shilling and sixpence. These terminals are, however, frequently reunited, especially in the case of traffic carried over considerable distances. For the terminal charge made, loading and unloading are performed by the railroad; but there is no cartage or other delivery off the premises, except in a few isolated cases, consignors and consignees being left to perform these services themselves.

In addition to the control exercised by Government by means of maximum and minimum rates, the power is retained of ordering specific quotations if considered to be required, though such power has not in the experience of the writer been ever used, and alterations in rates are scrutinized by Government officers at the headquarters of the several lines. Every change in charge must be included in a statement submitted monthly for scrutiny; and permission must be obtained from the local Government controlling officer before transfer of an item from one classification to another. Every authorized charge is included in a printed rate book, and invoices are checked by the accounts department. An invoiced rate not given in the rate book is objected to, and for each alteration in the rate book or tariff, authority must be shown. At the present time there is indication of a relaxation of the control exercised in the matter of rates; but it seems probable that the working companies when proposing changes of great importance will, even though they may be acting within their powers as governed by the standard of maximum and minimum rates, ascertain, before introducing the changes, the views of the Government as the predominant partner in the undertakings placed in the companies' charge.

Railroads in India, as regards liability, are not common carriers, but are bailees for hire. They are required to take the same amount of care of goods entrusted to them for carriage as a man of ordinary prudence would take of his own property. They are further allowed to relieve themselves of this liability by the quotation of reduced rates at owner's risk, and if these reduced rates are accepted by the consignor the railroad is freed from all responsibility from whatever cause, even though that cause may be the proved neglect or dishonesty of the servants of the railroad. There has been some comment on the extent to which freedom from liability is carried. Certain articles of special value, such as those of which gold or silver forms part, and Cashmere shawls, are "excepted"; that is, the railroad incurs no liability for their loss or damage.

REDUCED RATES FOR WAGON LOADS.

In India special attention is paid to the securing of good wagon loads. The carrying capacity of wagons is higher than on English lines, the standard gross load of four-wheeled wagons built during the last ten years being for the broad gage (5 ft. 6 in.), 24 tons, of which the net load is 16 or 17 tons. Certain railroads are now increasing the load of four-wheeled wagons to 28 tons, of which the net load is 20 tons. In order to make full use of the individual wagon capacity, the practice is growing of offering reduced rates for consignments of weights suited to the wagon capacity. The Calcutta export trade in wheat and seeds was till a year ago carried in multiples of 25 tons, each consignment taking two wagons; but the offer of a reduced rate by about 6 per cent. for 30-tons lots has been quite successful, and at the present time the two wagons which formerly carried 25 tons are taking 30 tons, and the reduction of 6 per cent. in charge has brought an increase of 20 per cent. on the wagon load. For 1903 the average load of a loaded goods vehicle, on the principal railroads, varied between 7 tons and 9 tons, excluding mineral traffic of which the average load is considerably greater. Taking into consideration empty running, the average load varied between 5 tons and 6½ tons.

With the same object of inducing full use of the wagon capacity, charges are quoted per wagon load of a particular commodity, the consignor gaining an advantage as compared with maund rates if he puts in a good load. This principle has not so far been applied to wagons with mixed loads of different commodities, where a middle-man steps in and shares with the consignor the advantage of reduced freight charges.

Group rates for the principal commodities are coming into favor in India. Although there are exceptions of great importance, there is general acceptance of the "differential rate," under which, on the same length of line, the charge for the lesser distance shall not exceed that for the greater.

COAL.

The charges for the carriage of coal have received special attention, and during the last 15 years there have been two reductions in the scale of rates, of great importance. Before the first reduction, British coal was imported into Calcutta in considerable quantities, although coal of good quality was being raised at collieries having direct railroad communication, situated within 130 miles of Calcutta, while all other ports were supplied exclusively with British or foreign coal. The export of coal from Calcutta was unknown. At the present time practically all the coal consumed in India is mined in India, and large exports are made to Colombo, Singapore, and other external ports. Excluding bunker coal, there were shipped from Calcutta in 1904 over 2,000,000 tons of coal.

The principal collieries are situated on the line of rail at an average distance of about 150 miles from Calcutta. These collieries, in addition to sending to the port, consign coal over long distances to the interior, at present principally for railroad consumption. Probably more than a quarter million of tons are sent over distances exceeding 1,000 miles.

The collieries so far opened out in India, other than those near to Calcutta, are not of very great importance, the raising for 1903 having been about 1,000,000 tons only.

The first of the two reductions referred to in the opening portion of this paper having proved most successful in establishing an altogether new trade, the second reduction to the present scale, was decided upon with the view of affording an impetus to the export trade, and also to assist coal in replacing wood and other descriptions of fuel at long distances in the interior. The scale is here given:

	Per md., per mile.
For all distances up to 75 miles, inclusive....	0.14 pie.
Plus for any distance in excess of:	
75 miles, and up to 200 miles, inclusive..	0.12 "
200 miles, and up to 450 miles, inclusive.	0.1 "
450 miles, and up to 1,000 miles, inclusive	0.09 "

The total charge being subject to the minimum fixed by Government of 1/10 pie per md. per mile, or something under one farthing per ton-mile of 2,240 lbs. The scale shows that even during the first miles of its carriage, coal is charged at less than one-third of a penny per ton-mile of 2,240 lbs., while for every mile over 450 the charge is reduced as low as one-fifth of a penny per ton-mile.

In order to assist the export of coal, a rebate of 20 per cent. is given off tariff rates. The value of coal as exported from Calcutta may be taken at 9s. 6d. per ton of 2,240 lbs., f. o. b.; that is to say, including cost of coal, carriage over 150 miles by rail and shipment charges. Coal is charged at owner's risk, and is loaded and unloaded by sender and consignee. The charges which have been given apply generally throughout the principal colliery districts.

So far as concerns coal, Indian railroads have a clear and concise tariff, without complications. There are no special station-to-station rates, and everything is according to the one scale, except where, under agreement, the longer route between the same points has equalized with the shorter, the charges in these cases being calculated by the scale on the shorter route. This simplicity is rendered possible by the circumstance that there is only one principal source of supply, and, therefore, no competition between different sources of supply competing for the trade of the markets of consumption.

SPECIAL QUOTATIONS.

For raw agricultural products there are probably not more special quotations than the importance of the traffic warrants. Here there are both competing sources of supply and competing marts of distribution.

For ordinary and unimportant articles, however, a mass of station-to-station rates and exceptional conditions has sprung up for the reason that there has been no general revision of classification, but individual treatment of each of some thousands of commodities. On pages 37 and 38 of the paper by Mr. Mange, Assistant Traffic Manager, Orleans Railway, it is shown that a similar growth of special quotations on the Paris, Lyons, Mediterranean Railroad has been met by reductions in scale, and abolition of the bulk of the station-to-station rates. The reduction of the scale necessarily could not be to the level of the lowest special quotation, and we are told that while those who profited by the general reduction kept silent, the sufferers by the increases protested energetically, so that although the reform was a considerable step in advance, it appeared to give rise to nothing but discontent.

There was the difficulty in making the alterations in the tariff of the French line, that commodities of the first importance came under revision; but, as it has been endeavored to show in this note, on Indian lines the scale for the charge of coal is simple, and agricultural products have not undue complications, though there are probably a number of station-to-station rates which, at one time necessary, have served their purpose and could be withdrawn. Of the five ordinary classes, it is probable that a readjustment in scale could be arrived at for the three higher classes, which, without having any seriously detrimental effect on revenue, would enable the great bulk of the station-to-station rates to be withdrawn without causing discontent to consignors. The same remarks apply in a less degree to the two lower classes of ordinary goods. Here larger interests are concerned, both for the consignor and for the railroad. Profiting by the experience of the French line, important station-to-station rates would be preserved; but with a small reduction in scale a large number of special quotations would disappear. The subject of sim-

plification of goods tariff is now having the attention of the Indian Railway Conference Association.

POSSIBLE DEVELOPMENTS.

The question of slow freight rates for Indian railroads is at present in an interesting position. While, as already shown in this note, the powers given to the managements of the various lines by the Government which owns the lines permit a maximum charge on high class goods of 2½ pennies per ton-mile, and on coal and low-class goods a maximum of one-third of this amount, or .77 penny per ton-mile; and forbid a lower charge than .38 penny for high-class goods, and than .23 penny for coal and low-class goods, the *average* charge in 1903 on all Indian railroads taken together, was for all merchandise, including coal, under .5 penny per ton-mile, and for coal taken by itself .26 penny per ton-mile. The average charge made is thus out of all proportion nearer to the minimum than to the maximum allowed, the result being brought about by the low rates levied on coal carried for export or over long distances to the interior, and on grain and seeds carried to the ports of Calcutta, Bombay and Kurrachee. Many of these rates are actually down to the minimum allowed of .23 penny per ton-mile.

Until the commencement of the present decade, the Government of India as a proprietor and guarantor of railroads was losing large sums of money annually on the working of the lines as a whole, but for four years in succession there has been a surplus, and there has been such steady progress that it may be hoped that for the future the position will constantly be of income greater than expenditure. It is, however, by no means the case that all roads earn sufficient to cover their working expenses and the interest on capital outlay. The statistics, indeed, show that of a total mileage of, say, 27,000, only about 10,000 miles are being worked at any profit, and only about 5,000 miles at any considerable profit. Carrying the examination a step further, it is seen that the system of about 2,250 miles from which the largest share out of all proportion of the profits comes, is that which charges the lowest rates, this system being specially favored in the matter of gradients, coal and a steady traffic, so that the cost per ton-mile carried is much lower than on other Indian lines.

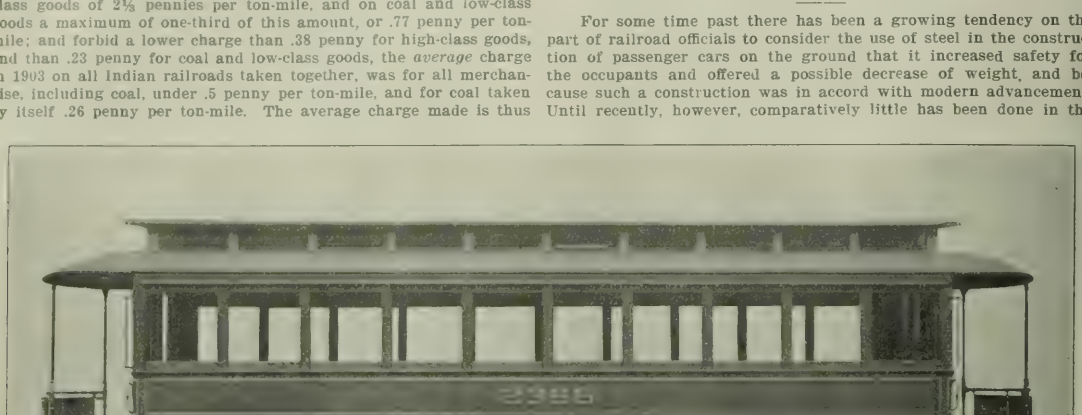
COST PER TON-MILE.

In India there are accurate statistics of ton miles, and a rough and ready method has been adopted of apportioning the cost of working between coaching and goods traffic. This method is open to just criticism, but for the purpose of comparison between different lines may be accepted without fear of great error, the proportion of goods and coaching traffic to the whole on important railrads not being dissimilar. There are three principal ports to be served—Calcutta, Bombay and Kurrachee. Working on an average for five years, and assuming the cost of carriage to Calcutta as 1 per ton-mile, the cost to Bombay is 1.81 and to Kurrachee 1.80.

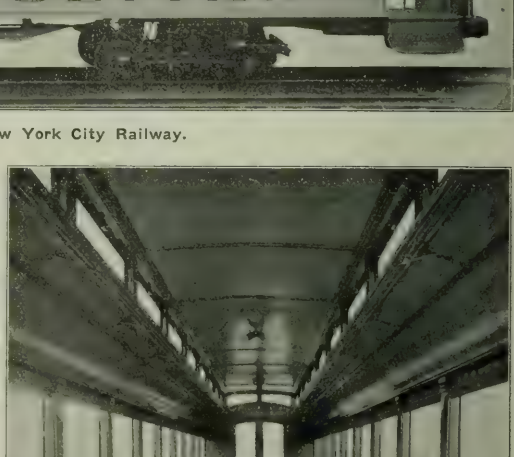
The present minimum charge of .23 penny per ton-mile is acting as a restraint on the operations of the managements to which Government has entrusted the working of its railroads, and it seems probable that in the early future the Government may consider whether the minimum can be reduced. There will then be the problem whether, as hitherto, there shall be one minimum for all alike, or whether the cheap working line shall be allowed to charge a lower rate than the system where the prevailing conditions do not permit of the same economy. In other words, whether the cost of working shall be taken into consideration in fixing the minimum rate which may be quoted by the different systems. It is too much to expect that there shall be a different minimum for each railroad, small and large; but it is submitted that different minimum rates based on cost of working could be laid down for the larger systems, and a general minimum for the smaller, and that such a procedure would be both fair to the consignor whose goods are to be carried, and in the interests of Government as owning the railroads.

Steel Car for New York City Railway.

For some time past there has been a growing tendency on the part of railroad officials to consider the use of steel in the construction of passenger cars on the ground that it increased safety for the occupants and offered a possible decrease of weight, and because such a construction was in accord with modern advancement. Until recently, however, comparatively little has been done in the way of a practical application. Steel has crept into passenger car construction to a limited extent in details, such as body bolsters, carlines, trusses and the like, but it was not until the subway cars were built that an all-steel construction was used to any extent, though cars had been designed and built with steel framing a number of years ago.



Steel Street Car for the New York City Railway.

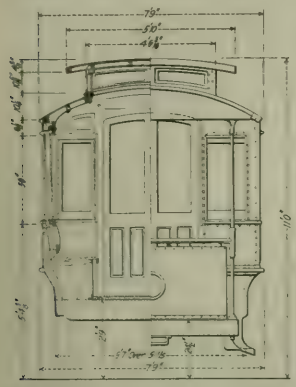


Interior of Steel Street Car.

Following closely on the construction of the all-steel cars for the New York subway, and those with pressed steel underframing for the Brooklyn Rapid Transit, a car has been built by the Pressed Steel Car Co. for the New York City Railway and placed in service on the Broadway run, that is built of steel throughout. A controlling reason for the construction of the car was to obtain one that would

avoid all danger of fire through accidental short circuiting or other causes.

In the car under consideration, no wood has been used at all except for a portion of the window sash, the linings of the window posts, the roof, ceiling and floor matting strips, and these have been thoroughly treated with a fireproofing compound. In general appearance the car bears a close resemblance to the wooden cars of the same class, and this has been sought throughout the design; the bottom heads of the rivets on the paneling and window posts alone serving to indicate the fact that the car is built of steel.

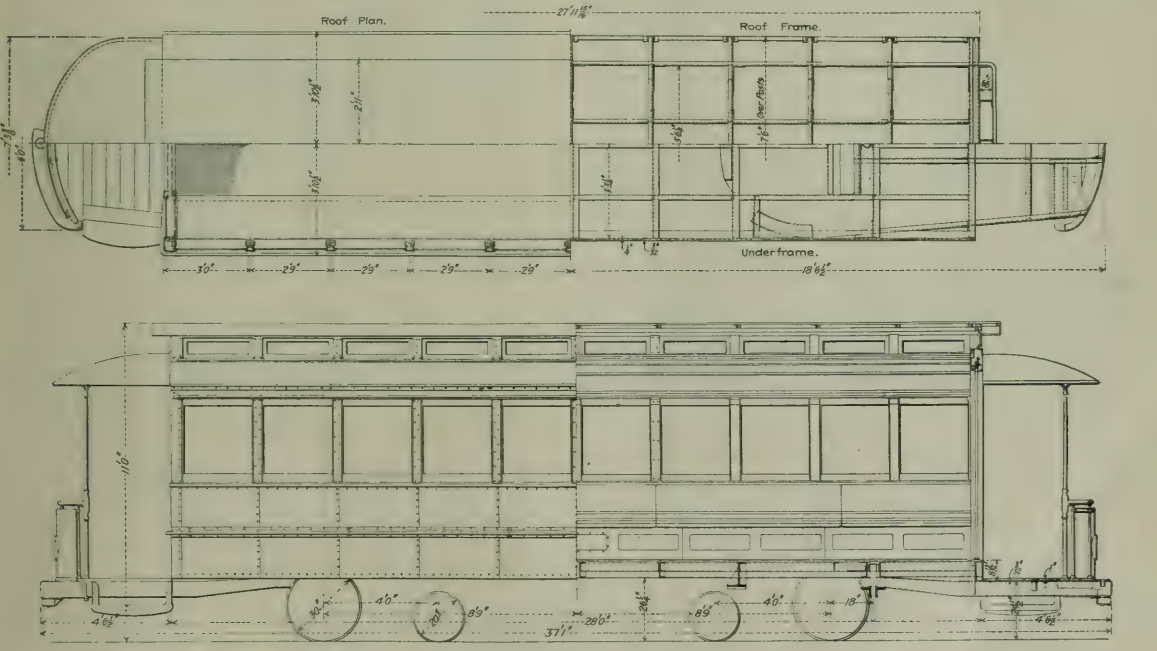


Part End Elevation and Cross-Section of Steel Street Car.

The body is 28 ft. long and the over-all dimension is 37 ft. 1 in. to the outside of the platform and sill. Complete with the trucks the car weighs about the same as a wooden car of the same type. As with other designs coming from the Pressed Steel Car Co., pressed steel is extensively used throughout the frame, and this applies not only to the underframing but the superstructure as well. The side and end sills are of pressed channel shapes, and the former are tied together at intervals by cross-tie beams extending from side to side and formed with closed ends that are riveted to the side sills. The intermediate sills are built up of pressed channel sections that are riveted to the cross beams, as shown on the plan.

As the car is carried by the Brill maximum traction side bearing trucks, wherein the whole load rests upon the side bearings, no body bolsters are required, but a stiffening cross-brace is use above the ends of the side bearing castings. The general arrangement of the framing of the platform bears a close resemblance to that of the ordinary wooden car. The belt rail is also of pressed steel, whose section will be readily understood by a reference to the side elevations of the car. The paneling is formed of steel plates extending from the bottom of the side sill to the belt rail, where there is a division, the panels between the belt and the window rail being separated from those below. By making the panels and belt rail in sections in this way, provision has been made for repairing any portion of the side that may be damaged without disturbing the uninjured portion of the car; thus materially reducing the expense of repairs. The ceilings and interior finish is of fireproofed composite board, so that the general appearance of the standard car has been maintained.

The total width of the car over the belt rail is 7 ft. 9 in. and the height of the monitor roof above the rail is 11 ft. The other general dimensions will be found upon the line engravings of the elevations and plan, while the reproductions of the photographs give a clear idea of the outside and interior appearance.



Plan and Side Elevation of Pressed Steel Street Car for New York City Railway.

A Study of the Walschaert Valve Motion.*

BY W. PFITZNER.

The object of the following study was to enable a valve motion to be designed on paper to a convenient scale and with sufficient certainty to render it unnecessary to test the design on a model. The best method of procedure is to investigate the influence of each member by means of an adjustable model. The model used for the purpose was made half size, in accordance with the scheme shown in Fig. 1. The dimensions given are in millimeters. The design was made up from a Muller valve diagram, the size of the resultant eccentric being determined from the assumed curve for 80 per cent. cut-off.

The important phase points in the steam distribution were determined by means of valve ellipses drawn directly by the model. The valve stem carried a pencil while the paper was carried on a table moved at right angles to the valve by a reducing motion from the crosshead. By laying down the port dimensions on the ellipses thus drawn, all the points of steam admission and exhaust were clearly marked for both sides of the piston. A similar recording device connected to the link and the block gave a record of the slip of the block, in order to determine the effect of the suspension of the radius rod on the slip.

The information as to the steam distribution obtained from the valve ellipses is recorded in the so-called curves of errors, which give a direct criticism of any design of gear. These curves of errors show the differences between the steam distribution at the head end and that at the crank end. The cut-off in the crank end is taken as an abscissa, and the ordinates give the amounts which must be added to the admission, exhaust, etc., to get the corresponding value for the head end with the same valve setting. Conse-

*Translated by Lawford H. Fry from the *Zeitschrift des Verein Deutscher Ingenieure*, March 25, 1905.

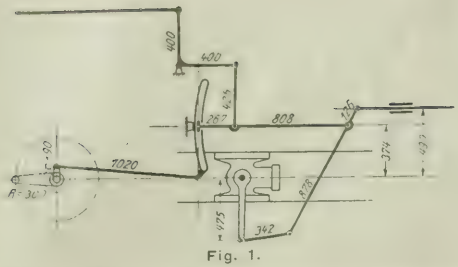


Fig. 1.

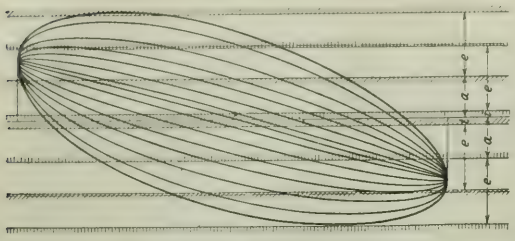


Fig. 2.

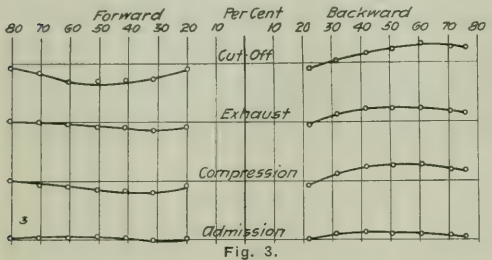


Fig. 3.

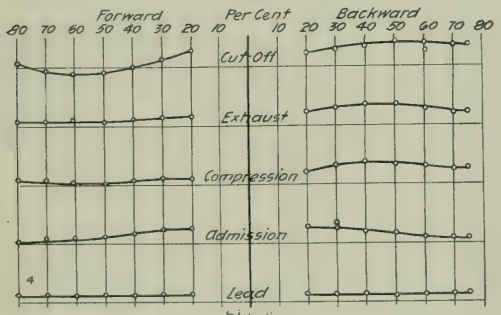
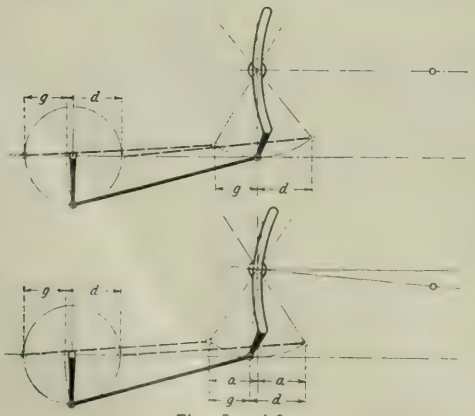


Fig. 4.



Figs. 5 and 6.

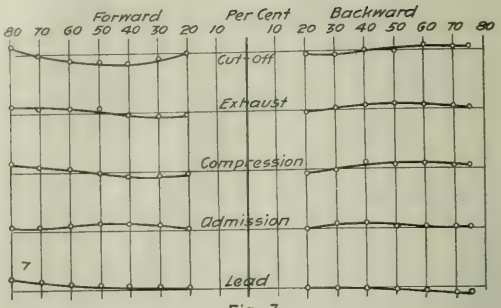


Fig. 7.

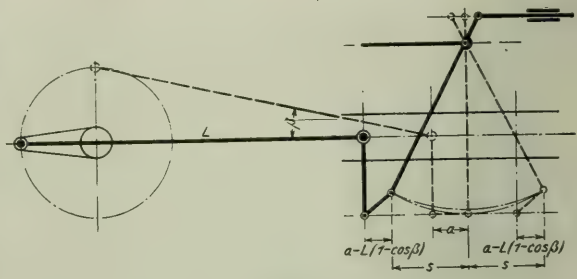


Fig. 8.

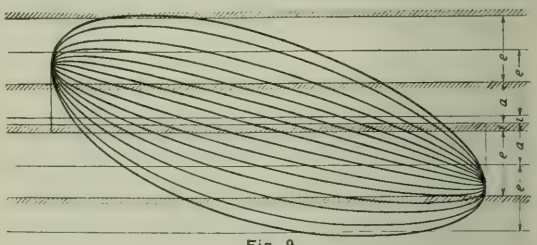


Fig. 9.

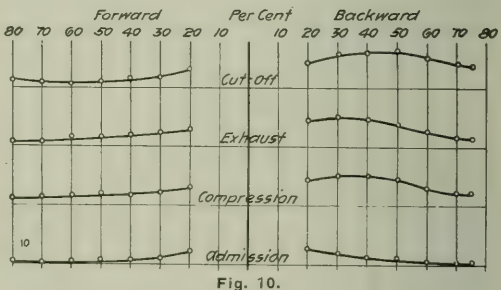


Fig. 10.

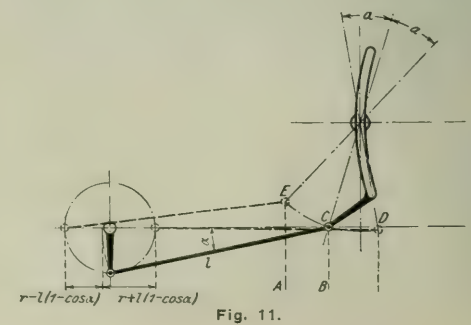


Fig. 11.

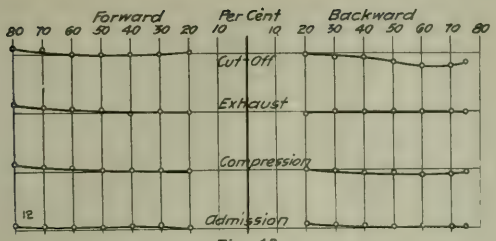


Fig. 12.

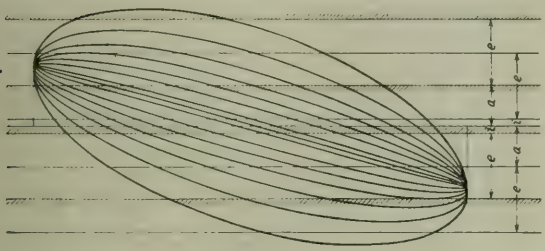


Fig. 13.

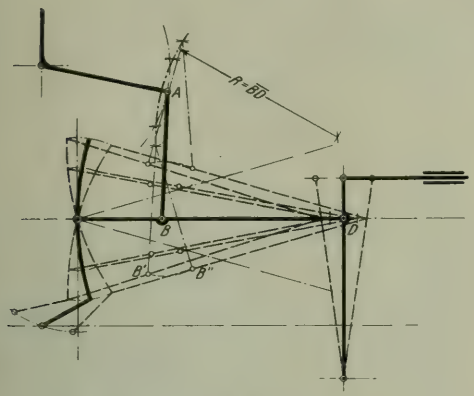


Fig. 14.

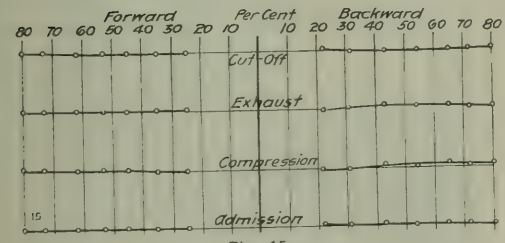


Fig. 15.

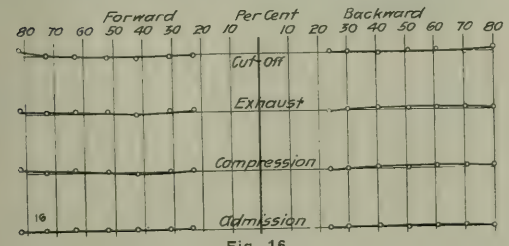


Fig. 16.

quently an ideal valve motion will give a series of straight lines on the horizontal axis.

Test Series A.

The valve motion was as shown in Fig. 1. The valve ellipses, which are shown in Fig. 2, are not irregular when compared with those from other valve motions, but they show some considerable variations in the steam distribution. From the curves of errors in Fig. 3 it will be seen that the cut-off was only the same on both sides when running backwards at a cut-off of 29 per cent. The greatest difference between the two sides is nearly 7 per cent., and the other points in the distribution show similar variations.

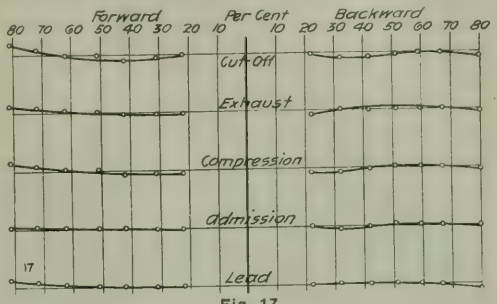


Fig. 17.

When running forward the cut-off on the head end is always too early and it might therefore be thought advisable to shift the position of the valve so as to change the position of the ellipses in relation to the port openings and thus increase the time of admission on the head end. This can only be done at the expense of the previously constant lead.

Test Series B.

In order to increase the admission at the head end it is necessary to move the valve towards the crank and the valve stem must be shortened. The lead is changed by double the amount of the shortening which in the tests amounted to about $^{3}/_{16}$ in. The curves in Fig. 4 show the results of the change. The forward motion

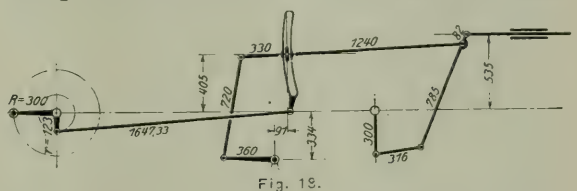


Fig. 18.

shows the desired improvement in equalizing the cut-offs which are the same at two points. In backward motion the results are worse than before, but undoubtedly the greatest defect is the considerable variation in the points of pre-admission. Figures 3 and 4 show what influence a wrongly placed valve will have on a motion otherwise correctly designed.

The desired improvement cannot be obtained in the way tried, and instead of changing the position, it is necessary to change the motion of the valve.

Test Series C.

By closely examining the valve curves it will be seen that one side is more strongly curved than the other, that is the valve does not travel equal distances each side of its center. This cannot be due to the motion transmitted from the crosshead, for it can be

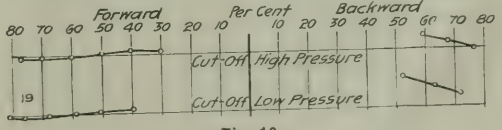


Fig. 19.

seen in Fig. 2, that with the block in mid-position the ellipse is contracted to an almost straight line and the lead is the same on both sides. The difference in the travel of the valve in the two directions is due to the angularity of the eccentric rod as shown in Fig. 5. It was therefore attempted to counteract this, as shown in Fig. 6, by shortening the eccentric rod so that the throw of the link is the same on both sides of its central position. With this arrangement when the main crank is at the dead points the link is moved from its central position by the amount $L\ (1 - \cos \phi)$, where L is the length of the eccentric rod and ϕ the angle this rod makes with the horizontal when the main crank is on the dead point. As a

consequence of this the lead changes as the duration of admission is increased.

The error curves, Fig. 7, show that the distribution is better than was obtained with other arrangements; the greatest variation only amounts to about 3.5 per cent. In backward motion the distribution is good, except that the considerable variation in the lead is a disadvantage.

Test Series D.

The attempt was made to influence favorably the form of the valve ellipses by changing the motion given to the valve by the cross-head. At the same time a procedure was tried which has been widely referred to. The effect of the angularity of the connecting rod on the motion of the valve can be counteracted by making the crosshead link so short that in the end positions its horizontal projection is shorter than the real length of the link by the amount $L\ (1—\cos\beta)$. This arrangement is shown in Fig. 8, from which it will be seen that the angle at which the link works is very unfavorable. The valve ellipses are shown in Fig. 9. At midgear a line is produced which has a slight downward curve, and on this the other curves are built up but with unequal travel in the two directions. Fig. 10 shows the variations in the steam distribution which are large, amounting in the backward motion to 13 per cent. Since the cut-off is always too late on the head end, the distribution could be improved by lengthening the valve rod, but this would give a changeable lead.

A shortening of the eccentric rod as in the Test Series C gives no important change in the error curves. This arrangement D shows itself to be undesirable in every way. The direct and accurate transmission of the cross-head motion to the valve is one of the most important advantages of the Walschaert valve motion, and any deviation from this only introduces errors. It is incorrect to attempt to counteract the angularity of the connecting rod in the valve motion. The cross-head link should be taken into account and made of sufficient length.

Test Series E.

An improvement in the steam distribution can only be achieved by overcoming the effect of the angularity of the eccentric rod. A simple means of doing this is to move the point C, Fig. 11, towards the crank. By trial a point can be found for C, such that the angles of vibration of the link each side of the center (C E, and C D) are nearly equal. The great improvement effected by this change is shown in the curves of errors in Fig. 12. In the forward motion there is scarcely anything more to be desired. The valve ellipses which are reproduced in Fig. 13 are almost mathematically correct. The variations in the distribution in the backward motion are due to the suspension of the transmission bar.

Test Series F.

In all the previous experiments the suspension of the transmission bar has been that shown in Fig. 1. The choice of dimensions was an arbitrary one. In order to improve the distribution the end A of the suspension link should be carried on a locus which is such as to lead to the expectation of good results. The construction for determining such a locus is shown in Fig. 14. The link block is considered to work without slip, and the end positions of the point B are determined for all degrees of cut-off. From these points with the radius B A, the length of the suspension link arcs of circles are drawn. The points of intersection lie on the dotted curve, which has its concave side towards the cylinder and coincides very closely with a circle having a radius B D. If the suspension link has its end A carried on this curve the valve will move very nearly correctly in all positions.

In practice* it would be difficult to find a place for the reverse shaft in the neighborhood of the cylinders and this arrangement cannot be used. The curves of errors have been drawn in Fig. 15 and show how close the distribution is to being the same at both ends of the cylinders. The variations are hardly noticeable.

Test Series G.

In practice, where it is necessary to have the reverse shaft in the neighborhood of the link, the point A must be carried on a circle having its concavity the reverse of that of the theoretical curve. To obtain good results the actual circle should be arranged so as to be in contact with the theoretical curve as much as possible, particularly at those points corresponding to the most usual points of cut-off. Such an arrangement is shown in Fig. 14. The curves of errors, Fig. 16, are nearly as smooth as those of Fig. 15. Usually the angle between the arms on the reverse shaft cannot be made a right angle.

Test Series H.

It is of interest to know how the steam distribution is influenced by the riding of the engine on the springs. The influence cannot be large because the motions taken from the machinery for the movement of the valve are all at right angles to the motion due to play on the springs. In the model the axle was raised about three-quarters of an inch, corresponding to a movement of 1½ in. on the real engine. The results are shown in Fig. 17, which is otherwise from the same motion as Fig. 16. The variations are very slight, amounting to about 1.5 per cent. at medium cut-offs. The lead shows a slight change.

The Slip of the Block.

The slip of the block in the link was measured by the apparatus described above. The slip is reduced in proportion as the suspension link is correctly carried. In the tests recorded the suspensions used in Test Series A to E give slips up to about 1⅜ in. actual. In Test Series F the slip up to 80 per cent. cut-off was only ⅛ in.; in the back motion the slip was ⅝ in. at 60 per cent. cut-off and 1⅛ in. at 80 per cent. In test series G, which would represent the actual construction, the slip was about ⅛ in. at 60 per cent. cut-off in the forward motion, and about 1 in. at 80 per cent. In the backwards motion the slip ran from ⅝ in. to 1⅛ in. It may be concluded from the foregoing that the slip may be held down to a very small amount if the suspension link is carried approximately in the proper locus.

For purposes of comparison Figs. 18 and 19 are given to show the outline, and the curves of error of the cut-off point, of the valve motion for the standard 4-4-0 compound locomotive of the Prussian State Railways. This motion is designed for the forward motion only and no attention is given to obtaining equal points of cut-off in the backward motion, and no attempt is made to counteract the angularity of the eccentric rod. The excellent steam distribution in the forward motion and the small slip of the block are obtained by slightly shifting the point about which the link turns.

The rules which should be observed in designing a new valve motion are few in number and may be summarized as follows:

The movement of the crosshead should be transmitted as exactly as possible to the valve; the crosshead link should be made long and where there is space it should swing about a central horizontal position.

The influence of the angularity of the eccentric rod should be overcome by moving the link joint towards the crank. The best position can be found by trial, as two or three points usually give the required solution. By this means very short eccentric rods can be used if necessary. The throw of the link is slightly increased.

In locating the top of the suspension link the locus method shown in Fig. 14 should be used.

•This applies with more force to European than to American locomotives.—Translator.

Railroad Shop Tools.

Continued.

PLANERS.

The accompanying illustrations, Figs. 1 and 2, show two planers made by the American Tool Works Company, Cincinnati, Ohio. The design of both machines is practically the same, the only difference being in the size. Fig. 1 shows a 24-in. x 24-in. planer, while Fig. 2 shows a 33-in. x 33-in. machine. The beds of these machines are of deep pattern and are made extra wide between the V's. They are strongly braced by box cross-girts at short intervals and are rigidly supported by short legs. The bed is made long in proportion to the table length and the tables have but little overhang when planing at full length. The central portion of the bed where the gears are mounted and where the strain is heaviest, is strongly reinforced. The V's are wide and are lubricated by oil rollers. The tables are fitted with T slots extending their entire length, and are also fitted with an improved dirt-proof device which protects the V's from dirt and chips. All T slots are cut and all holes are drilled and reamed

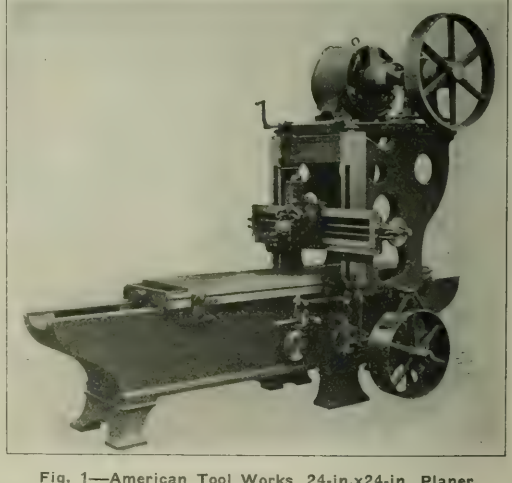


Fig. 1—American Tool Works 24-in.x24-in. Planer.

from the solid metal. The tables are provided with quick return and the reverse is practically void of all shock or jar. By an improved shifting mechanism the belts are moved from one pulley to the other before the return movement belt engages the other pulley; thus the slipping and shrieking of the belts is obviated. A safety locking device is also provided, which prevents the table from starting before the operator is ready. The back dogs are arranged so that the table can be run from under the tool for the examination of the work. The housings are of the double-webbed, cored section type and are securely held to the bed. The rail bearings are very wide and scraped to surface plates. The cross rails are of box section and are provided with wide bearings. They are raised and lowered by hand and are furnished with one head unless otherwise ordered. When two heads are ordered the 33-in. x 33-in. machine is furnished with an improved power elevating device, and the rail is made extra long so that one head can be made to plane the full width of the machine when desired. The heads are secured to the saddles by four bolts and have automatic cross, vertical and angular feeds. They can be operated from either side of the machine and the saddle is graduated for angular work, and down feeds are provided with micrometer adjustment. All driving shafts are of crucible steel and arranged so that they can be readily removed with all of their parts without disturbing the rest of the machine. The pinions are of steel and all gears and racks are cut from the solid. The bull-wheels are fixed on these shafts, which run in long bushed bearings. These machines can be furnished with any length of bed. The 24-in. x 24-in. machine when provided with a 6-ft. table has a bed 10 ft. long and the 33-in. x 33-in. machine when provided with an 8-ft. table has a bed 12 ft. 6 in. long. Two types of motor drive are shown in the accompanying illustrations. Fig. 1 shows an arrangement for motor drive, using the silent chain connection between the motor and the pulley shaft. The motor in this case is of the constant speed type and the ratio in the chain sprocket is varied according to the speed of the motor used, consequently any standard motor may be mounted as shown. This type of drive is also provided with gears substituted for the chain and sprockets. The drive pinion furnished is of rawhide to insure noiseless running and the housings are very rigid, and are cast in one piece with box section. This insures minimum vibration and maximum stiffness, which will easily withstand any strains sustained by reason of the motor attachment on top. The motor is substantially mounted upon a rigid bridge which connects with the housings and the arch, and

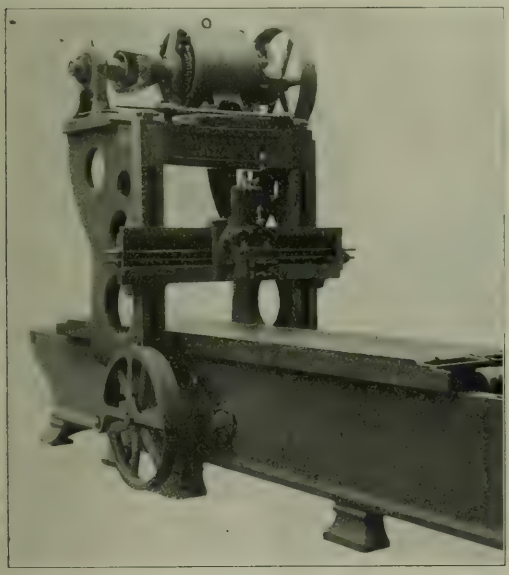


Fig. 2—American Tool Works 33-in.x33-in. Planer.

is securely bolted in place. The drive shaft is mounted upon massive stands which are adjustable for alining the motor and driving shaft. The stands contain ring oiled or dynamo bearings of very liberal proportions, which insure perfect lubrication and long life to the journals. The return drive pulley is furnished with a fly wheel rim in order to increase the momentum of the return pulley and belt, thus reducing the strain of reverse on the motor, and other parts. Fig. 2 shows a type of motor drive in which the motor shaft is connected direct to the upper driving pulley shaft by means of couplings as shown. This construction is used where the speed of the motor is the same as the required speed of the countershaft. The large driving pulley has a fly wheel rim and the housings and motor bridge are similar to those shown in Fig. 1. Both illustrations show arrangements as applied to planers having hand elevating device to rails with single head. When double head rails are supplied the power elevating device is furnished to all planers from 30 in. up, while all planers from 36 in. up are regularly furnished with a power elevating device whether single or double head.

Fig. 3 shows a locomotive connecting rod planer made by the John Bertram & Sons Company, Dundas, Ontario, Canada. This machine is of massive construction and has ample power for carrying four heavy cuts. Two heads are fitted to each cross-rail; thus two connecting rods can be planed at the same time. The machine admits 48 in. between the housings and 30 in. under the cross-rail, when it is at its extreme height. The standard length of bed is 16 ft. The saddles are arranged so that the tools on each cross head can be brought

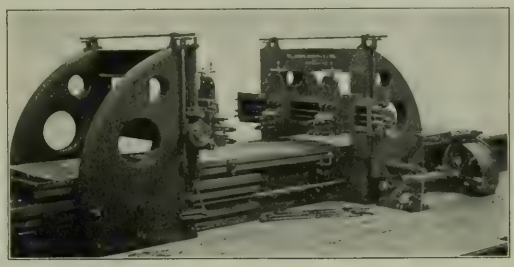


Fig. 3—The John Bertram & Son's Co. Connecting-Rod Planer.

to 10 in. from center to center. This machine is driven through spiral gears, and the movement of the table is parallel with the line shaft.

(To be continued.)

Railroad Employment Bureaus.

At the May meeting of the Association of Railway Claim Agents, Mr. R. C. Richards of the Chicago & North-Western, in discussing the question of railroad employment bureaus, said:

Having had constantly brought to my attention the expensive results caused by employing men who, by reason of their mental, moral or physical make-up, are not fitted for service in the operating department of a railroad, I have given the matter of how to remedy the trouble much consideration. I am satisfied that the only way is to give the matter the same attention and thought that is given the question of determining what class of engine or type of car, bridge, rail or structure is the best, as well as the most economical for a railroad company to adopt. These matters are given the most careful attention from the president on down through the ranks while the matter of inquiring into and passing upon the qualifications, character and record of applicants for employment who are to operate or care for these expensive engines, cars, bridges, signals, track, etc., with but few notable exceptions, is left to a clerk or a subordinate officer in the transportation or mechanical departments, when any inquiry at all is made. Any one who wears pants, who is under the age limit, or is willing to swear that he is, who by any possibility can pass the physical examination, who frequently is unfit for the business, dull of comprehension, hesitating and slow of speech, clumsy in movement and low in morals, is put to work solely because men are needed for immediate service, and there is not time to get the kind of men desired. The result is just what might be expected. Here are some examples of such a system of employing men:

(1) A recent inmate of an insane asylum, employed as a fireman of a stationary engine; no need of saying what happened.

(2) A city policeman recently discharged for rape is employed as a brakeman.

(3) A boy, more than half fool, is employed as a messenger in a switching yard on account of the importunities of his father who was an old employee; as a consequence the boy is injured.

(4) A morphine and cigarette fiend, known to be a monumental liar, is employed as a brakeman and turns up with a fake injury claim.

(5) A brakeman employed for 12 years is examined for the position of conductor and is reported to be so ignorant that, although an Irishman, he did not know the name of his national color.

On nearly all railroads civil service rules govern promotion and permanency of service, but the foundation on which the whole system should rest, the important problem of selecting applicants for employment and passing on their qualifications, seems to have been left out. Employing men for the operating department (and the same method would work advantageously in all departments) should be done by an officer or agent who is a good judge of human nature; one who would make it his business to look up young men

and there are thousands of them who are not only adapted to the railroad service, but who are anxious to get into it, but do not know how to go about it—pass upon the qualifications of the applicant, and if he appeared to be a desirable man, look up his record, and if satisfactory and he could and did pass the physical examination, put him on a waiting list, and when new men were needed supply them from that list.

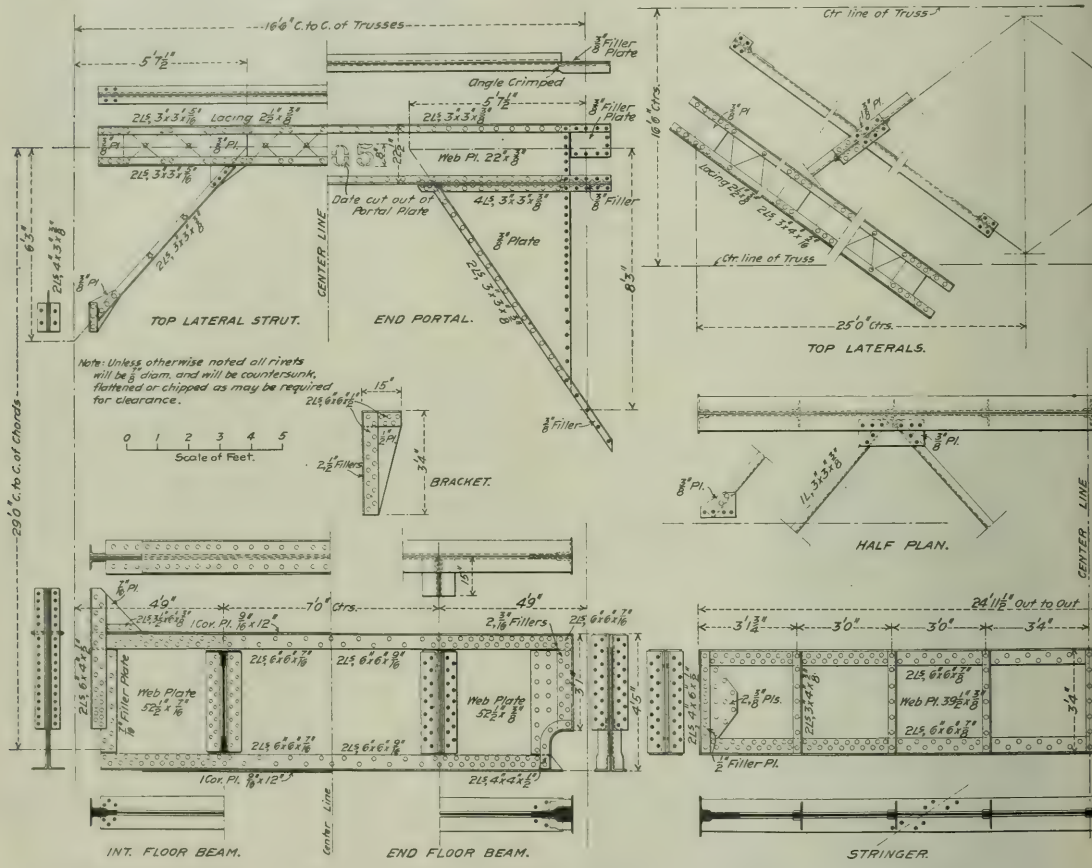
Plenty of clean-cut, nervy, ambitious young men, coming from respectable families, of good standing legally, adjacent to the railroad, would at the present rate of wages paid by the railroad companies, jump at the chance of getting into the service, and by securing them the companies would not only get a higher class of men, morally, mentally and physically, than they do now, but would also in a measure secure the good will and interest of their families. This frequently in local and state affairs could be used advantageously and at the same time would prevent the employing of such characters as those above mentioned. We all know that it is the careless, unfit men, those who neither know the rules nor care to learn them, who have no adaptability for the service, that get wonderful improvement in the class of men now engaged in the service.

If, in addition to having a Bureau of Employment, we also had a school in which to instruct the new men, and the old ones too, for that matter, what the rules and their duties are, and how to perform them, the labors of the claim department and the losses of the companies would be cut in half.

Standard Bridges on the Harriman Lines.*

The previous series of articles showed the standard designs of plate girder bridges for short spans from 30 ft. to 100 ft., and included the complete specifications for steel bridges. The accompanying drawings show the shortest of the riveted through truss bridges, which are used for spans from 100 to 150 ft., including 110, 125, and 140-ft. spans. They are designed for the same loading as the plate girder bridges and are to carry a single track.

The panels are of uniform length, 25 ft., and the distance from



Details of Floor System and Portal Bracing for 100-ft. Riveted Through Truss—Common Standard, Harriman Lines.

injured themselves and cause accidents that result in injury to others and loss and damage to property.

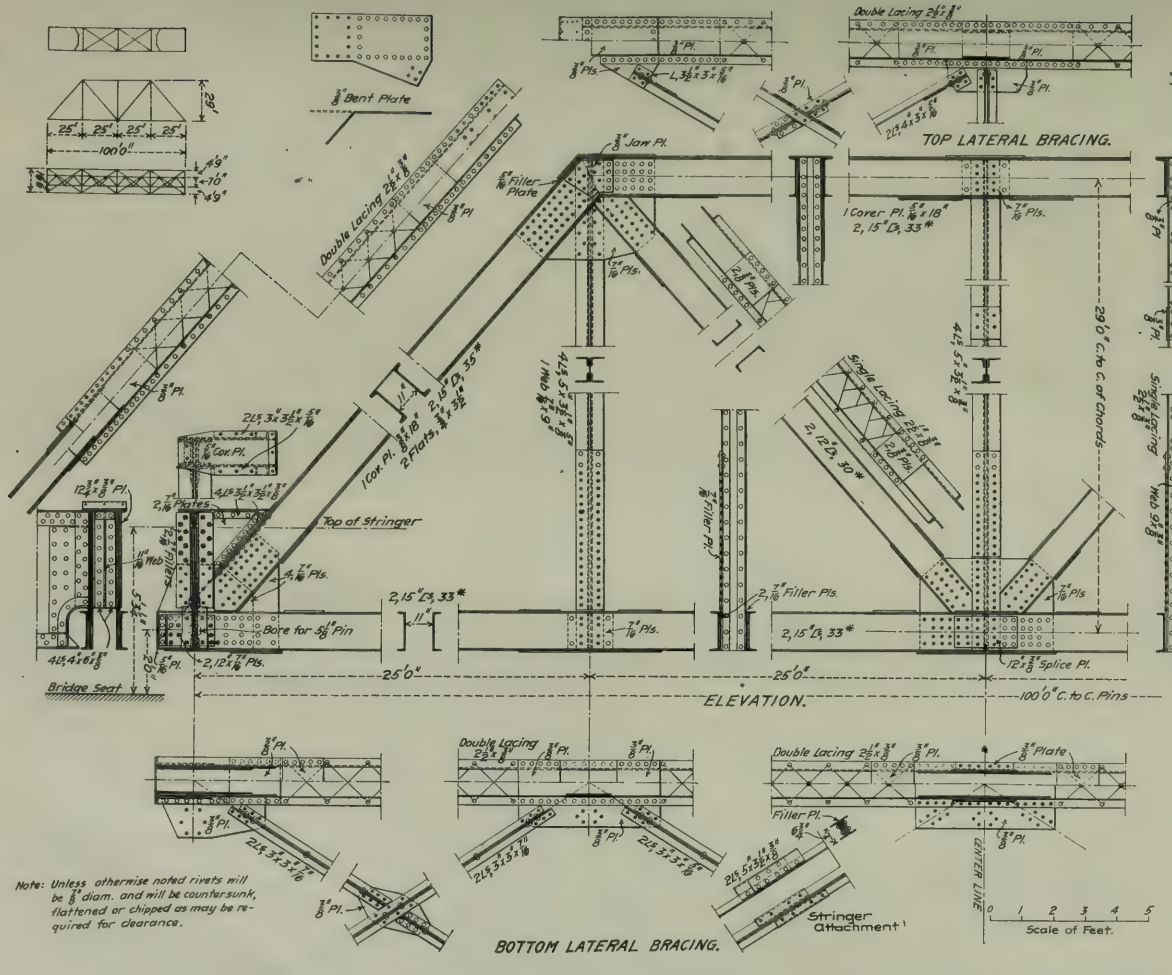
How much better it would be to be able to telephone or telegraph the officer whose duty it was to employ and furnish men that you want so many agents, telegraph operators, firemen, brakemen, or switchmen, and know you would get good men, instead of being obliged to hustle around and hire the first thing you can pick up and call him an agent, operator, brakeman, fireman, or switchman, and then hold your breath fearing every minute a telegram will come calling for the wrecking car and the coroner or the chief of police!

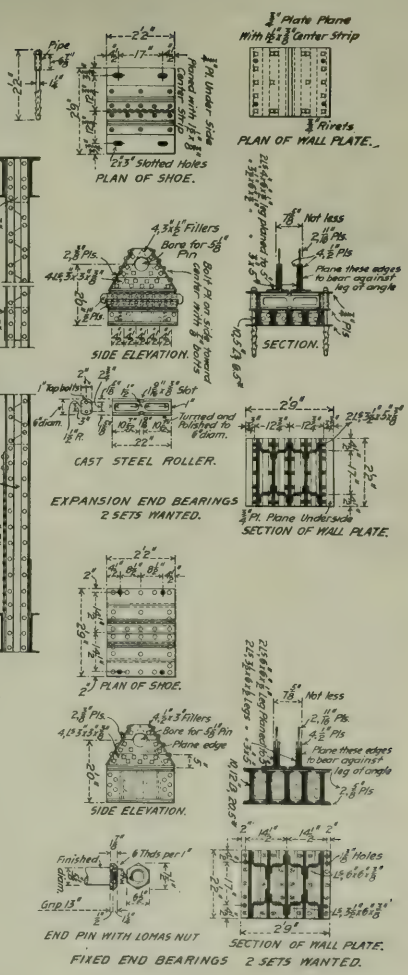
The adoption of such a plan would, of course, cost something and mean a lot of work for somebody to start and maintain it, but the cost would be nothing compared to the losses caused by the present method, and would, in the end, prove the best investment the railroad adopting it had ever made. It would demonstrate by results that it is as important to have good men as it is to have good engines, cars and roadway, and in a few years we would see a

center of bottom chord to center of top chord is 29 ft. The top an bottom chords are made up of 15-in. 33-lb. channels placed back t back, a 5-16-in. cover plate being used on the top chord and doubl latticing on the bottom chord. For the end diagonals a ⅜-in. 18-in. cover plate, two 15-in. 35-lb. channels and two flats, ¾ in. 3½ in. are used. The vertical members at the panel points ar I-beam posts made up of four 5-in. x 3½-in. x ⅜-in. angles and web plate 7-16 in. x 9 in., while the intermediate diagonals are tw channels tied with single lacing. For the top lateral bracing doubl angles are used for the diagonals and laced struts for the transvers braces. Between the bottom chords diagonal angle braces only ar used.

The floor system consists of deep floor beams at each pan point riveted to the posts and a pair of stringers 40 in. deep betwee each floor beam. The ties are notched over the top flanges of th stringers in the usual way. At the ends of the bridge the end floo

*Previous articles appeared in the *Railroad Gazette*, Mar. 17, 24, 3 April 7, 14, 21 and 28.





Details of Side Trusses and End Bearings for 100-ft. Riveted Through Truss Bridge—Common Standard, Harriman Lines.

beams are riveted to the bearing plates which are built up inside the channels forming the bottom chord and the bearing pins pass through the bottom chord and bearing plates. The end bearings, both fixed and movable, are the same as those used for the plate girder bridges. The weight of a span complete is 165,000 lbs.

Electric Tramways and the Carriage of Goods in Great Britain.*

BY ALFRED H. GIBBINGS,
M. Inst. E. E., A. M. Inst. C. E.

Within a period of less than seven years, the development of electric traction in Great Britain has been marvelously rapid. The rate at which Parliament has granted concessions for private enterprise, and the eagerness with which the municipal and local authorities have pressed forward in this matter, has been abnormal in comparison with the progress of any other undertaking of a similar class, not excepting electric lighting.

In 1897, the writer, in conjunction with the city surveyor of Bradford, drew up the first municipal electric tramway specification, and on July 29, 1898, the working of the first ten miles of municipally-owned electric tramways was successfully inaugurated. Prior to this the only electric lines of any considerable extent were those of the Bristol Tramways and Carriage Co., which commenced running electrically in October, 1895, and the Dublin United Tramways Co., which were opened in May, 1896.

At the present time there are no less than 153 electric tramways and light railways in the United Kingdom, with nearly 2,000 route miles in operation. Many of these are in groups, physically connected up and maintaining an interchange of traffic, and hence the possibility arises of conveying goods as well as passengers over these lines. Every Electric Tramway and Light Railway Order contains a schedule of the articles allowed to be carried and the maximum rates and charges for the conveyance of almost all classes of goods, animals and things which include such heavy pieces as boilers, stone, machinery, etc., of which any single piece may weigh over eight tons. In fact, such facilities are granted for the carriage of goods on electric tramway systems, that it is impossible to forecast the extent of the probable development in this direction in the immediate future.

It will be apparent therefore, that the very short time which has elapsed since the introduction of electric traction, has precluded any very striking progress on the "goods" side of these undertakings; indeed, in some cases, it has not been possible to meet adequately the demand of "passengers." On the other hand, however, it has been found that on many of the interurban and rural tramways, the traffic receipts from passengers have not been, and are not likely to be, sufficient to meet expenditure owing to the high initial cost of construction. The problem of goods traffic is thus, at the outset, confronted with two difficulties of an entirely opposite character. On the one hand the town systems are already overcrowded with cars and are earning enormous profits; on the other hand the urban and rural systems are handicapped by unremunerative capital and are limited in their scope and extent. It is true that this is only one aspect of the subject, but typical of many other difficulties which present themselves, and are the first and most important requiring solution, and it is clear that some compromise must ultimately be arrived at.

There will be no need to enumerate those towns which are fortunately situated in having good dividend-earning undertakings, but some instances of the opposite class may be cited here in order to indicate clearly the necessity which exists for them to use all their available powers in order to increase their earning capacity. The following tabulation shows the loss sustained in operation on a passenger traffic basis.

Loss on Electric Tramway Undertakings.

Names.	Commencement of electric running.	Length of line open, miles.	Deficit for 1904.
Aberdeen	1899	25	No profit.
Birkenhead	1901	23	No profit.
Blackburn	1899	24	£5,138.
Brighton	1901	13	£4,779
Burnley	1901	19	No profit.
Burton-on-Trent	1903	8	No profit.
Darwen	1900	6	£1,485
Farnworth	1902	7	£1,780
Halifax	1898	44	No profit.
Huddersfield	1901	35	£4,911
Ipswich	1903	12	£1,920
Lancaster	1903	8	£2,833
Leicester	Horse trams.	16	£1,330
Lowestoft	1903	6	£226
Northampton	Horse trams.	9	£392
Oldham	1902	28	£7,826
Reading	1903	13	£543
Rochdale	1902	5	£4,037
Rotherham	1903	9	£17
Southport	1900	19	£341
Warrington	1902	9	£783
Wolverhampton	1902	13	£2,366
Great Yarmouth	1902	5	£215

The position in which these undertakings find themselves is indeed unfortunate. Before commencement of operation it was almost impossible to tell with any degree of accuracy what the number of passengers per car mile would be, and hence the nature of these promotions has been highly speculative. When once this figure has been ascertained it is in most cases almost invariable from year to year and so, unlike most other business ventures, the tramway is absolutely circumscribed in its development. So far, however, we have been referring to passenger traffic alone. There remains yet one solitary hope to admit of these concerns being placed on a sound financial footing. That hope is in the carriage of goods.

Attention was first called to the potentialities of a goods traffic on electric tramway systems by passing the Light Railways Act, in 1896, which to all intents and purposes has in almost every instance been used to obtain electric tramway powers instead of applying under the Tramways Act, 1870. The Light Railways Act was passed with the special object of facilitating the transport of goods, but more particularly agricultural produce, from country districts to railway centers, canals, towns, etc. It has not yet fulfilled the object of its existence, but indirectly, through the construction of a large number of interurban tramways and light railways, it may ultimately do so.

In 1900—1901, the writer was interested in the development of the South Lancashire Tramways, which serve an area full of promise for the most successful growth of goods traffic, a careful canvass showing an enormous amount of road conveyance of a wide variety of goods. Papers by the writer were read on the subject before the British Association in September, 1901, and the Liverpool Engineering Society in January, 1902. The compilation of these papers necessitated enquiry into all sorts of conditions, pro and con, which exist in this country; into many similar cases on the continent and in the United States, where more progress has been made, and the discussions which arose at the reading of the papers brought out many novel and striking features. Several of these will be referred to further on in this article.

The next step has been a practical application of the powers which hitherto have lain dormant. It consists in the inauguration of a local parcels service on several systems, on some of which it has been very completely and extensively organized.

The undertakings which have made this attempt are: Manchester Corporation, Bradford Corporation, Dublin United Tramways Co., Ltd., Dundee Corporation, Edinburgh and District Tramways Co., Ltd., Huddersfield Corporation, Bury Corporation, Gravesend and Northfleet Electric Tramways, Ltd., Ipswich Corporation, Reading Corporation, Potteries Electric Traction Co., Halifax Corporation and the London United Tramways Co.

A full description of most of these schemes has appeared in the technical press, but it is not the intention here to describe or enlarge upon the details of a parcels service. It will suffice to remark that the Manchester Corporation has designed a special goods or parcels van, which runs between the passenger car services throughout the day. The van is almost identical with the type which has been used for many years by the Pittsburg Express Company, Pittsburg, Pa. It is a clear indication that the business will not be allowed to rest within the limits of parcel conveyance, but that when some of the more obstructive difficulties have been overcome, the carriage of goods will commence in earnest.

Beyond the movement in connection with parcels, very little has yet been done towards inaugurating a comprehensive goods service. The Huddersfield Tramway Department are carrying coals over their lines, and in 1901, the South Lancashire Tramways Co., appointed a goods traffic manager, but gave up the idea through want of capital.

At the annual meeting of the Potteries Electric Traction Co., on April 11, this year, the chairman, Mr. G. F. M. Cornwallis-West, said:

"There had been an increase again in the parcels traffic, the number of parcels carried being 209,633, and the receipts had increased correspondingly. Other tramway undertakings, both municipal and otherwise, had taken up this important subject, and the Potteries Company had been the model in many instances upon which these systems had worked. It was to be hoped that in the near future it would be possible for these concerns to form some sort of combination whereby they could act as each other's agents in the districts they serve, and so enormously increase the volume of business, and thus reap the profits now obtained by intermediaries. The carriage of heavier goods was receiving the directors' attention, and application had been made to the local authorities with reference to the construction of sidings to facilitate such traffic, but so far unsuccessfully."

This undertaking is one of the large group of tramways associated with the British Electric Traction Co., and it may be assumed therefore that the foregoing speech indicates that the British Electric Traction Co. attach considerable importance to the goods traffic problem.

In enumerating the difficulties of inaugurating a goods service on electric tramways, no regard need be given to such objections as may be classed as æsthetic, constructive, or purely traffic troubles. These are simple and weigh but little in comparison with those of a more obstructive and real nature. Indeed, there are some which must be removed, notwithstanding the facilities and powers already conferred by the Acts and Orders, before any business can be done.

In the first place even the carriage of parcels has met with strong local opposition in Manchester, and has involved the corporation of Manchester in serious litigation on a question, the decision of which will be awaited with great interest.

When the scheme was proposed, it met with determined opposi-

*Reprinted from the July number of the *Engineering Review*.

tion from the private traders whose businesses it seemed likely to affect. A well-known parcel carrying firm of Manchester has now served a writ on the corporation in which they set forth the following claims:

(1) A declaration that the defendants have no power to convey, collect, or deliver by means of road vans, handcarts, or messengers; to act as general carriers or delivery agents, general forwarding or railway agents; or to undertake the collection of the value of goods on delivery.

(2) An injunction restraining the defendants from acting as above.

(3) A declaration that it is unlawful to spend money out of the city funds or the tramways receipts for any such purposes.

(4) An injunction restraining such spending.

(5) A declaration that it is unlawful to use the buildings, plant, and servants of the tramways undertaking otherwise than for strictly tramway business.

(6) An injunction restraining the defendants from such use.

The writ has been granted in the Chancery Division of the High Court, and the Tramways Committee gave the Town Clerk authority to defend the action.

Without attempting in any way to pre-judge the merits of this action, there can be no question but that it amounts to an admission that the tramway parcels service is a better and more expeditious service than the horse and van service, and hence becomes a serious competitor.

The other drawbacks may be summarized as follows:

(1) Co-operation with regard to interchange of traffic and through running powers by contiguous undertakings.

(2) Sidings from main lines and into private premises.

(3) Collection and delivery to and from places remote from the service lines.

(4) Trailers and marshalling.

With regard to the first, running powers necessarily implies two things. In the first place it is an arrangement by which the goods can be carried from point to point. Secondly, it is obviously necessary that the rail gages must be the same throughout, and that the method of haulage or traction should be identical. In other words, the systems must be the same in both cases. In the majority of systems of electric traction in this country the conditions are almost identical, with the exception in a few instances of gages narrower than 4 ft. 8½ in. The difficulty therefore resolves itself into the possibility of agreement or co-operation between two or more contiguous authorities. This is a portentous subject in itself, especially when one considers the usual type of rate-payer who figures conspicuously in all negotiations, whether the undertaking is owned by the local authority or by a company. Some attempt, however, has been made by a committee in Lancashire consisting of representatives from the Liverpool Corporation, other corporations, Liverpool Chamber of Commerce, Mersey Dock and Harbor Board, and mill owners, etc., to arrive at some common basis for the conveyance of goods over all the South Lancashire systems, including Manchester and the district east of it, bordering on Yorkshire. No report of the proceedings has yet been issued.

The next difficulty relates to the question of sidings into mills, collieries, railway yards and similar places.

A very real and immediate difficulty arises in obtaining the sanction to lay additional lines and sidings. It has been referred to in the speech of Mr. G. Cornwallis-West, quoted herein. It affects both municipal and private enterprise alike, although of course the private enterprise is in much the worse position, because it would frequently have to obtain the sanction of the local authority as a *sine qua non*. Under the existing legislation, therefore, it is possible for a local authority or private individual (as a frontager for instance) to withhold in the most arbitrary manner the consent which is necessary, to lay even a special siding into premises. Therefore, whether powers have been obtained under the Tramways Act, or Light Railways Act, the whole course of the original procedure of applying for powers has to be repeated for every additional line or siding required. It is at once apparent that such a condition becomes practically prohibitive in consequence of the costs and delays involved.

It is true that the Board of Trade can exercise very limited powers in this respect, but after a concession has been obtained in the usual way, it should not be allowed to remain practically impossible to obtain such reasonable and beneficial extensions, as special short lines to mills, and sidings from the predetermined track. This appears to the writer to be the most important obstacle to be removed, for it would also supply the key to many of the other difficulties. The difficulty might very well be dealt with on a similar basis to the laying of service lines from electric light street mains, provision for which (including extensions of mains) is made in the Electric Lighting Acts, 1882 and 1889.

The collection and delivery of goods to and from places remote from service lines or depots is a problem which can only be solved very gradually and in accord with the exigencies of the business to be done. Given the facility to lay additional sidings, and short extensions into mills, collieries, etc., much supplementary collection, etc., would be avoided. It must not be forgotten that the essence of economy in connection with the carriage of goods on electric tramways is the avoidance of loading and unloading several times in the course of one journey. Hence, whether the collection of goods is from points near to or remote from the system, some method of handling and transferring in bulk must be adopted. With the horse-drawn truck this has been a difficult, if not an impossible matter, but with the new motor trucks the transference and carriage is simplified. The platforms and upper portion of trucks should be identical, interchangeable, and readily removable from one to the other when fully loaded.

The employment of trailing cars is also not yet permitted by the Board of Trade. It is not anticipated that more than two or three trailers would ever be required, except perhaps in a purely local service in country districts. The employment of trailers involves shunting and marshalling, both objectionable and uneconomical methods, but nevertheless it would very often be a great convenience and great economy to make use of one or two trailers. So far, however, this is not permitted on lines in this country, but it is a common feature in the United States and on the Continent.

The advantages which would accrue from the utilization of electric tramways for the carriage of goods would be, broadly speaking, twofold. In the first place an increased revenue and reduced standing charges would result to the undertaking; and secondly a healthy competition would be set up between this departure and existing carriers, including the railway companies. Thus the local manufacturer, colliery owner, agriculturist, and tradesman would benefit by cheaper rates of transit for their goods and an incentive would at once be given to the improvement of local conditions and trade generally. When once the main obstacles to the initial start are removed, or at least considerably modified, and assuming the same rapid development as was experienced with electric tramways, it is safe to predict that this new boon will soon become a formidable competitor with railway companies, and therefore of national importance. High railway rates has long been a subject of strong complaint by all importers and exporters, both with regard to raw produce and the manufactured article, and until some form of competition, in the nature of cheaper rates and fairly rapid transit is introduced, no hope of a reduction is tenable.

There is, therefore, the very strongest reason why all local industries and rate-payers should assist in every possible way towards the inauguration of this most desirable facility.

The question that immediately arises is, how is it possible for tramways to offer cheaper rates of carriage than railways? If we take the capital cost of a tramway undertaking, we find that it is proportioned somewhat as follows:

Permanent way, overhead equipment, etc.	60 per cent
Generating station, car sheds, etc.	25 "
Rolling stock	15 "
	100 per cent.

From this it will be seen that the utilization of the permanent way would result in reduced standing charges to both passenger and goods departments to the extent of a large proportion of capital. Maintenance charges would still remain the same for both concerns, though in reality doubled due to extra wear and tear. The greatest economy, however, would arise from the through conveyance of goods, not necessarily on the same vehicle, but without rehandling in detail. Hence such charges as warehousing, service terminal charges (often the most serious and heavy charge of all), loading and unloading, and shunting costs, would be greatly reduced, if not totally avoided in the majority of cases. Incidentally such an arrangement should be also to the benefit of the railway. With properly constructed interchangeable truck bodies, goods could be transhipped in bulk to the railway, and thus the long distance goods traffic would be augmented and made more profitable.

Other indirect advantages are also possible. The increased traffic on the system will tend towards the reduction of the cost of electrical energy, by increasing the load-factor of the generating station. The difference may be represented as the saving between a 60 per cent. and a 40 per cent. load-factor, or in other words more than 20 per cent. more energy can be generated at the higher load-factor at the same cost. Another detail in economy is the saving in road repairs and maintenance to the local authority through lessened horse and motor truck traffic, and that this is likely to be of real importance, appears from papers read by eminent engineers and road surveyors.

Four Cylinder Compound Locomotives on the Paris-Orleans Railway.*

In February, 1903, the Orleans Railroad put into service on the Paris-Bordeaux division 23 new locomotives, eight of which, Nos. 3,001 to 3,008, are of the Atlantic or 4-4-2 type, and 15, Nos. 4,001 to 4,015, are of the ten-wheel, or 4-6-0 type. These locomotives were

*Abstract of article by M. P. Gonte in La Revue Générale for July, 1904. Translated by Lawford H. Fry.

built at the Alsacienne Company's works at Belfort, from designs prepared by this company and by the Orleans Railroad. Except that they are larger, these locomotives do not differ from the four-cylinder compounds put in service during the last few years by the Northern Railway of France, the Southern and the Eastern Railways and the Orleans Railroad. The increase in power was rendered necessary by the constant increase in the weight of the high speed trains. The maximum axle load is limited to 40,000 lbs. The Atlantic type locomotives, which have 79 in. drivers (2 in. tires) handle the expresses at a speed of 55 to 60 miles an hour, making the run from Paris to St. Pierre-des-Corps, a distance of 150 miles, and with one stop at Aubrais, and the run from St. Pierre-des-Corps, a distance of 217 miles, with two stops, at Poitiers and at Angouleme. The 4-6-0 locomotive haul expresses at a speed of 45 to 50 miles per hour with heavy trains and with frequent stops. They make the run from Paris to Tours, a distance of 150 miles, and from Tours to Angouleme, a distance of 133 miles, with numerous stops. These 4-4-2, or Atlantic type, and the 4-6-0, 10-wheel type engines, only differ from each other in the arrangement of the wheels and have boilers and cylinders of identically the same design. The grate area of these locomotives is 33.4 sq. ft. (122 in. x 39 in.). Experience has shown that this considerable length of firebox (122 in.) does not offer any difficulty in the firing if the grate has a slope of 12 deg. The heating surface is 174 sq. ft. in the firebox and 2,403 sq. ft. in the Serve tubes, making a total of 2,577 sq. ft., or approximately 77 times the grate area. The evaporative power of the boiler has shown itself to be high, the rate of combustion being 102½ lbs. of coal per square foot of grate area per hour, with a rate of evaporation of 8 lbs. of water per lb. of coal.

The cylinders are 14⅜ in. and 23½ in. diameter, with a 25-in. stroke, while similar locomotives built for the Orleans Railroad in 1900 had cylinders 14 in. x 22 in., with a grate area of 25.8 sq. ft.

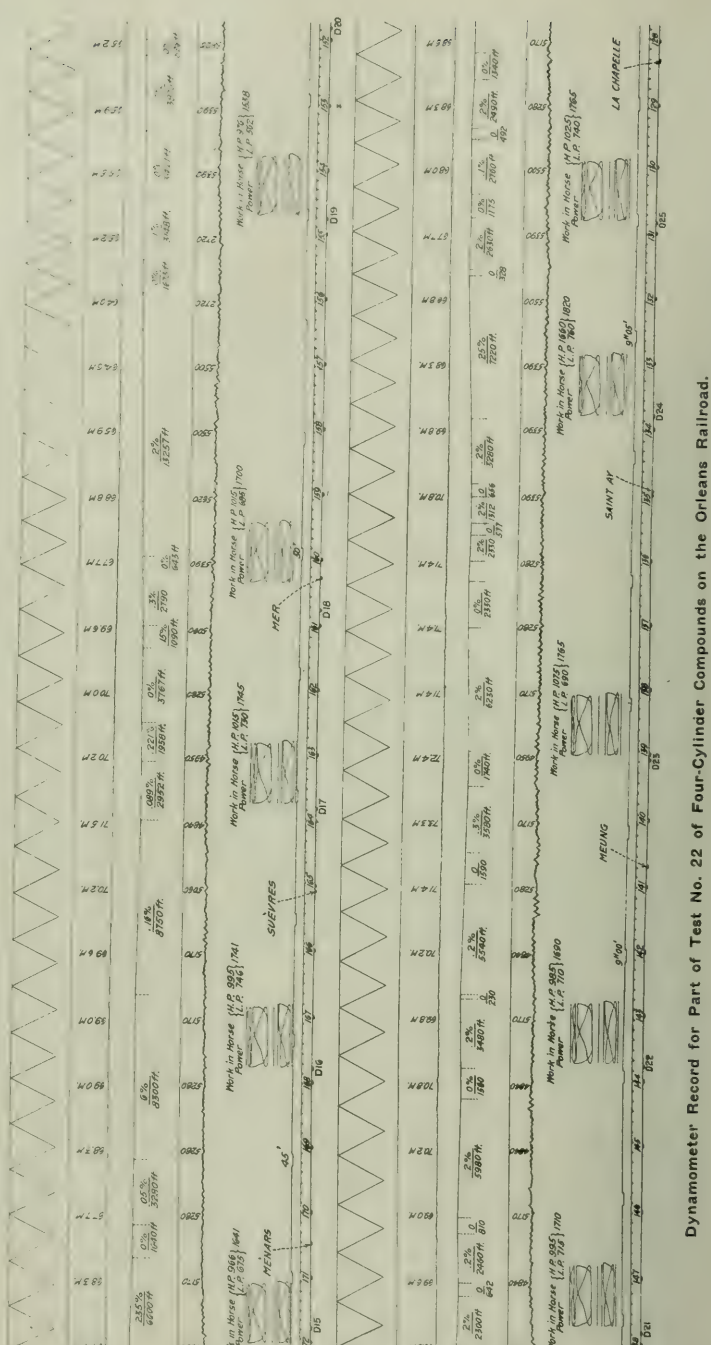
With a cut-off of 55 per cent. in the high-pressure cylinders at high speed the engine consumed all the steam generated by the boiler when burning from 100 to 110 lbs. per sq. ft. of grate with a fuel composed of half coal and half briquettes.

The high-pressure valves are of the balanced type, and the low-pressure valves are plain D valves.

The cylinders and steam pipes of these engines have been designed with the view of making the steam-passages as direct and of as large a section as possible. The high-pressure steam pipes are 4⅛ in. in diameter, while those of the receiver are 5⅛ in. in diameter. The steam ports are 14 in. x 1⅜ in. and 20½ in. x 1¾ in.

The indicator diagrams on the dynamometer record herewith show the efficiency of the ample sections given to the steam passages.

The wire-drawing at cut-off is decidedly less than in the previous locomotives, and it is not until the high speed of 70 to 75 miles per hour is reached that there is a drop of from 2 to 3 lbs. between the high-pressure exhaust and the low-pressure admission pressures. This arrangement enables the engines to run with nearly the same cut-off in both cylinders, say, 50 per cent. in the high-pressure and 55 or 60 per cent. in the low-pressure. Further, the pressure in the low-pressure steam chest can be kept down to about 7.7 lbs. per sq. in. and the work in the two cylinders nearly equalized.



Dynamometer Record for Part of Test No. 22 of Four-Cylinder Compounds on the Orleans Railroad.

The general dimensions of the locomotives are given below in tabular form:

Boiler.	Locomotives 3000 and 4000.
Working pressure	227 lbs.
Grate area	33.37 sq. ft.
Length of firebox	122.0 "
Width of firebox	39⅝ "
Slope of firebox	12 degrees.
Heating surface of firebox	174 sq. ft.
Heating surface of Serve tubes	2,403 "
Total	2,577 "
Proportion of heating surface to grate area	77.25
Volume of water	1,500 gals.
Volume of steam	766 "
Length of tubes between tube plates	14 ft. 6¼ in.
Mean diameter of boiler waist	59½ in.
Engine.	
Cylinders—Stroke	25½ in.
Diameter of high-pressure	14⅛ "
Diameter of low-pressure	23⅝ "
Ratio of volumes	2.78
Valves	High-pressure, balanced
Outside lap	2⅛ in.
Inside lead	¼ "
Maximum travel	5½ "
Dimensions of admission ports, h.-p.	14⅜x1¾ in.
" " exhaust " h.-p.	14⅜x3⅜ "
" " admission " l.-p.	20½x1¾ "
" " exhaust " l.-p.	20½x3⅜ "
Sectional area of steam pipe to h.-p.	13.3 sq. in.
" " " steam pipe to l.-p.	20.5 "
" " " exhaust l.-p.	58.9 "
Maximum sectional area of exhaust pipe	45.6 "
Minimum sectional area of variable exhaust	17.7 "
Proportion of volume of h.-p. valve chest to that of cylinder	1.18
Proportion of volume of receiver* to that of l.-p. cylinder	1.44

*Common valve chest and exhaust pipe from h.-p.

Wheels.	Engines—No. 3000.	Engines—No. 4000.
Diameter of drivers (thickness of tire 2 in.)	78.8 in.	70.9 in.
Diameter of front truck wheels	46.25"	36.25"
Diameter of trailers	50.0 "	" "
Distance between axles 1 to 2	90.5 "	90.5 "
" " " 2 " 3	69.0 "	69.0 "
" " " 3 " 4	84.5 "	78.8 "
" " " 4 " 5	98.5 "	86.5 "
Rigid wheel base	15 ft. 3 in.	13 ft. 9 in.
Total wheel base	28 " 6 "	27 " 0 "
Weight.		
Distribution of weight, truck	44,500 lbs.	42,695 lbs.
" " " third axle	38,250 "	39,890 "
" " " fourth axle	40,690 "	39,890 "
" " " fifth axle	36,130 "	39,890 "
Total	159,660 lbs.	161,765 lbs.
Weight on drivers	77,775 lbs.	117,265 lbs.
Total length of engine	38 ft. 6 in.	38 ft. 2 in.
Tenders.		
Tank capacity	5,300 gallons.	4,500 gallons.
No. of wheels	8	8
Weight, empty	42,065 lbs.	36,180 lbs.
Weight, in working order	99,425 "	81,585 "
Length of tender	24 ft. 2 in.	20 ft. 0 in.
Total length of engine and tender	63 " 0 "	58 " 3 "
Total wheel base	54 " 9 "	50 " 0 "

Results of Tests Carried Out on Locomotives of the 3,000 and 4,000 Series.

Tests have been made with locomotives No. 3,001 and No. 4,013 with the object of determining the power actually available in regular service with these two types of machines. The tests were carried out on the run from Paris to Tours (146 miles) and return, which was made in each direction with a single stop of 15 minutes at Auxbrais. This stop is almost exactly in the middle of the run. The trial train consisted of a dynamometer-car weighing somewhat less than 395,000 lbs., and which was described in the *Revue Générale* of March, 1903, and the *Railroad Gazette* of June 19, 1903, and loaded cars varying in number according to the weight desired for the test. These cars had two axles spaced 19 ft. 8 in. apart. They were loaded so as to weigh about 44,000 lbs. apiece. The amount of water and coal used were accurately noted during the run. The fuel used was a half and half mixture of Aniche coal and Somain briquettes.

Table 1 shows the averages obtained from the 32 tests run between Paris and Tours. The train loads ranged from 242 tons to 385 tons (2,000 lbs.) behind the Atlantic type engine No. 3,001, and from 385 to 536 tons behind the 10-wheeler No. 4,013. The trains were run at nominal speeds of 59, 56, 50 and 47 miles an hour. The results obtained are referred to the horse-power at the periphery of the driving wheel. This has been calculated by deducting, in each case from the indicated horse-power, the power required to move the engine and tender, which was determined from a series of tests made by running the locomotive with steam shut off, as explained below.

It will be seen that the power of the 10-wheeler No. 4,013 was not so fully utilized as that of the Atlantic No. 3,001.

The averages given in Table 1 are supplemented by the figures given in Table 2 for the maximum tractive effort, and the horse-power which were developed on stretches of from six to 28 miles in length with trains of 365 tons with the Atlantic type and 536 tons with the 10-wheeler.

The dynamometer car records for the part of test 22 which gave these maxima are reproduced in the accompanying illustration.

The Atlantic type engine No. 3,001 with a train of 385 tons over a distance of eight miles with short rising and falling grades of not over 0.25 per cent. maintained an average speed of 69.6 miles an hour; the average drawbar horse-power was 913, and the average at the drivers was 1,650 horse-power.

The indicator diagrams are shown on the dynamometer record at the points where they were taken. The maximum indicated horse-power is 1,860.

On the Etampes grade of 0.8 per cent., which is 6.8 miles long, the Atlantic type with 385 tons averaged 53.4 miles an hour, developing 986 h.p. at the drawbar and 1,500 h.p. at the drivers.

Averages from 32 test runs made between Paris and Tours (146 miles) with one stop of about 15 minutes.

TABLE 1.—Locomotive No. 3001.

Weight of train.*	Average speed, exclusive of stops.	Average H.P. Drawbar.	Average H.P. At driving wh'l. tire.	Water consumed per hour. Per drawbar H. P.	Water consumed per hour. Per H.P. at drivers.	Coal burned pr sq. ft. of grate per hour.	Lbs. of water evaprated per lb. of coal.
242	57.6 m. p. h.	481	970	47.4	23.6	82.0	8.31
282	60.2 "	593	1,108	41.8	22.4	97.3	7.72
330	57.9 "	580	995	43.1	25.1	88.1	7.98
387	57.40 "	700	1,130	39.7	24.0	106.0	7.68
		Locomotive No. 4013.					
387	54.7 m. p. h.	620	1,069	41.2	23.8	96.7	7.89
431	53.12 "	628	1,022	41.6	25.5	107.0	7.24
541	47.76 "	628	942	37.6	25.0	101.0	7.047

*In tons of 2,000 lbs.

Averages from 32 test runs made between Paris and Tours (146 miles) with one stop of about 15 minutes.

TABLE 2.—Locomotive No. 3001.

No. of test.	Distance considered.	Percentage of cut-off, H.-p.	Percentage of cut-off, L.-p.	Average speed, m. p. h.	Average drawbar pull in. lbs.	Average horse-power—At drawbar measured by dynamometer car.	Average horse-power—At drivers calculated.
15	18.64	50	65	66.2	4,840	856	1,440
16	27.96	50	65	66.5	4,800	854	1,455
17	18.64	52	65	67.7	4,840	876	1,495
18	18.64	53	63	67.7	4,800	866	1,505
19	24.85	50	62	66.8	4,800	856	1,468
19	18.64	50	62	69.6	4,680	868	1,522
20	18.64	50	65	63.7	5,540	943	1,520
20	12.43	55	65	57.8	6,320	970	1,450
20	6.21	55	65	65.5	5,560	976	1,580
21	12.43	53	70	62.8	5,810	974	1,495
21	12.43	53	65	66.5	5,190	922	1,509
22	22.99	53	65	67.9	5,140	933	1,570
22	8.08	53	65	69.6	5,170	960	1,650
22	27.96	53	65	67.1	5,165	940	1,580
22	8.67	55	65	65.2	5,500	957	1,554
				Locomotive No. 4013.			
29	17.34	43	68	54.7	5,280	773	1,194
30	10.56	55	65	48.0	5,630	705	1,045
31	13.67	45	60	54.4	5,080	735	1,168
32	11.19	50	65	52.5	6,420	897	1,336

APPENDIX.

Method of Calculating the Rolling Resistance of the Locomotive and Tender.

The dynamometer car records show the amount of work utilized at the drawbar, and in order to determine the total amount of work it is necessary to add the work consumed in the propulsion of the locomotive and tender which is made up as follows:

1. Work done in overcoming gravity.
2. Work done in accelerating or retarding.
3. Work done in overcoming the resistance of the locomotive and tender.

When the engine is running with closed throttle, the resistance is the only quantity not capable of direct measurement.

The drawbar work is given by the dynamometer records; the work done in overcoming gravity is determinable from an examination of the profile of the road, and the work of acceleration is easily calculated from the recorded changes of speed. These quantities being known the only unknown is the resistance of the locomotive and tender which can be easily calculated, as the relation linking all these quantities together is known.

The laborers' pension fund of the Prussian State Railroads amounted at the end of 1903 to about $6,950,000 for one division, to which 247,733 men contributed; and to about $15,300,000 in the other division, which had 200,328 men belonging to it. This is a capital of $28 per man in the first division and $76 per man in the second. The contributions per man to these funds in 1903 were $1.58 and $3.14 in the two divisions respectively, an equal amount being contributed by the railroad management. Invalid and old age pensions and sick allowances were paid to 11,841 persons in the first division, only 174 of whom had sick allowances; the invalid pension averaged $43 per pensioner; the old age pension a little less. The management of this fund has the right by law to dictate the treatment of invalid pensioners, and it made extensive use of this authority in 1903, especially in the case of consumptives, who were sent to sanitaria, early notice being given of their condition. In these cases allowances were paid to the families of invalids. In 1903, 953 persons were treated at an average cost of $70 each. Of the 553 consumptives so treated no less than seven-eighths were so benefited that they became wage earners again. This, it must be remembered, is a laborers' pension fund. The regularly appointed employees are otherwise provided for. There are also various sick funds covering limited classes or districts.

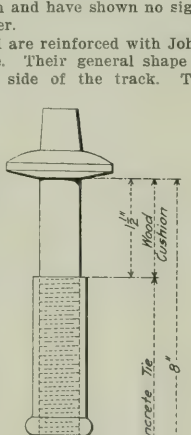
The Percival Concrete Tie.

The accompanying illustration shows a number of Percival reinforced concrete ties laid in the track of the Galveston, Houston & Henderson at the entrance to the Galveston, Tex., yard. The form of tie has been patented by H. E. Percival, of Galveston, and this short experimental section has been laid with them to determine

Percival Concrete Ties in the Track of the Galveston, Houston & Henderson at Galveston, Tex.

their strength and wearing qualities under heavy traffic. They have been in the track now about a month and have shown no signs of failure or needed any attention whatever.

The ties are moulded in one piece and are reinforced with Johnson corrugated steel bars and steel wire. Their general shape is clearly shown by the loose tie at the side of the track. The dimensions are 8 ft. long; 9¼ in. wide on top and 9 in. deep. The ends for two feet of the length are made with a parabolic cross-section to give greater bearing surface under the rails, but in the center the tie has a V shape to make it self tamping and to relieve the center binding pressure, which is always present with a flat bottom tie. The reinforcement consists of three ½-in. bars bedded near the top surface and a ¾-in. bar bedded near the apex of the triangular section. Every 16 in. of the length a steel wire is bound around the longitudinal bars to give further reinforcement from crushing. The ties weigh 385 lbs. and cost about $1.60 to make.



Screw Spike and Socket for Percival Concrete Ties.

The bearing for the rail and the form of fastening are essential details of the Percival tie. The top surface of the concrete is recessed out under each rail to take a hard wood block 2 in. x 9 in. x 14 in. which has previously been treated with a preservative. This block forms an effective cushion to prevent the concrete from crushing under the action of heavy wheel loads and poor counterbalance. In the body of the tie are bedded composition Babbitt metal and galvanized steel screw sockets, and the spikes for holding the rail are screwed down through the cushion blocks into these sockets. The sockets, being thoroughly protected in the concrete, will last indefinitely, and renewals of worn or corroded spikes can be easily made. The spikes are of approximately the same form of head as those used on the French Eastern Railway, and are ⅞ in. in diameter and 10 in. long. The spike illustrated is similar in design, but smaller.

What is the Best Method of Painting Steel Cars?*

BY F. P. CHEESMAN.

The committee appointed by the Master Car Builders' Association on What is the Best Preventive of Rust on Steel Cars? reported at its 1904 convention as follows:

First.—For New Cars: (a) The steel should be thoroughly cleaned of all rust and furnace scale before the car is assembled. (b) All joints before assembling should be thoroughly coated with coal tar. (c) After car is assembled all grease should be thoroughly removed from the steel and same given a good coat of carbon or graphite paint on the outside and underneath, and the inside a heavy coat of crude petroleum, coal tar applied hot, or some similar substance. (d) The outside to be given a second coat of graphite or carbon paint, as may be desired.

Second.—For Old Cars: (a) All scale and rust should be removed wherever it appears on the car, by steel brushes or scrapers and in the case of the inside of the car by any of the above methods or by the use of pneumatic hammers or mauls. (b) After all scale and rust have been removed the car should be thoroughly cleaned with steel scrapers or wire brushes and blown out with air, in order to present a clean surface for the paint. (c) The methods of painting recommended for new cars should be followed out in the case of old cars, after a clean surface is obtained.

The following report was made at the 1904 convention of Master Car and Locomotive Painters by a committee especially appointed to draw up the best specifications for painting of steel cars:

"It is the sense of this association that, in the construction and painting of steel cars the following points are of vital importance to their preservation:

"First.—All flash or mill scale, rust, oil, grease and dirt should be entirely removed from all parts entering into the construction of cars before any paint is applied. We believe that this can be best accomplished by the use of the sand blast.

"Second.—During construction all overlapping joints, wherever metal is placed upon metal, should be thoroughly coated with a heavy mixture of moisture-repelling paint.

"Third.—The initial painting, being of the greatest importance, should be done in the best possible manner. The first coat should be applied immediately after metal has been sand-blasted and before the cleaned surface can accumulate rust.

"The material should be of an elastic nature and sufficient time should be allowed between coats for drying. It should be put on evenly in a workmanlike manner.

"Fourth.—We believe that not less than three coats should be applied to all exterior parts of body, including underframing, and

*Paper read at the Atlantic City meeting of the American Society for Testing Materials, June 30, 1905.

two coats on interior of body; also all parts of trucks except wheels and axles.

"Fifth.—We recommend a rigid inspection of the cleaning and painting of cars under construction by competent, practical men, believing this in the line of economy.

"Sixth.—We would suggest that the abuse of cars in service be stopped by discontinuing the loading of the hot slag, billets, etc. Also that the hammering of side sheets and other injurious methods used to facilitate unloading be discouraged.

"Seventh.—In the repainting of cars, all corrosion and loose paint should be removed with steel scrapers and wire brushes or the sand blast, and not less than two coats of an elastic preservative coating applied to all cleaned parts. As the greatest loss from corrosion is found on the interior parts of coal-carrying cars, we would consider that matter of painting those parts worthy of serious consideration."

We agree largely with the above reports and will consider the subject under two headings: First, as applied to "New Cars Constructed by Steel Car Builders," and second, as applied to "The Repainting of Cars by Railroads."

Under the first heading, we desire to call your attention to the fact that the conditions as we find them now are such as make it impossible to secure a good job of painting, and it is simply money thrown away to attempt to furnish first-class material for the work as it is now done.

In nearly all the large car shops it is the practice to put on two coats of paint in one day, followed usually by the stenciling of the cars that same day. It is unnecessary to state that under these conditions neither adequate protection nor durable results may be expected, but until the present methods are changed we must meet them as they exist, and do the best possible under the circumstances. We believe that better results can be obtained by the application of only one coat rather than the forcing of the two coats to dry so that they can be applied inside of 12 hours. We therefore suggest that in specifying paint for new steel cars when not more than 12 to 24 hours is allowed for painting that only a single coat be specified, and that care be taken to see that the surface to which this coat is applied is properly prepared by removing all rust, mill scale, grease and dirt by sand-blasting; that this work be done under close inspection and that the paint be applied immediately after the sand-blasting as new rust will accumulate in a very short time.

For this one coat work the pigment base of the paint should be pure blue lead. Theoretically the vehicle ought to be only pure raw linseed oil, but as conditions make this impossible a pure selected turpentine drier should also be used. This drier should be of such a nature as to act both as a binder and a drier, and only enough should be used to dry in the required time which for satisfactory results should not be less than ten hours. All overlapping joints which cannot be reached to be repainted, to be coated with a heavy coat of blue lead made in semi-paste form. This shop coat should be followed in the course of six months with two coats of paint, at which time all rust to be removed by scraping and with wire brushes and the abrasions repainted with blue lead. The main reason why we suggest blue lead in this connection, in preference to any other pigment for first coating, is that our experiments seem to prove conclusively that rust will not progress or extend under blue lead, hence it is only necessary to remove the rust that is visible, whereas in the use of any other paint pigment we find that the rust spreads under the paint for quite a considerable distance, and as it is covered and not visible it usually is not removed. Blue lead for single coat work stands weather exposure better than other pigments, and is not affected by sulphurous or carbonic acid gases, which are very injurious to red lead. Carbon black will not answer for single coat work, as it will not cover with as heavy a coating as is necessary to withstand abrasion, and it also takes too much drier when required to dry in such a short time as say ten hours. Graphite when used for single coat work does not give durability, as under the conditions of ordinary application it is made to cover too much surface, hence the coating is thin, and the pigment seemingly repels the vehicle, leaving many minute holes, causing corrosion.

We quote from a paper by H. M. Butts, Master Car Painter, New York Central Railroad, read at a meeting of the Central Railroad Club of Buffalo: "We must admit that the combination of red lead and linseed oil properly used has served its purpose long and well, but experience has demonstrated that it has its faults, for it is not a success for finishing coats. Red lead, being too strong a pigment for the carrying vehicle, the paint soon becomes hard and brittle and in time will chalk off. In this state it is pervious to moisture, which will soon penetrate to the metal and cause corrosion. Therefore, in order to obtain better and more lasting results the red lead must be covered with a coating which carries a pigment fine enough to fill the pores of the oil, thus forming a more elastic and non-porous surface. If an elastic coating is preferable for finishing coats, why not for priming coats as well? This, I think, is coming to be understood as the better way and hence red lead, which has stood in the front rank so long, is gradually being superseded by other pigments." We, of course, would prefer to have the cars properly painted when built, but under the present limited trackage that exists, in and around the car shops, it seems impossible to keep the cars for a long enough time to properly paint them, and again it frequently happens that the mill scale cannot be removed properly at the time the cars are built and until the mill scale does separate from the steel it is impossible to obtain a durable job of painting. Hence, if matters could be arranged so that at the end of say six months the car could be thoroughly overhauled and painted, a much more durable job would then be obtained.

As a rule the dryer used at the car shops is not of the quality that it should be, and while they are usually very particular to see that the linseed oil is pure, the large amount of dryer added (in many cases as much as two gallons of dryer to one gallon of oil), destroys completely the life of the oil and makes the paint so brittle that in some instances it commences to peel within two weeks after it has been painted. By applying only one coat we would be able to double the drying time, and consequently more than double the life of the paint, at a lower expense than by forcing on two coats in less than one-half the necessary time.

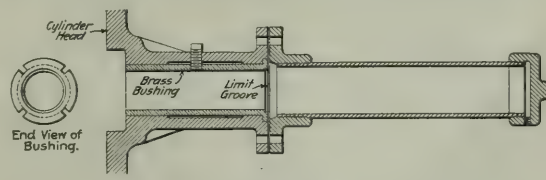
Under the second heading, "The Repainting of Cars by Railroads," our first choice would be, after the surface is put into proper condition by the removal of all rust and the retouching with blue lead of all bare spots, a coating of a paint made approximately of about 50 per cent. pure carbon black, 15 per cent. of pure white lead, 15 per cent. of pure white zinc, and 20 per cent. of selected inert pigment, non-hygroscopic in its nature, and the vehicle to consist of pure linseed oil and selected dryers. If the color of this paint is suitable we would recommend the use of two coats of it. If, however, the road prefers to use its standard shade for a finishing coat, it should not be made up in the same manner for use on steel cars as when intended for wooden cars. We also consider it of special importance both for the shop and the finishing coats that the size of the brush used should be specified in the original specifications, and that a larger brush than a 6 deg. round brush should not be allowed and particular care should be taken to avoid the use of a flat wide brush such as is now generally used for this work. In working with a wide flat brush workmen cannot brush the paris in and on as well as it should be done.

In regard to the interior of the car it should be painted when built with one coat of the blue lead paint, and the bottom of the car should be protected with a heavy wooden floor, arranged so as to be readily removed when the car is repainted, at which time all the rust on the interior would be removed, and two coats of paint applied, the first of blue lead and the second of a paint made along the lines of the formula used by the P. R. R. for their standard red freight car color. The cars are usually not painted under cover, hence we have very unequal results regarding durability. The sand-blasting and painting should be done under cover, especially in the case of the priming or foundation coat.

Extended Piston Rods on Union Pacific Vauclain Compounds.

BY G. H. LIKERT.
Assistant Master Mechanic, Union Pacific.

The Vauclain four-cylinder compound locomotives in service on the Union Pacific are of the 2-8-0 and 4-6-0 type, and when received were equipped with a non-extended piston rod, having a cast-iron head, bored out, with a shell approximately ¾ in. thick. The low-pressure piston heads were 26 in. in diameter, 4¾ in. thick, weighed about 390 lbs. and had cast-iron snap rings ¾ in. by ⅝ in. The high-pressure heads were 15½ in. in diameter, 4¾ in. thick, weighed about 180 lbs. and had the same size snap rings as the low-pressure heads. These pistons caused a great deal of trouble, especially the low-pressure, due to the heavy unsupported head traveling back and



Application of Extended Piston Rod to Vauclain Compound Locomotives.

forth in the cylinder. The difficulties experienced may be summed up as follows:

(1) Piston heads would break frequently, the result being that a cylinder head would be knocked out, the barrel of the cylinder cracked, or a piece of the cylinder broken out. This could be due to three things:

(a) Defective piston heads caused by the core having slipped when the casting was made, leaving one of the walls of the piston head very thin; or by poor material in head.

(b) Heating of head due to improper lubrication.

(c) Failure on the part of the roundhouse forces to make proper and regular inspection of heads.

The foregoing items were the most expensive of all, as several cases happened where the cylinders were so badly broken that they could not be patched.

(2) It was found that the cylinders were becoming badly worn out of round, necessitating frequent truing up or bushing of same. On account of the cylinder becoming out of round, the full service could not be got out of the piston heads, as the head would be fitted to the smallest diameter of the cylinder and it would only be a short time until an examination of the packing was required, and invariably it would be found that the trouble was due to the head being too small for the oval-shaped cylinder.

(3) It was necessary to increase the cylinder packing inspection from one to two or three times a month, in order to reduce the danger to a minimum.

(4) The greater friction of the heads in the cylinders made more oil necessary, thus increasing the cost of lubrication.

(5) Annoyance due to the piston rod packing blowing. Frequent renewing of packing was necessary as it was impossible to keep the piston head central with the cross-head and the piston rod therefore ground out the packing.

(6) Delay to power on account of being held for repairs. Also, slow turning of power at the various roundhouses and delays to trains on the road on account of engine failures and packing blowing.

As a result of the foregoing difficulties the cost of operation on these locomotives was very high and means had to be devised to reduce this cost.

About July 1, 1903, the company began equipping a few of the locomotives with extended piston rods, the accompanying drawing showing the method of application. The cylinder head, extension and brass bushing are shown. The brass bushing is turned, bored and fitted so that it can be applied or removed freely by hand. There is a ⅛-in. limit groove in the end of the bushing to gage the wear of same, and as soon as the bushing is worn to this limit, it is turned one-quarter turn. This is done until the bushing has been turned four times, when a new one is applied. The life of these bushings averages about six months.

From the very start it was apparent that the extended rod was the solution of the problem. Since applying the extended rod no cause has been found for removing the piston head except in case of accident, while the average life of the head on the non-extended rod is only about three months. The rocking wear on the cross-head is entirely eliminated, and there is less strain on the guides as the piston is supported at both ends of the cylinder. The guides also require closing less frequently. The life of the piston rod packing is greatly increased, as the packing supports practically no weight. It is seldom now that the piston rod packing on an engine blows. The cylinder packing and piston heads are now examined every 30 days.

The wear on the walls of the cylinder is hardly noticeable and we have only had one cylinder broken since using the extended rods. This was due to defective material in the piston head. A very appreciable saving in oil has also been made, as engines are now making 25 miles more per pint of cylinder oil than formerly. With the extended piston rods, the heads are turned ½ in. smaller than the cylinder. This allows the wear to come on the cylinder packing rings and the barrel of the cylinder.

Japanese Railroads.

The Imperial Railway Bureau of Japan has issued its annual report for the year ended March 31, 1904, which shows that the total length of railroad open for traffic at the end of the year was 4,496 miles, of which 1,345 miles was government railroads and 3,151 miles private railroads. Very complete traffic statistics for each separate railroad, government or private, the totals for all government railroads, the totals for all private railroads, and the grand total on all roads, are given. These show that the average train on all roads consisted of six passenger cars and nine freight cars, a total of 15 cars for each train. On the government railroads the average mileage of each passenger was 24.10 miles, and of each ton of freight 81.62 miles. On the private lines the average passenger journey was 15.13 miles and the average freight haul was 51.73 miles. On the government roads the average receipts per passenger per mile were 0.765 cent, and per ton of freight per mile one cent (2 sen= 1 cent). On the private roads the average receipts per passenger per mile were 0.735 cent, and per ton of freight per mile 0.88 cent. The passenger traffic on all roads was largely third-class. In each one thousand passengers four traveled first-class, 50 second-class, and 946 traveled third-class. The freight traffic is classified into the following four groups: Luggages; common parcels; corpses, precious goods and animals, and goods. Of each 100 tons of goods on government railroads 10.8 tons were carried under general tariff, 3.1 by special contract and 86.1 by carload rates. On the private lines, per 100 tons of goods, which includes the third classification, 9.2 tons were carried by general tariff, 25.4 by special contract and 65.7 by carload rates. In 13 years the total passenger traffic has grov from 470,300,633 passenger miles in 1890, paying $2,574,558, to 036,557,666 passenger miles paying $15,227,781 in 1903. The freig traffic has increased from 1,560,206 tons in 1890 to 17,761,312 to in 1903.

In 1872 there were only 16 miles of government road in oper tion. In 1883 this had increased to only 100 miles. In that year t first 48 miles of private line was built. In 1890 there were 5 miles of government road and 717 miles of private road in oper tion. The average net earnings per mile of line for all roads we in 1883, $3,419; $1,516 in 1890, and $3,364 in 1903, which seem indicate a very general prosperity. The revenue and expenditu table shows that a number of roads pay above 10 per cent. a one 14 per cent. dividends. The striking fact, as compared with American railroad, is that from the standpoint of earnings, t passenger traffic is of much more importance than the freight traffi a difference similar perhaps, though much greater, than that existi not many years ago on one of our American railroads in thick populated territory. On the other hand the average earnings p unit per mile appear to be greater from freight than from pa sengers. The report has several admirable statistical tables whi show graphically by diagrams and colors the increases in mileag traffic, earnings and expenses of the two classes of railroa separately and as a whole. The railroad map of Japan sho that the government controls the only existing line through t center of the island. It runs from Tokyo through Yokoha and along the eastern shore of the island through Kyoto to Osak Judging by the cities it reaches this seems to be the most importan though not the longest, of the through routes. By using both go ernment and private roads it is possible to travel practically fro one end of the group of islands to the other. The following tab shows the principal statistics for both government and private road The yen has been taken as equal to fifty cents in United State currency:

	1904.	1903.
Miles Open: Government	1,345	1,226
Private	3,151	3,012
Total	4,496	4,238
Miles under construction	1,194	.....
Cost: Government	$139,366,336	.....
Private	226,611,643	.....
Total	$365,977,973	$352,462,382
Total: Locomotives, number	1,544	1,428
Passenger cars, number	5,101	4,864
Freight cars, number	22,735	21,459
Train mileage	34,294,358	32,066,079
Gross Earnings: Government	$10,054,558	$9,168,291
Private	17,736,105	16,622,107
Total	$27,790,663	$25,840,398
Expenses: Government	$4,948,450	$4,533,083
Private	8,187,300	8,101,612
Total	$13,135,750	$12,634,693
Net Earnings: Government	$5,106,107	$4,635,209
Private	9,548,805	8,570,495
Total	$14,654,902	$13,205,694
Passenger Earnings: Government	$6,296,450	$5,760,211
Private	8,931,321	8,548,685
Total	$15,227,781	$14,308,895
Freight Earnings: Government	$2,854,424	$2,526,744
Private	6,531,281	6,076,330
Total	$9,385,705	$8,603,073

Foreign Railroad Notes.

The entire Hungarian cabinet resigned lately, and with it th Minister of Commerce, Hieronymi, who was in charge of the Stat Railroads. He was succeeded by von Vörös, a man 56 years old, 3 of which he has spent in the office of the Ministry of Commerce. A number of other high railroad officers have been changed.

The Egyptian State Railways will expend this year about $3, 500,000 on additional motive power, rolling stock and improvements to permanent way. Of this sum $750,000 will be spent for new loco motives, $700,000 for freight cars and $650,000 for passenger equip ment. For renewals of rails, ties and new ballasting $375,000 has been appropriated.

The Prussian Minister of Public Works in an address to the Prussian House of Lords gave as follows the net earnings of the State Railroads, in millions of marks:

1901.	1902.	1903.	1904.
518	541	612	633

The capital invested has increased meanwhile, but not in pro portion to the profits, which have been the following percentages on the investment:

1901.	1902.	1903.	1904.
6.41	6.54	7.12	7.19

Times were bad in the first two of these years, and began to recover in 1903.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 5. FRIDAY, AUGUST 4, 1905.

The Government's last quarterly accident bulletin, reprinted on another page of this paper, contains a new feature—a statement of the losses for six months by derailments at derailing switches. They amounted to $48,387, not counting damage to freight or sums paid for personal injuries, which very likely would swell the loss by many thousands. Whether or not collisions would have occurred in these cases if the derails had not been there is a conundrum for the curious on which the Government record sheds no light. It is plain, however, that if the derailer is to be employed as a "moral safeguard"—a warning to enginemen that if they disregard stop signals they will be found out and penalized, there is room for improving it; for two of the derailments are charged to the misconduct of the signalmen, one to a defect in the derailer itself, and one to freezing of a signal. This bulletin contains the report of the rear collision at Clifton, Pa., March 3, when seven passengers were killed. The details given tend to confirm the evidence that the engineman, though possessed of years of experience and a good reputation, took chances; that, having found signals clear for 12 miles he concluded to run the risk of finding them so in the 13th mile. This bulletin contains the first reference, in the four years since the records were begun, to a collision caused by an intoxicated engineman. The causes of coupling accidents are in this bulletin classified more in detail than heretofore, and we copy the detail table. This analysis serves to put on record an exhibit of what a great variety of mishaps a brakeman is liable to, but otherwise is of very moderate value. As is pointed out in the bulletin, many of the accidents are of kinds not peculiar to coupling and will continue to occur even if every coupler be ideally automatic and ideally perfect. Many accidents are due to deliberate risks taken by the men who suffer them, as when one jumps on the front of a moving engine to open a knuckle. Again, it appears that cars not equipped with automatic couplers are still in service here and there. No less than 16 fatal injuries, out of 62, occurred when the victim was by himself, so that no witness was left to give information about the cause. In Table 3A, classifying the injuries, 281 cases out of 790 were contusions or lacerations of fingers. Seven of the 18 passengers killed in collisions were riding in cabooses on freight trains.

The Royal Commission appointed in 1903 by King Edward to inquire into the means of locomotion and transport in London, and to suggest improvements in the same, has made its report, which is a bulky affair, filling eight volumes. The report proper, however, is contained in the first volume; the others dealing with minutes of evidence and other supplementary matter. The situation at the present time, summed up briefly, seems to be that London is a great, ill-arranged city, composed really of a collection of communities which are not ready to merge their private rights of control, especially that of the veto power, into any central body that can provide a harmonized scheme. The heart of London lies in an oval, some four miles long and two miles wide, with railroad stations at different points on its boundary, but no efficient scheme of rapid transit within. The streets are very narrow and crooked, and most of the local governing bodies—which have the power of veto—are unalterably opposed to tramway lines in these streets. The result is that except for a limited amount of east and west traffic on the borders of the oval, served by the Metropolitan District, and for a smaller amount going out towards Shepherd's Bush from the Bank on the Central London, cabs constitute the best means of rapid transit, with the lumbering omnibuses a close second. The commission in the first part of its report is bold, and advocates as a fundamental basis of relief the construction of two great boulevards—one east and west and one north and south—each somewhat over four miles long, to run through the heart of the congested part of London. It would put four-track subways beneath these boulevards, and four-track tram lines on the surface, with abundant room for vehicle traffic on either side of the rails. Unfortunately, the cost of any such enterprise seems hopeless; although the commission suggests an ingenious way by which the municipality could be in part recouped, through right to purchase abutting property at existing prices and hold this property for the great increase which might logically be expected to follow the improvements. But the commission itself does not take this great thoroughfare plan too seriously, and says that the other improvements suggested must not wait for it. The other improvements consist primarily in a scheme of tramways to connect up the stub-ended system of the present day and really accomplish something. Before this can be done, the individual veto powers previously referred to must be done away with. It is proposed to supplement these tramways with additional subway routes, and this part of the plan is important, for, at the prevailing British tramway speed, the relief which they could afford would necessarily be limited. London has a tough problem before it. Real relief seems impossible without the existence of broad thoroughfares in place of the tangle of narrow and crooked streets, but we fear it will be a long time before such thoroughfares will exist.

THE WACHUSETT DAM.

Of the great masonry dams which have been built for the storage of water, the principal ones in this country are the one at San Mateo, California, which has a height of 170 ft. above the ground, and a storage reservoir with a capacity of 32,000,000,000 gallons; the

new Croton Dam, which is founded on the rock and is 290 ft. high, and the new Wachusett dam at Clinton, Mass., 228 ft. high and 1,250 ft. long (20 ft. shorter than the Croton dam), but which has an average depth of water of 46 ft. behind it, and a capacity in the reservoir of 63,068,000,000 gallons, or about double the Croton reservoir, which holds 32,000,000,000 gallons. The completion of this important work, in its essentials, has just been announced, and a description of some of the principal features in the design and construction, together with plans and photographs, appears elsewhere in this issue. It has been about nine years in building, and it will probably take the balance of the present season to entirely finish it. The city of Boston and the adjacent cities and towns will then have an abundant supply of pure water for many years to come. The amount of water used per capita has enormously increased during the last twenty-five years, so that the works built in 1873-1877 on the Sudbury river and its tributaries, which it was expected would be amply sufficient for the needs of the city of Boston for many years, have been long outgrown. When these were planned the amount necessary to be provided was based upon an estimated consumption of water which was considered liberal, viz., 60 gallons per day for each individual. The Water Board, in a special report for the year 1874, says that "as there will probably be means devised at no distant day to check the great waste that has heretofore taken place, an allowance of 60 gallons per day for each person should and, without much doubt, will be ample." The waste or extravagant use of water was, however, not then a new thing. When the original supply was drawn from Lake Cochituate, the capacity of the works was planned with the assumption that 28½ gallons per day for each person would be sufficient, as the Water Board reported in 1838 "that this appears to be the largest quantity furnished to any city which is subject for any portion of the year to the influence of a cold climate, or where the habits of life are of British origin."

This estimate was, however, quickly found erroneous, and in 1849 the consumption of water reached 61 gallons per individual, and in 1851 had risen to 66½ gallons, and in 1856 it was 72 gallons, and the Water Board sounded a note of alarm at the great and needless waste, and complained that "the present supply will soon be exhausted at the present rate," and that it "would be impossible to keep the water in the reservoirs at a suitable height in case of fire." In 1893 the amount supplied had increased to 107 gallons per head, and during 1904 it was 123 gallons, having advanced four gallons per head during the preceding year. (This applies, however, only to the city of Boston, as the average of consumption in the whole Metropolitan District was only 83 gallons per head, which rate is, however, greatly in excess of what was formerly used.) It does not seem possible that the rapid increase in the amount which has been noted will continue, as it is certain that much is absolutely wasted, while the use everywhere is very extravagant. By proper regulation and supervision much of this waste could be stopped, and the existing works be made ample for many years longer than if the present apparent consumption is continued. But should an additional supply become necessary there are other sources which exist in that part of the state lying north and west of the Wachusett reservoir which can be connected to it and made available at a small additional expense, and without constructing any more large works, as the present total consumption of water in the district is but 173,000,000 gallons per day, while the capacity of the aqueduct is 300,000,000. Of the amount used the Wachusett reservoir supplies about 105,000,000, and the balance of the works, 68,000,000.

The preliminary studies and investigations which led to the adoption of the plan of which the building of the Wachusett dam is one prominent feature, were carried on by the Massachusetts State Board of Health during the years 1890 to 1895. They were aided by Frederic P. Stearns, Chief Engineer, who was responsible for the engineering work and estimates which were necessary, and by numerous assistants. Mr. Stearns was selected by the Metropolitan Water Board to have entire charge of the planning and construction of the works necessary for providing, storing, conveying and distributing an adequate supply of water in the Metropolitan District, so that the design and execution of this great project have been from the beginning under his charge. How wisely and with what extensive foresight for the future needs of the metropolis of New England and its suburbs these works have been accomplished, would be perfectly apparent only upon an exhaustive study of the whole of the problems involved, and a complete record of the work that has been done; but the brief and condensed description of this most important part of the scheme will show how faithfully and successfully it has been carried on.

AN ERA OF RAILROAD HEALTH.

The completed record of railroad foreclosures in the year 1904 shows that they covered only 13 roads, with a mileage of 524, and total stock and funded debt of $28,266,000. With the single exception of the year before (1903) this is the lowest annual foreclosure return for the 29 years during which the figures are available. The record of railroad receiverships takes up much the same tale. The number of roads (8) is fourth from the bottom during the twenty-nine years; the mileage (744) is fifth; the amount of stock and bonds affected ($36,069,000) also fifth. But in the receivership list the Detroit Southern, a railroad without head or tail, and a legatee of very weak constituent properties, returns $25,160,000 of the stocks and bonds. If we withdraw that exceptional case we have, as the record for last year, 7 roads with a mileage of 355, and stock and funded debt of $10,909,000. It is probably a fair statement, therefore, that railroad foreclosures and receiverships together for 1904 make the most cheerful showing for any year but one for a period of more than a quarter of a century.

But let us push the statistical evidence still further as a basis for later deduction. Taking railroad foreclosure sales for the last four years they give the annexed figures:

	No. of roads.	Mileage.	Stock and bonded debt.
1901	17	1,139	$85,808,000
1902	20	693	39,788,000
1903	13	555	15,883,000
1904	13	524	28,266,000
Total	63	2,911	$169,747,000

And for the same four years the receiverships supply the annexed returns:

	No. of roads.	Mileage.	Stock and bonded debt.
1901	4	73	$1,627,000
1902	5	278	5,835,000
1903	9	229	18,823,000
1904	8	744	36,069,000
Total	26	1,324	$62,354,000

The receiverships in the last table include the Detroit Southern road.

Comparisons and contrasts with earlier railroad periods can be multiplied to make graphic the showing by the two brief tables of the low ebb to which foreclosures and receiverships—the most searching tests of railroad infirmity—have run. For example, in one year (1896) foreclosures rose to $1,150,377,000, or almost seven times the amount of railroad values involved during the past four years. In 1895 they were $761,791,000, or about four and a half times. One seeks in vain for the record through any period of four years since 1875, during which foreclosures were not vastly in excess of the last four, notwithstanding the great extension of railroads. If we take the receivership returns it will be found that in each of 21 years out of the last 29 years the receiverships involved greater liabilities than during the last four collectively; and, again, one finds no continuous four-year period during which the excess of receivership values is not enormous, while a single year (1893) returns $1,781,046,000, or about 29 times the receiverships of the last four. In round numbers the average foreclosures per year during the 29 years has been $236,000,000, the average for the last four years only $42,436,750, corresponding figures for receiverships being $223,000,000 and $15,588,500, the latter sum including, as stated, the Detroit Southern receivership. But the contrasts need not be amplified further to exhibit the low drop in the railroad bankruptcy curve.

Pointing in the same quarter toward sanity in railroad method and progress are the returns for railroad construction. They appear for the last six years in the table subjoined:

	Miles.		Miles.
1899	4,588	1902	5,684
1900	4,437	1903	5,786
1901	5,322	1904	4,168

It will be noticed how what we may call the curve of construction is reduced for the last six years almost to a straight line, and that, too, during a period of high speculation and national prosperity, when, if the curve had run upward sharply, it would not have been a surprise. There is no abrupt fall, as in 1883, when new mileage sank from 11,568 to 6,741, nor such a leap as in 1886, when it rose to 9,000, and again to the record high mark of 12,983 in the year following, nor such a low record as followed the year 1893, when new mileage fell below 2,000 for each of four successive years. Other things being equal, the even rise of construction during the last four years suggests a growth sober, methodical and sane, with no hint in it of the chills and fever of Wall Street, and confirming the adjective "sound" so commonly applied in these days to our

railroads as a whole. The foreclosure test, the receivership test and the construction test all center on the same conclusion, saying nothing of the more variable and doubtful test of gross and net earnings, important for immediate purposes as the latter may be.

The causes of the railroad stability indexed by the returns cited do not have to be sought far afield. The prime force is, undoubtedly, that better organization of capital at the great money center which has averted panic and crisis and money stress—sure, in some degree, to involve the railroads—which a good many fiscal prophets predicted, but which have not come. But there are secondary causes as well. Most potential of them has been the swift consolidation of railroads, which has thrown a kind of protective shield over the weaker lines absorbed. As in the familiar fable, where the single stick might have broken, the faggot has been strong. The branch road, which, as an independent line, might have gone to the wall, has found shelter behind the guarantee of the bigger corporation, itself often content to gain from transferred traffic what it loses by operation of the subsidiary road—particularly if the latter is sought by a rival. Exhaustion of territory directly profitable and resulting discouragement of speculative railroad building is another factor. Reduced interest charges in taking care of railroad properties is yet another, and the diversion of capital from the steam to the electric railway enterprises must be reckoned in also as a large component. But above and beyond all these, underlying the present epoch of fiscal and physical sanity of the American railroad, is the long and often bitter lesson which past experience has taught projector, investor and operator alike during the mutations of our great railroad system.

It would be well if we could take one step farther and add that the sanity reflected from minimized foreclosures and receiverships during the last few years had also reached Wall Street; but it is a statement which "high finance" and "holding" companies and the facts of speculation, at once vast in size and novel in shape, forbid. For all these, doubtless, some form of retribution waits, and for others it has already arrived. But the comforting fact remains, writ large, that in spite of those adverse influences, our railroads, as *properties*, have entered a period of sane conservatism. How far that conservatism will resist the next industrial and fiscal crisis when it comes, will be one of the most interesting chapters in our railroad history.

The Use of the Catalogue.

It goes without saying that reference to manufacturers' catalogues is constantly necessary in the conduct of many kinds of business, but it is unfortunately true that catalogues are not always made as valuable either to the user or the maker as they might be, were both sides to take advantage of all the possibilities that exist. A number of years ago it was recognized by the mechanical officers of the railroads that catalogues would be of value if they were properly indexed and arranged, and so the standard sizes came into being. For a time there was some stir in the matter and catalogues assumed a semblance of uniformity, and even that conservative organization that will adopt no standards or assume the responsibility of endorsing or condemning, the American Society of Mechanical Engineers, did accept the report of a committee on the subject of catalogue sizes. But the matter has not been pressed, and the younger men in the business are woefully ignorant of what has been done and how much it is to their interest to follow the prescribed sizes in their catalogue making. At a meeting of the society about two years ago, much disgust was expressed at the summary method of one member who incontinently consigned every catalogue to the waste basket that was not of a standard size and therefore convenient to file. Those who spoke against such wantonness failed to recognize the value to this man of those catalogues that he did save.

The standardizing of catalogues, valuable and indispensable as it may be for convenience of filing and handling, is but half the battle unless the receiver is willing to take some pains to so index what does come in that the contents will be readily and quickly available for instant reference. For this a little, a very little, care is needed. In one case in mind, every catalogue coming into the office of a certain engineer passes through his hands and every item listed therein is underscored. This work does not require an average of two minutes a day. An assistant then takes the catalogue and gives it a number, records the issuer's name in an indexed book and then enters every underscored item on a card index. The total time required is not felt, and the catalogue file is ready at all times for immediate service.

It is impossible to carry in mind the names of all of the makers of any one line of goods, so that an index of this kind is indispensable to any who are obliged to use them. With the system outlined above in force it becomes possible to refer, at a moment's notice, to every catalogue in the office bearing upon any subject, whether it be the minor one of taps and mandrels or the one of greater value which deals with locomotives, or with traveling cranes; and when the indexed catalogues have been produced the owner knows that it is useless to search elsewhere on the premises for further information. Those who merely list the names of the firms issuing the catalogues are handicapped at the start, and the value of the publication depends solely upon the memory of the user. The result, too, is that many catalogues issued by small firms, who do not happen to be known to the head of the department, are lost to sight and buried beneath later accumulations, and straightway become absolutely useless to all concerned, so that they might as well have been consigned to the scrap basket on arrival, for all the good they have ever done or will do.

It is a pity, too, that so many valuable tables and so much engineering data that is published in catalogues should be forever buried, except for an occasional accidental use that comes only when the catalogue happens to be opened at an opportune moment. Much of this data has been compiled at great expense, and it frequently represents a great deal of original and costly investigation. Here again, the memory of the man is a frail reed to lean upon, and the card index should be the sole resort. For data of this kind, as well as for other matters of occasional reference it is advisable to carry a special index. Tables, capacities, and matters of moment can be so listed that they are immediately available, and if not found in the index it will be known at once that they are not in the office.

All this may seem commonplace, and is, but when the condition of the catalogues in the larger portion of the railroad offices is considered, and this is coupled with the disregard of most manufacturers for the convenience of the user, it is quite in order to jog the minds of both parties as to the value of the commonplace. In the great majority of offices there is a mass of valuable information thrown aside on dusty shelves, or packed away in improperly indexed packages, that would immediately become available and extensively used if only the head of the department or some one of his principal assistants had a proper appreciation of the full value and the use that can be made of the catalogue, when all of its resources are listed in such a manner that they may be used without resorting to the nervous and exhausting process of a long search.

NEW PUBLICATIONS.

Civil Engineering. By Lieut.-Col. G. J. Fiebeger, U. S. A., Professor of Engineering, U. S. Military Academy. New York, 1905: John Wiley & Sons. Cloth, 573 pages. Price, $5.

Civil engineering in all its branches is a big and broad subject to crowd into a book of 573 pages and if the author's purpose of preparing a text-book for a short course in civil engineering for students at the Military Academy was not frankly stated in the preface we should be inclined to wonder how any one could get up the courage to tackle such a comprehensive theme. The course of study at West Point is peculiar in its wide latitude, including as it does an excellent foundation in many subjects and a mere smattering of others, and this text-book is likewise peculiar in its mixture of elementary principles and extended higher mathematical discussions. But the aim of the author is apparent throughout. He has tried to lay the groundwork for a knowledge of the more important principles and facts needed by an army officer who may be called upon to work out problems in civil engineering both in times of peace and in times of war. In dealing with applied mechanics and the theory of strength and elasticity, less theory and more practical information might perhaps have been included, for while the theoretical considerations are of course highly important, the man who is building a temporary bridge to pass a waiting army wants to know primarily how much a beam will stand and not why it will stand that much.

The wide range of subjects treated—each of them worth a whole volume or volumes—includes elementary stresses, strength and elasticity of beams, effects of moving loads on beams, column formulæ, design of riveted and pin connections, analysis of stresses in framed structures, masonry dams and retaining walls, masonry arches, hydraulics, timber, properties of metals, properties of stone and cement, masonry, foundations, bridge design, roofs, highways, water supply and sewerage. The chapters on column formulæ, highways, and timber are particularly good. There are numerous diagrams and illustrations scattered throughout the book, and not the least valuable pages are those containing an excellent index.

Hearings Before the Committee on Interstate Commerce, Senate of the United States, on Bills to Amend the Interstate Commerce Act, 1904 and 1905. Published by the Government Printing Office, at Washington, 1905. In five volumes: a total of 5,116 pages.

The Senate Committee has caused to be published the voluminous testimony on the subject of Federal regulation of railroad rates, and has included with the oral testimony the additional statements and documents filed with the committee. The result in the five volumes at hand is a stupendous collection of information on every side of the question of American railroad traffic relations between the shipper and the carrier. It is certainly not overstating the case to say

that no document of anything like equal importance in this field has ever been published heretofore. The work is well indexed, volume by volume, and the very fact that much of the testimony was of a character which would be inadmissible in an ordinary court trial because of remote relevancy to the subject adds vastly to the statistical and historical value of the work. The first volume, which contains 771 pages, contains the testimony of 15 men relating to the regulation of railroad rates, and of two others in regard to private car line systems. At the close of this testimony there is an appendix giving the current resolutions of state legislatures with regard to enlarging the powers of the Interstate Commerce Commission, and also resolutions from a large number of chambers of commerce and boards of trade. A second appendix contains a partial list of bonds and stocks of railroads held by savings bands, insurance companies and other institutions in 1900, and also an appendix containing bills introduced in the Fifty-eighth Congress relating to interstate commerce and to the Interstate Commerce Commission. The second volume continues the testimony with regard to railroad rates and concludes with a careful topical index and with a map showing lumber production and lumber territory in the United States. The third and fourth volumes conclude the testimony about railroad rates, including a vast amount of incidental information; while at the close of the fourth volume there is a consolidated index of the entire five volumes, divided topically and also giving a list of appendices and a list of authors. The fifth volume consists entirely of appendices, including the railroad laws of Canada, Great Britain and France; complaints before the Interstate Commerce Commission; inland port differential; briefs, report and opinion; interstate commerce statutes annotated and indexed; Federal courts and the orders of the Interstate Commerce Commission, and employers' liability laws of states and territories. These five volumes are not on sale, but can presumably be obtained through senators and members of congress, and they form an almost indispensable basis of a correct understanding of economic railroad conditions in the United States at the present time. If the agitation for Federal rate regulation has no other result, it will have gone far toward being justified in the production of this amount of light and understanding on a difficult and complex subject.

TRADE CATALOGUES.

Nickel Steel.—The International Nickel Co., 43 Exchange place, New York, has issued a neat booklet giving a long list of the purposes for which nickel steels have been successfully applied in the United States, France, Germany and England. The company points out that the addition of 3 to 4 per cent. of nickel in steel increases the proportional elastic limit, adds to the ductility of the steel, increases its resistance to compression, abrasion and shock, and increases its toughness, so that nickel steel is a safer material than carbon steel. A number of other interesting pamphlets are issued by the same company.

Lewis and Clark Exposition.—The Union Pacific has a booklet in folder form on the Lewis and Clark Exposition. It can serve as a pocket manual to visitors to the exposition, as it contains beside a map of the United States a large bird's-eye view map in colors of the exposition grounds with a directory, a map of Portland, half-tone illustrations of the exposition buildings, and general information about hotel rates, street car lines, etc. There is also a history of the Oregon country and information regarding its present condition, resources, prospects, etc., as well as descriptions of the exposition buildings. The book will be mailed upon receipt of a two-cent stamp.

Reinforced Concrete.—The St. Louis Expanded Metal Fireproofing Co., St. Louis, maker of corrugated bars for reinforced concrete, sends a folder containing an extract from the official proceedings of the International Railway Congress, in which it is stated that "railroad practice shows that carefully built reinforced concrete structures give excellent service and require almost no maintenance. For this reason the use of reinforced concrete should be recommended, even if the cost of construction should, exceptionally, be higher than for another system of construction."

The Chicago, Milwaukee & St. Paul includes in the literature being distributed by its passenger department three delightful little books on "Lake Lore," the Lewis and Clark Exposition, and its Chicago-Kansas City train, The Southwest Limited, respectively. The first is a vivid description by Forrest Crissey of "Lakeland," the northern lake resort region reached by the Chicago, Milwaukee & St. Paul. The nature of the contents of the other two is indicated by their titles.

Electric Grinders and Buffers.—The Northern Electrical Manufacturing Co., Madison, Wis., sends Bulletin 48 on Northern electric grinders and buffers. The bulletin is quite complete, illustrating by nice half-tone engravings the different styles of machines and their details and explains fully their construction, application and merits. Two interesting engravings at the front show respectively a Hindu grindstone and an ingenious dog-driven device used in California.

Railroad Shop Tools.—The July issue of the "Progress Reporter," published by the Niles-Bement-Pond Co., New York, contains a number of excellent full page illustrations of heavy machine tools used in the Angus shops of the Canadian Pacific Railway. Full page illustrations of the locomotive erecting and machine bays of the above shops are shown, and a brief description of the tools and the method of doing work at these shops is also given.

Friction Draft Gear.—The Gould Coupler Co., New York, is distributing a catalogue descriptive of its friction draft gears for passenger cars, freight cars and locomotives. Excellent illustrations in both line and half-tone are given, as well as diagrams showing the results of compression tests made at Cornell University. Illustrations and descriptions of the Gould friction buffer for passenger equipment are also given.

The Erie Railroad, through Luis Jackson, Industrial Commissioner, has issued an "industrial map" of the territory tributary to its lines. This shows in different colors the anthracite and bituminous coal areas, the areas in which oil or gas is produced and the regions which contain coal, oil and gas. A map of the Erie lines adjacent to New York is included.

Graphite.—The August number of *Graphite*, published by the Joseph Dixon Crucible Company, Jersey City, N. J., contains an interesting article on condensers, an extract from an address by Mr. James H. Reed on competition and salesmanship, and the usual number of brief suggestions for the use of graphite for many purposes.

Compressed Air.—The July issue of this magazine contains numerous interesting articles on the modern application of compressed air, including a description of the drainage system of the Interborough Rapid Transit Railroad tunnel under the Harlem River, the pumps for which are operated by compressed air.

Interurban Railway Construction.—J. G. White & Co., Engineers and Contractors, New York, send their interurban railway bulletin. It is handsomely illustrated throughout, with views showing work done by the company, in various stages of completion, including power houses, car barns, bridges, road construction, etc.

The Wachusett Dam of the Metropolitan Water Works.

BY GEORGE W. BLODGETT.

The substantial completion of the Wachusett Dam, at Clinton, Mass., which was begun in 1895, and has been carried on almost continuously ever since, marks an epoch in the history of the water supply of Boston, Mass., and the adjacent cities and towns. This great work was undertaken in accordance with an act of the legislature of Massachusetts, passed in 1895, by which the Metropolitan Water Board was created, "to construct, maintain and operate a system of Metropolitan waterworks, substantially in accordance with the plans and recommendations of the State Board of Health, contained in their report to the legislature for the year 1895," etc., etc.

For two years previously, the State Board of Health had been engaged in investigations for designing a system of water supply (as directed by an act of the legislature passed in 1893), for the "city of Boston and the cities and towns within a radius of ten miles of the state-house, and such other cities and towns, as in their opinion should be included in connection therewith." It presented a voluminous and comprehensive report in 1895, which led to the passage of the act above mentioned.

The dam is founded on solid rock, which, in the deepest part of the valley is about 60 ft. below the level of the then existing mill-pond. Borings were made every ten feet across the lower part of the valley, and every 20 ft. up and down stream, at the proposed site of the dam. The work was of such magnitude, and the preliminary investigations required were so many and so arduous, that although a large force of engineers were constantly at work, it was not until 1898, that the necessary surveys, etc., were so far completed that the Water Commissioners were able to announce that "the actual site of the proposed dam has been fixed." The contract for its construction was executed Oct. 1, 1900, and the date of Nov. 15, 1904 was fixed for the completion of the entire work, and the sum named in the contract is $1,603,635.

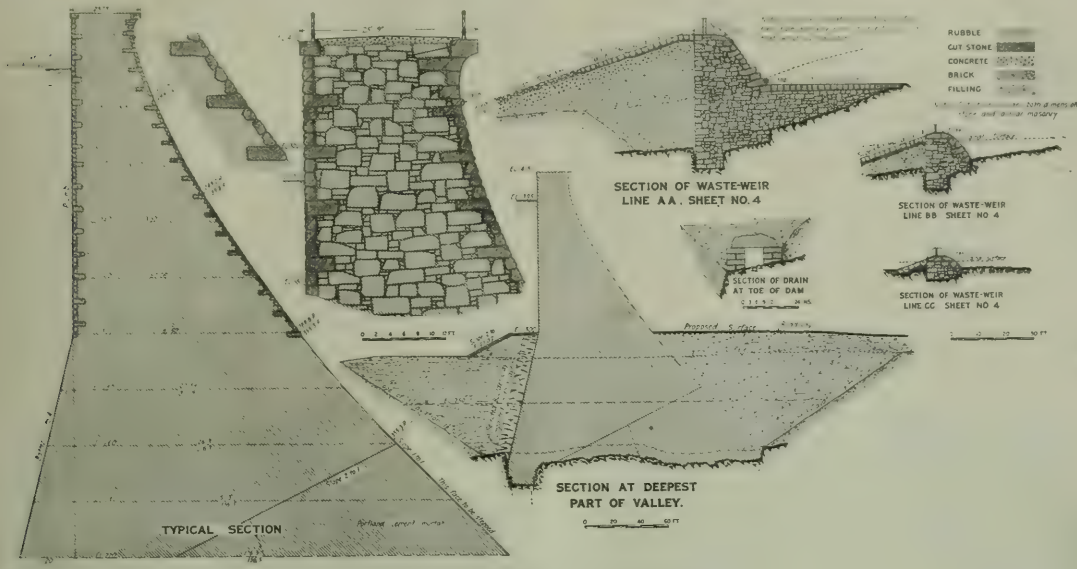
Besides the building of the great dam there was to be built a reservoir covering 6½ square miles of land, and a conduit 13½ miles long, partly tunnelled through rock, partly built of masonry, and partly an open channel following the course of an existing

brook, to carry the waters of the south branch of the Nashua river (on which the dam is located) to the storage basins and the conduits leading to Chestnut Hill Reservoir, the main distributing point for the city of Boston. (This was to be connected to other suitable reservoirs, adapted to furnish water to the other towns and cities within the metropolitan district.)

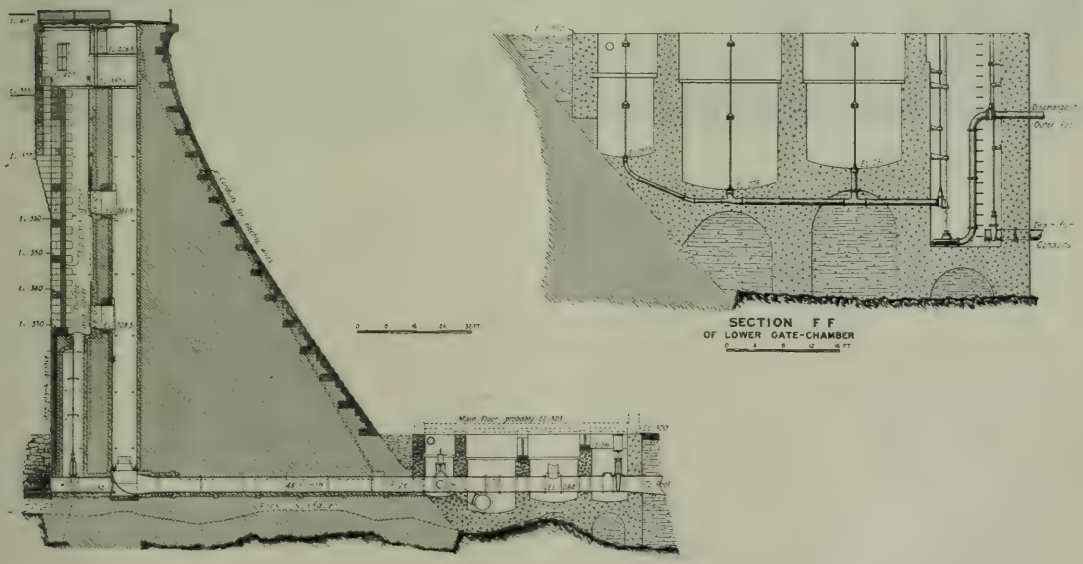
It was early seen that an increased supply of water would be needed before the dam could be completed, and it was determined to build the conduit as soon as possible, so that water might be turned into it when necessary, by a temporary connection with the river above the dam. As the tunnel would be the part of this conduit requiring the longest time for its completion, it was placed under contract as soon as the location and plans could be decided upon, and work was begun March 31, 1896.

A temporary dam was built above the site of the proposed main structure and a flume 7 ft. 2 in. wide x 7 ft. 7 in. high was made of timber and planks, to take water from the river above the temporary dam, into the tunnel and conduit below, so that the danger of a shortage of water in Boston was averted long before the building of the main dam had progressed so far that water could be stored behind it and discharged into the conduit in the manner finally arranged for. Water was turned into the conduit through this temporary connection March 7, 1898.

In order properly to build the great dam it was necessary to divert the waters of the river from their natural channel and carry them past the excavation for the foundations of the dam. This was done by means of a wooden flume 700 ft. long, 40 ft. wide and 16 ft. deep at the upper end and 13 ft. deep at the lower end, through which the water was carried and discharged into the river beyond another temporary dam built lower down, to prevent flooding the excavation by backwater from the river below. The main dam, as finally located, is at a point where the valley is 1,250 ft. wide at the level of high water in the reservoir, and the dam itself is 850 ft. long, and more than 200 ft. high at the deepest part of the gorge. The distance from the full water level of the reservoir to the rock at the downstream edge is 179 ft. At this upper level the masonry is 25 ft. thick, while 175 ft. below the thickness is 179.3 ft. It is much thicker and higher above the water than many masonry


RUBBLE
CUT STONE
CONCRETE
BRICK
FILLING
SECTION OF WASTE-WEIR LINE AA. SHEET NO. 4
SECTION OF WASTE-WEIR LINE BB SHEET NO 4
SECTION OF DRAIN AT TOE OF DAM
SECTION OF WASTE-WEIR LINE CC SHEET NO 4
SECTION AT DEEPEST PART OF VALLEY.
TYPICAL SECTION

Cross Sections through the Wachusett Dam.



Sections through Gate Chambers of the Wachusett Dam.

dams which have been built for the storage of water, partly to provide a very large factor of safety, where a failure might cause so large a loss of life and so great a destruction of property as here, and partly to provide for the thrust of the ice against the upper side of the dam when the reservoir is full and the weather is very cold for a long time. It has not been usual, the writer believes, to take account of this force, in the design of large masonry dams similar to this.

To provide the necessary stability under these conditions the height of the dam was increased 20 ft. above the full reservoir level, as it was found less masonry would be required if built in this manner, than to increase the thickness at the high-water level as much as would have been necessary. The rock on the northerly side of the gorge where the dam is built, consists of granite covered with a comparatively thin layer of sand or gravel; the southwesterly slope is composed of metamorphic slate or schist, with a layer of gravel over it 30 ft. deep above the level of the mill-pond, which formerly existed, and under the mill-pond, to a still greater depth.

The action of the water before the rocks were covered with earth eroded the softer schist to a much greater depth than the harder and more unyielding granite where the two come together, and this produced an abrupt wall of granite from 30 to 40 ft. high. The granite therefore extends to within a comparatively short distance of the surface, and advantage was taken of this circumstance to construct the waste-way of the dam at an elevation only a little above the original level of the rock on which it rests.

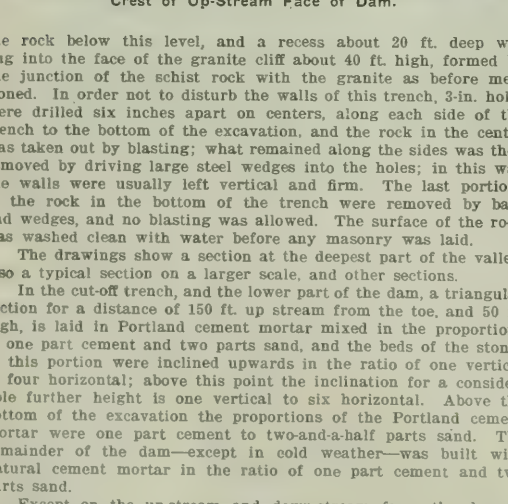
For the building of the main dam the earth and the rock itself were removed to a depth where the rock was firm and free from seams. The average depth of rock thus removed was 13 ft. A cut-off trench 20 ft. wide and 14 ft. deep was then excavated into the rock below this level, and a recess about 20 ft. deep was dug into the face of the granite cliff about 40 ft. high, formed by the junction of the schist rock with the granite as before mentioned. In order not to disturb the walls of this trench, 3-in. holes were drilled six inches apart on centers, along each side of the trench to the bottom of the excavation, and the rock in the center was taken out by blasting; what remained along the sides was then removed by driving large steel wedges into the holes; in this way the walls were usually left vertical and firm. The last portions of the rock in the bottom of the trench were removed by bars and wedges, and no blasting was allowed. The surface of the rock was washed clean with water before any masonry was laid.

The drawings show a section at the deepest part of the valley, also a typical section on a larger scale, and other sections.

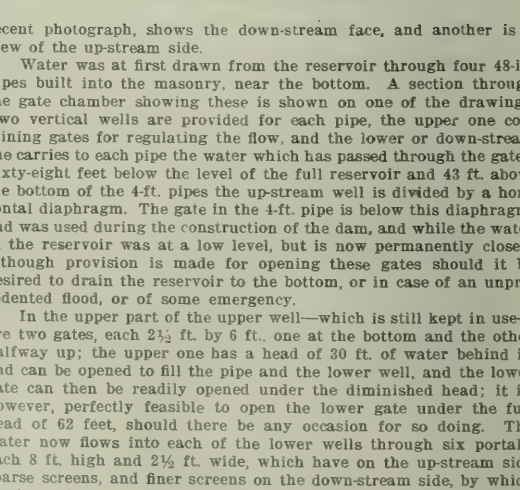
In the cut-off trench, and the lower part of the dam, a triangular section for a distance of 150 ft. up stream from the toe, and 50 ft. high, is laid in Portland cement mortar mixed in the proportions of one part cement and two parts sand, and the beds of the stones in this portion were inclined upwards in the ratio of one vertical to four horizontal; above this point the inclination for a considerable further height is one vertical to six horizontal. Above the bottom of the excavation the proportions of the Portland cement mortar were one part cement to two-and-a-half parts sand. The remainder of the dam—except in cold weather—was built with natural cement mortar in the ratio of one part cement and two parts sand.

Except on the up-stream and down-stream faces the dam is composed of rubble masonry, consisting of large pieces of granite obtained from an excellent quarry on the reservoir property about 1½ miles up the river. These stones were quarried with a flat or slightly convex surface on the under side, and a bed was prepared for each stone by suitable small stones laid in cement, and all spaces between and around the large stones were filled in the same way, and all the joints filled with mortar, so that the whole is a solid mass of masonry. A facing of granite ashlar from 12 in. to 14 in. thick, obtained from Chelmsford, Mass., is laid on the up-stream and down-stream faces of the dam, partly to improve the appearance, and partly to better resist the action of frost. It is bonded with the rubble behind it by frequent headers extending well back into the mass. The down-stream face is a straight slope of 1:1 and is built in steps from the bottom of the excavation to a height of sixty feet; above this the face has a slight curve up to the finished grading of the ground; beyond this the radius is changed three times and gives a pleasing appearance to the finished work. On the up-stream face there is a batter of 1:4 from the bottom, which is at elevation 187 to elevation 300 (that is for 113 feet in height); above this point the up-stream face is vertical. The crest of the dam is at elevation 415, so that the entire height of masonry is 228 ft. There is a sharp curve near the top of the down-stream face, which causes it to overhang the lower portion, and gives it a bold and striking appearance. The coping stones on this side are anchored back into the masonry behind them by large steel rods. The top of the structure has a slightly rounded surface to give proper drainage, and is to have a granolithic finish. It will be surmounted by a handsome stone balustrade on each side.

At the northerly end of the dam proper is what is called the bastion, which is added, partly to give a finish to this end, and partly to afford convenient space for storage of the stop-planks for the spill-way. This is built of granite and concrete, and the ceiling is supported by steel "I"-beams, between which are slabs or panels of reinforced concrete. At the southerly end a somewhat similar structure called the "abutment" has been built. (The plan of both these is however rectangular, instead of circular, as originally designed and shown on the drawings.) One of the illustrations, from a recent photograph, shows the down-stream face, and another is a view of the up-stream side.



Crest of Up-Stream Face of Dam.



Down-Stream Face of Dam.

Water was at first drawn from the reservoir through four 48-in. pipes built into the masonry, near the bottom. A section through the gate chamber showing these is shown on one of the drawings. Two vertical wells are provided for each pipe, the upper one containing gates for regulating the flow, and the lower or down-stream one carries to each pipe the water which has passed through the gates. Sixty-eight feet below the level of the full reservoir and 43 ft. above the bottom of the 4-ft. pipes the up-stream well is divided by a horizontal diaphragm. The gate in the 4-ft. pipe is below this diaphragm, and was used during the construction of the dam, and while the water in the reservoir was at a low level, but is now permanently closed, although provision is made for opening these gates should it be desired to drain the reservoir to the bottom, or in case of an unprecedented flood, or of some emergency.

In the upper part of the upper well—which is still kept in use—are two gates, each 2½ ft. by 6 ft., one at the bottom and the other halfway up; the upper one has a head of 30 ft. of water behind it, and can be opened to fill the pipe and the lower well, and the lower gate can then be readily opened under the diminished head; it is, however, perfectly feasible to open the lower gate under the full head of 62 feet, should there be any occasion for so doing. The water now flows into each of the lower wells through six portals, each 8 ft. high and 2½ ft. wide, which have on the up-stream side coarse screens, and finer screens on the down-stream side, by which foreign substances which it is desired to exclude, can be prevented from entering the pipes. These gates, screens, etc., are operated from a room in the body of the dam above the wells, but which does not, however, extend to the top.

Below the dam is built the lower gatehouse, which serves also as a head-house for the Wachusett aqueduct, and later may be used as a power-house for utilizing the energy of the water flowing from the reservoir, by means of turbines and electric generators.

This structure is divided into a series of four wells for each four-foot pipe. The first of these is a dry well, and contains for each pipe, two 24-in. branches, each of which has a gate to regulate the flow of water into the aqueduct. These two-foot pipes discharge into a four-foot perforated pipe called a diffuser, located in the second well; the second and third wells contain the feed-pipes for the turbines (when these are installed), and the discharge pipes from the turbines. The fourth well is also commonly a dry well, and contains a gate in each of the four-foot pipes, which can be used to discharge water from these pipes directly into the pool below the dam. Also, if by accident the quantity of water passing from the reservoir should be greater than the capacity of the aqueduct the excess would overflow into this fourth well, and be carried thence by two 5-ft. pipes into the waste conduits and the pool. Each well is connected by a drainage pipe with a pump well at a lower level from which any drainage water is easily removed by a pump. Each waste pipe from the fourth well increases in diameter from the lower four-foot gate, until its reaches the size of eight feet 40 ft. from the well, and 10 feet a little farther on, where it connects with the masonry conduit leading to the pool; this diminishes the velocity of the water from 50 ft. per second to 12½ ft. at the end of the pipe, and 8 ft. at the end of the masonry. At the pool, 55 ft. diameter, the water is discharged through many openings in the bottom at a velocity of but four feet per second, corresponding to a head of but about three inches.

This pool is located in the middle of a larger one 150 ft. in diameter, with a waste way at the side farthest from the gate-house, 110 ft. long, from which the water falls about 8 ft. on an apron at the upper end of the river or mill-pond below. By the terms of the agreement with the Lancaster Mills Company, about one mile down the river, two million gallons per day of clean water are to be supplied to them, and hence at least this amount is allowed to flow through the pipes and conduits into the pool and the river below.

In freshets, and at some other times, there will be water to be wasted above the capacity of the pipes before mentioned. This will be taken care of by means of a spillway, which is 450 ft. long, and occupies the space between the end of the dam proper and the northerly shore of the reservoir. To obtain the necessary length it is carried up-stream at an angle with the dam for the greater part of the distance (the last hundred feet or so being at right angles to the shore), and is terminated by a small abutment of granite, from which a cut-off wall is built into the rock and into the bank beyond the abutment for a considerable distance.

The elevation of the top of the spillway for the greater part of its length is the same as that of the water in the full reservoir, but the first one hundred feet is at an elevation three feet lower. In times of freshet, therefore, the stop-planks can be removed and the rise of water partially or wholly checked, before any considerable depth passes over the remainder of the waste-way. The whole length will be provided with flashboards, mainly to prevent the loss of water by waves dashing over the crest, and with this in view the top has been made a plain surface, and dressed smooth after the top stones were in place, by pneumatic hammer.

All the stop-planks can easily be removed when desired, from a foot-bridge which is being built 7 ft. above the crest of the waste-way, upon the iron standards which contain and support the grooves for the flashboards. Slope-paving is placed above the spill-way, at an angle of one vertical to three horizontals, and the crest of the spill-way is rounded and the down-stream side curved so as to cause the water to follow the masonry for the most part. The facing is of ashlar, and steps are built in the lowest part, to receive the impact of the falling water. The deepest part of the depression was filled with rubble masonry or Portland cement concrete.

With flashboards on the lower part of the spillway and a depth of 5 ft. on the whole of the crest, the spillway can discharge a quantity of water equal to 4.9 in. over the whole of the watershed above the dam. The greatest freshet in the valley of the Nashua river of which any account is obtainable occurred Feb. 13, 1900, while the dam was building, and was due to a rainfall lasting 37 hours, and averaging 3.18 in. over the whole watershed; the ground was frozen and largely covered with ice at this time, so that the greater part of the water found its way rapidly into the reservoir and the flume which had been built to carry the river over the excavation for the main dam, which was then in progress. This was taxed somewhat beyond its expected capacity (being calculated for a flow of 9,000 cu. ft. per second), as the maximum flow of water was 9,050 cu. ft. per second, but this maximum flow lasted only about two hrs., increasing and decreasing rapidly before and after this period; the total for 24 hrs. averaged 6,390 cu. ft. per second. In another freshet which occurred March 2, 1900, the maximum flow was 7,840 cu. ft. per second, which was produced by a rain of about 3.18 in. in 34 hours. Ample provision has therefore been made for the most unusual conditions likely to occur.

Below the waste-way a channel has been excavated through the earth and through rock averaging from 50 to 70 ft. wide and from 20 to 30 ft. deep, for about 800 ft. below the waste-way to the river below the dam. This channel may not be large enough to carry all the water flowing over the waste-weir in such freshets as occur about every 25 years, and almost certainly will not be sufficient for those which come once in about 100 years, but it will undoubtedly be cheaper to pay the damage that may be caused by the insufficient capacity of the channel than the extra cost of the construction necessary to enable it amply to meet these unusual conditions, which may not arise during the next century.

Electric Train Service on the London Metropolitan.

The electric train service installed last February on the St. John's Wood line of this company between Baker street, Harrow and Uxbridge, has proved to be quite successful from the standpoint of comfort and convenience of passengers. The accompanying illustration shows one of the six-car motor trains which are fine specimens of the car builder's art. Whether they are as profitable to operate as the old rolling stock used in steam trains, may be doubted however. They weigh more, cost more and seat fewer passengers than the old cars. The old six-car trains weighed 90 tons and seated 420, while the new trains weigh 150 tons and seat only 320. The cars were built by the Metropolitan Amalgamated Carriage & Wagon Company at its various works near Birmingham and Manchester. Two classes only are provided, the difference being in the nature of the upholstery on the seats. In the first-class compartments green "moquette" is used and in the third-class "buffalo hide," a patented imitation leather, but the seats in both classes are arranged in the same way and are of the same size so that if at any time it should be decided to have only one class, as in the tube railways, the change can be made with little expense.

Metropolitan Railway 6-Car Electric Train on the St. John's Wood Line.

The cars are exceptionally well lighted with electricity, there being four chandeliers in the roof of each car with three lamps each, and six single lamp brackets along each side above the windows. The roof lining is made of asbestos mill board painted white, which further assists the lighting effect. Deck sash ventilators are used and in addition a pivoted sash or transom is provided above each of the fixed side windows.

The seats in the trail cars are arranged in the same manner as in the cars of the Central London or "two-penny tube." There are six double cross-seats on each side in the middle of the car, holding 24 persons, and two side seats at each end, holding eight persons each, the seats being divided by low arms. This gives a seating capacity of 52 passengers in a car 52½ ft. long as against 80 in the old third-class cars, 42 ft. long. The motor cars seat 48, half in cross seats and half in longitudinal seats at one end only. They have a small baggage compartment with sliding doors on each side. A few spare parts are carried here for emergencies. The motorman's cab occupies the entire end of the car and has doors on each side and one in the end. This end door is intended for through communication only in case two motor compartments should be placed together in a train. Large windows on each side of the door provide an excellent lookout for the motorman.

The cars are mounted on two four-wheel trucks having pressed steel frames and 42-in. wheels. On each axle of the motor cars is mounted a 150-h.p. motor giving a total of 1,200 h.p. to a train made up of two motor cars and four trail cars. As the line is in many places on a 1½ and 2 per cent. grade, ample power is necessary. The Westinghouse "turret" system of electro-pneumatic multiple unit control is used, as are the Westinghouse air-brakes. The motormen being as yet unused to their powerful action, considerable unpleasant jerking is experienced in making stops, but this will probably be overcome to a great degree in the future.

The service at present consists of trains between Baker street on the "Inner Circle" and West Hampstead, Willesden Green, Neasden, Wembley Park and Harrow. On week days trains leave Baker

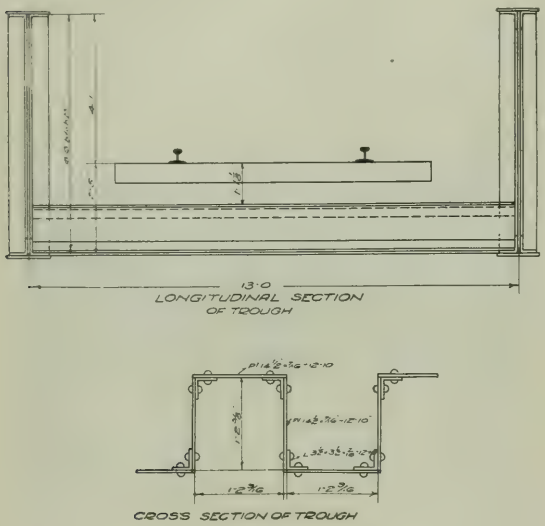
street from 2 p.m. to 11 p.m. at intervals of about 15 minutes except between 5 and 6 p.m., when they run every eight minutes. On Saturdays the service extends from noon to 11 p.m. with trains every 12 or 15 minutes, and on Sundays from 1 p.m. to 8 p.m., with trains every 15 minutes. Only one train an hour runs as far as Harrow.

Protecting and Water-Proofing Solid Floor Bridges.*

BY W. C. CUSHING,
Chief Engineer Maintenance of Way, Pennsylvania Lines, Southwest System.

The work of separating street and railroad grades in Chicago during the past 13 years has stimulated among railroad engineers the study of a suitable design for a bridge floor, which will be practically water-tight, and at the same time afford reasonable protection to the metal work of the structure, because the cost of reprotecting a ballasted solid-floor bridge is very large.

In the earlier days, when the Illinois Central became the pioneer of "track elevation," preparatory to the removal of the railroad track obstruction to the Columbian Exposition, the term "solid-floor" was considered synonymous with "shallow-floor," and the bridges were constructed with such floors till it was found to be practically impossible to comply with the conditions of water-tightness, steel



Bridge at Wright Street.

preservation and noiselessness. The latter condition has become a very important one, and has been a very considerable factor in the abolition of the shallow-floor, as it was necessary to put ballast between the cross-ties and the steelwork, in order to deaden the sound.

The change in style of construction has led to new problems in water-proofing and steel preservation, and it is the object of the writer to explain some of the plans used on the P., C., C. & St. L. at Brighton Park and Englewood, in 1904, while at the same time as clear a comparison of results as possible will be given.

Each of the Brighton Park bridges at Thirty-fourth, Thirty-fifth and Thirty-sixth streets has nine tracks, as follows:

No. 1, No. 2, No. 3, No. 4 } P., C., C. & St. L.

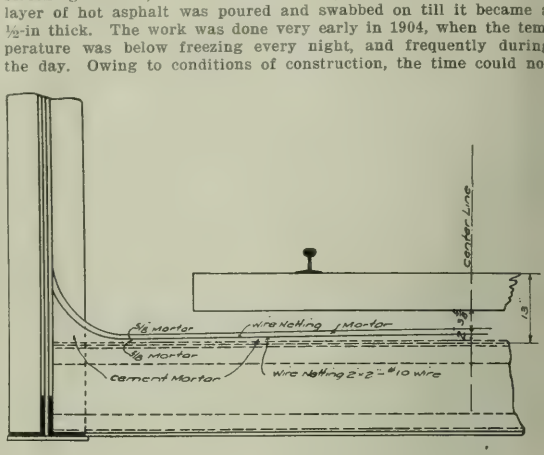
No. 5, No. 6 } Chicago Terminal Transfer.

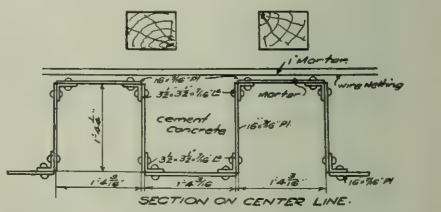
No. 7, No. 8, No. 9 } Chicago Junction.

In type, they are half-through, single span, plate girders, 55 ft. long at Thirty-fourth street, and 71 ft. long at the other two, with a double track between each two girders, except in the case of Track 9.

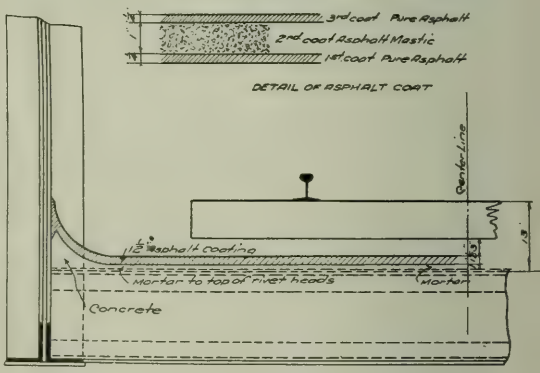
The floor system consists of 6-in. by 10-in. creosoted pine timbers laid closely together, parallel with the track, on the bottom flanges of heavy cross box-girder floor-beams. The drain water is carried through these box girders in 2-in. pipes, calked in like boiler tubes, and in gutters cut in the creosoted timbers, to the low end o the bridge back of the ballast wall.

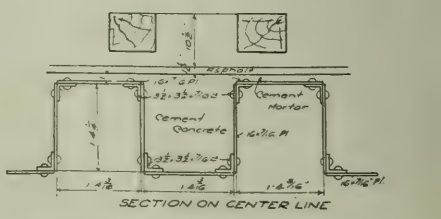
For tracks 1 and 2 a Portland cement mortar layer, 4½ in thick at the center, and sloping to the drain pipes at the sides, where it is about 2 in. thick, was first laid on the creosoted timbers, th proportions used in the concrete being 1 cement to 5 torpedo sand except at Thirty-fourth street, where it is 1 cement to 6 limeston screenings. Then, on this cement layer, and on the steelwork, a layer of hot asphalt was poured and swabbed on till it became ½-in thick. The work was done very early in 1904, when the tem perature was below freezing every night, and frequently during the day. Owing to conditions of construction, the time could no





Wire Netting Method at Archer Avenue.



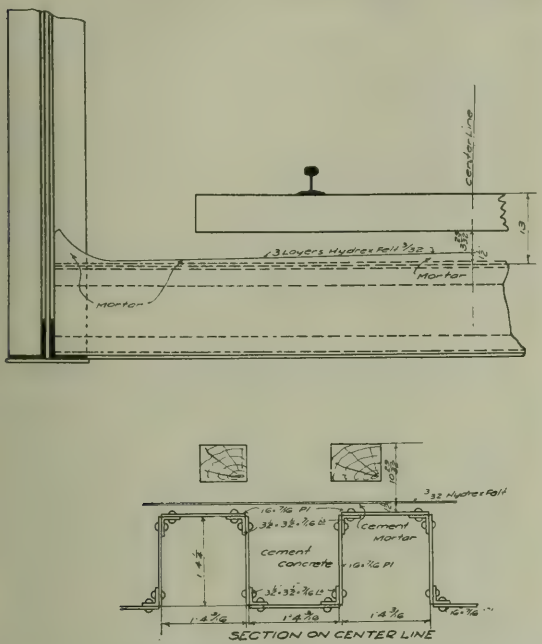


Asphalt Method at Archer Avenue.

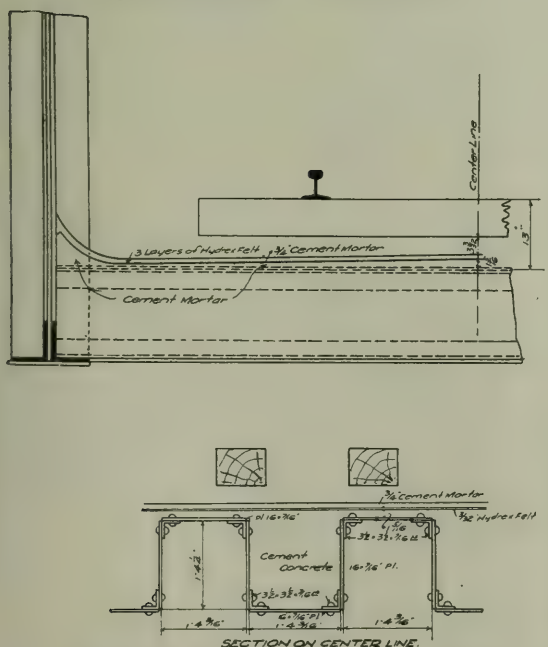
*Reprinted from *Bulletin* No. 64 of the American Railway Engineering and Maintenance of Way Association, June, 1905.

be chosen. The bridge erectors were waiting for the next bridge, and the work, therefore, had to be hurried. The asphalt did not adhere well to the cement, presumably on account of the moisture in the cement. Considerable difficulty was also experienced in getting the asphalt to adhere to the steel, on account of the shop coat of oil. An attempt was made to remove this coat by burning benzine, which was lightly poured over the oil, but with poor results. When the test was made by standing water on the bridges before use, they were all found to leak, principally around the pipes in the box girders, but were patched till entirely water-tight before being put in service under traffic.

Owing to the poor adhesion between the asphalt and the cement,



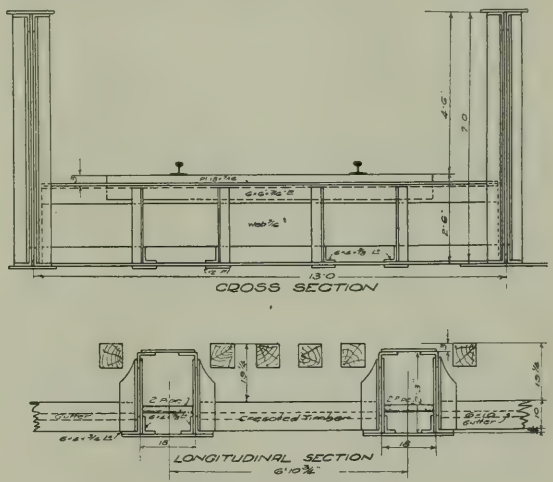
Hydrex Felt Method at Archer Avenue.



Hydrex Felt Method With Concrete on Top.

it was decided for the next work, tracks 5, 6, 7, 8 and 9, to omit the cement, and substitute asphalt mastic. After considerable study, specifications for the asphalt were prepared, which, after some changes, finally took the form submitted in the appendix. The writer is indebted to Mr. W. H. Finley, then Principal Assistant Engineer of the Chicago & North-Western, for the matter contained in them. The asphalt was purchased under the specifications from different manufacturers, and, after receipt of a shipment, samples were taken to a testing laboratory and tested. The steelwork was first thoroughly cleaned with concentrated lye, and then painted with asphalt paint. A layer of pure asphalt gum ¼ in. thick was poured over the creosoted timbers and top of the steel box girders, and mopped on the sides of the latter till of the same thickness, after which a layer of asphalt mastic (made in the proportion of 1 asphalt to 4 of limestone screenings) was put on 4½ in. thick at the center and about 2 in. thick at the side drains. Finally, on top of all was poured a ¼-in. layer of pure asphalt, which, of course, had to be mopped on the sides of the girders. All of the bridges were made water-tight under test by patching where necessary. The work was performed in July and August.

The difficulties experienced with the asphalt mastic at Englewood, which will be described later, and the good results from the protection for tracks 1 and 2, which were apparent after an inspection September 14th, succeeding a heavy rain, led to a return to the cement under-covering instead of asphalt mastic for tracks 3 and 4. A Portland cement concrete layer, 4 in. thick at the center, and about 2 in. thick at the side drains, in the proportions of 1 cement, 3 torpedo sand, and 3 crushed limestone broken to 1-in. size, except that at Thirty-fourth street the proportions were 1 cement to 6 limestone screenings, was placed on the creosoted tim-



Thirty-fifth Street Bridge Floor.

ber and well troweled on top, to a smooth sidewalk finish, after which it was allowed to dry thoroughly. The steelwork was cleaned with concentrated lye and water, and the parts of steel and concrete intended to be covered with asphalt were painted with two coats of liquid asphalt, after which a ¼-in. layer of pure asphalt was poured on, then the asphalt mastic, in the proportions of 1 asphalt to 4 parts of sand and screenings, hot from the kettle, was packed and rammed, and the whole, including the box girders, covered with a finishing coat of pure gum asphalt, ¼-in. thick. The mastic was not carried over the tops of the box-girder floor-beams. The work was done in August and September.

The Englewood bridges are single-track, half-through plate-girder bridges of one span, each 72 ft. long, except that the Murray street bridge has two tracks, with three girders, while the one at Wallace street is a steel trough floor bridge 25 ft. long, with the troughs running parallel with the track. The floor systems of the other bridges are of the same type, except that the troughs are at right angles to the track. On account of the intention to add a second track to these bridges in the future, it was decided to use the asphalt mastic instead of concrete for filling the troughs, the latter being completely filled so as to carry the drain water to one or both ends of the bridge.

At Wright, Wallace and Lowe streets a ¼-in. layer of pure hot asphalt was poured all over the steel-work to be covered, mopping being resorted to in the case of vertical surfaces, and the troughs were then filled with hot asphalt mastic, mixed in the kettle in the proportions of 1 asphalt to 5 parts of sand and screenings. This mastic was carried over the tops of the troughs, crowned in the

center and sloped to the sides, which were built up in the form of gutters. On level track the gutters were sloped to each end of the bridge from the center. On the mastic was poured a ¼ to ⅜-in. layer of pure hot asphalt, over which, while hot, was scattered a ½-in. layer of clean gravel. It developed during the progress of the work that the mastic, while cooling, contracted, and pulled away from the sides of the troughs, but the cracks were filled again as completely as possible with the liquid asphalt. On test, when the work was completed, the bridges were water-tight, but, in the light of subsequent effects, the cooling must have continued, resulting in very fine cracks, which caused leaks.

At Murray and Union streets in order to avoid the contraction of the asphalt recited above, mastic blocks were molded in the proportions of 1 asphalt to 4 lime-stone screenings and allowed to cool. They were of such size as would just fit between the rivet heads of the troughs, and were set in place after the usual ¼-in. coat of pure asphalt had been put on the steel. The spaces were poured full of pure hot asphalt, but it was evident, during the pouring, that the cool blocks absorbed a good deal of the liquid, and it is considered possible that some voids remained near the bottom. The top was finished in the same manner as the other bridges. Subsequent results seem to indicate that the new method did not entirely correct the old.

The Brighton Park bridge at Archer avenue is a four-track, single span, half-through plate-girder bridge, of the P., C., C. & St. L. There is only one track between each two girders, which are 68 ft. long, and on skew. The floor system consists of square steel troughs, similar to the ones used on the Englewood bridges. Some new methods of waterproofing having been proposed, it was decided to try a different one for each track of this bridge, but in each case, the shop coat was removed with concentrated lye, at a cost of about 1 cent per sq. ft. of surface.

For track 1 the troughs were filled to the top with Portland cement concrete, mixed in the proportions of 1 cement, 3 torpedo sand, and 3 crushed stone, after which a galvanized wire netting of No. 10 wire, with 2-in. mesh, and costing 5 cents a sq. ft., was spread over the tops of the troughs, so as to rest on the rivet heads. This was then covered with cement mortar, mixed with 1 cement to 3 sand, 2 in. thick in the center, and sloping to the sides, where it is about 1¼ in. thick, thus allowing the water to drain to the sides, and thence to one end, as the bridge is on grade.

For track 2 the troughs were filled with Portland cement concrete, as above, except that it was carried above the troughs, crowned at the center and sloped to the sides. A pocket was made at the top edges, where they joined the main girders, and the surface was troweled to a sidewalk finish. On this were placed three layers of Hydrex felt, laid transversely with the track, and lapped like shingles, with 12 in. exposure, starting at the lower end of the bridge. The Hydrex is a patent saturated felt, made by Hydrex Felt & Engineering Co., in rolls 36 in. wide, and about 66 ft. long. Before placing, the concrete is swabbed with hot "Hydrex Compound," and the felt then smoothed down on it. The felt is turned into the pocket at the girders, and the cavity filled with the "compound." On top of the felt a ¾-in. layer of cement mortar was placed to prevent the puncturing by ballast of the waterproof felt covering. It was laid in blocks and troweled as in sidewalk work.

For track 3 the same method was used as for track 2, except that the top layer of concrete was omitted. This is to determine whether the Hydrex felt will be punctured by the stone ballast or not.

For track 4 the concrete filling was carried up to the top of the rivet heads, except that the surface was sloped from the center to the sides, and on it was placed a 1½-in. layer of asphalt. This was made by first painting the dry concrete surface with liquid asphalt, made of asphalt and benzine, after which hot asphalt was poured on to a depth of ¼ in. The liquid layer was followed by 1 in. of asphalt mastic, in the proportions of 1 asphalt to 4 limestone screenings, and this by another ¼-in. liquid layer, on top of which torpedo sand was sprinkled to harden the top.

The P., F. W. & C. bridges at Fifty-first and Forty-seventh streets are steel trough floor bridges, square in section, and supported parallel with the tracks on transverse girders, standing on columns on the curb lines, and in the center of the streets, a total clear length of 68 ft., in two 11-ft. sidewalk spans, and two 23-ft. roadway spans. For the first track, the troughs were filled with asphalt mastic without either painting the steelwork, or pouring on a coat of pure asphalt; this being done at the expressed wish of one of the asphalt manufacturers, who was given charge of this to do in the best way he could recommend. The mastic, mixed in the proportions of 1 asphalt, 3 torpedo sand, and 2 limestone screenings, was built up to 2 or 3 in. over the tops of the troughs, the center being higher, and the surface sloping to each end of the bridge. On top, a layer of pure asphalt gum ¼ to ⅜-in. thick was poured, and then sprinkled with sand to harden it. On test, immediately after its completion, the bridge was found to leak badly. It developed during the progress of the work that the shrinkage of the asphalt when cooling was such as to leave the metal practically unprotected, and the method was abandoned.

The bridges for the remaining tracks, 10 in number, and for Forty-seventh street, were done as follows: The steelwork, after being cleaned, was painted with hot asphalt and benzine, and ¼-in. layer of hot asphalt poured on and thoroughly mopped over, after which the troughs were filled to within about 3 in. of the top with cement concrete in the proportions of 1 cement to 6 limestone screenings. When this was thoroughly set and dry, the remaining depth of the troughs was filled with asphalt mastic, which was carried over their tops in a layer 2 to 3 in. thick, somewhat thicker at the center than at the ends, and this was in turn covered with a ¼ to ⅜-in. thickness of pure gum.

There are six different bridges at Fifty-first street. No attempt was made to remove the shop coat of oil from Nos. 1 and 2, and on No. 3 most of the experiments for removing the shop coat, which will be described later, were tried, after it was decided to paint the steelwork of the remaining bridges with liquid asphalt, without removing the shop coat.

The Forty-sixth street bridge is a four-track half-through plate-girder bridge with a steel trough floor like that at Archer avenue. All the troughs were filled with Portland cement concrete made in the proportion of 1 cement to 5 parts of limestone screenings. At track 3, the concrete was carried up over the tops of the troughs, and a finishing coat of asphalt was put on.

Tracks 1 (the most easterly one) and 2 and 4 were finished in the same manner as at Archer avenue, but the depth from bottom of tie to top of trough, about 8 in., is greater at Forty-sixth street and permitted a greater thickness of mortar layer on top of the troughs, 3 in., with the wire netting in the center. This top layer of mortar was composed of 1 cement to 2 parts of limestone screenings.

RESULTS OF EXAMINATION MADE ABOUT JAN. 1, 1905.

Brighton Park Bridges.—Archer avenue: No indications of leaks on any of the bridges. Thirty-fourth, Thirty-fifth and Thirty-sixth streets: Leaks showed plainly at every track of each bridge, but tracks 3 and 4 showed the fewest. The asphalt examined when the temperature was about 0 deg. Fahr. showed it be to hard, glassy, and easily shattered by a blow.

Englewood Bridges.—Every bridge, with the single exception of the one at Wallace street, showed leaks along the girders. As the troughs are practically water-tight, the only place where leaks can show is at the junction point between trough and girder, but it does not prove that the water finds it way down between the asphalt and the girder; it may occur at any other point, but the drip will always show on the girder line.

P., F. W. & C. Bridges.—All the bridges at Fifty-first and Forty-seventh streets showed leaks at the post lines, because the concrete, as well as the asphalt, cracked at those places, on account of lack of steel reinforcement. One bridge protected with asphalt was not put into service for several weeks after completion, but there was no difference in the result. At Forty-sixth street, up to the time of the inspection, the bridges for tracks 1 and 4 seem to be water-proof, but that at track 2, done late in the fall, showed leaks. The top layer of the concrete, in which the wire netting was imbedded, froze during the work, which may be responsible for the trouble. At track 3, where a concrete filling with asphalt top was used, leaks appeared along the girders, which may have been due to the asphalt pulling away from the girders.

GENERAL INFORMATION AND COMMENTS.

From the start difficulty was experienced in obtaining a satisfactory adhesion of the asphalt to the steel. As soon as it became cold, it could be peeled off like paper. After a good deal of experimenting it was found that asphalt would adhere to steel in about the following order:

(1) Rusty steel; no adhesion.
(2) Shop coat of red lead or oil; slight adhesion.
(3) Shop coat covered with liquid asphalt; slightly better than 2.
(4) Shop coat burned by pouring benzine over the steel and burning it; about the same as 3.
(5) Perfectly clean bright steel; excellent adhesion.

In order to have the fifth condition, a sand blast is probably necessary, but as there was none available, other means of removing the shop coat were resorted to. The bridges had all been given a shop coat of oil, and on some parts, red lead. The usual wire brushes and scrapers were expensive to use, and not satisfactory.

Burning benzine over the shop coat had little effect on the oil, except to soften it. It, therefore, required a number of repeated burnings to remove it entirely, which was expensive.

A paint burner, similar to the Buckeye burner and Wells light, was tried to a small extent, but it was slow, on account of being necessary to concentrate the flame on a small area in order to soften the oil sufficiently to be easily removed with scrapers. It was thought when this burner was made that the heat would be great enough to burn off the oil coat completely, without scraping, but it did not prove to be the case.

Cleaning with concentrated lye and lime was tried at Fifty-first street with good results, so far as removing the shop coat was

concerned, but it was found so difficult to remove entirely the lime and lye from the steelwork that the method was given up as impracticable. The lime stuck to the steel in spite of the frequent washings, and small particles would lodge in uneven surfaces around the rivet heads, where it was next to impossible to remove it.

The best results were obtained by using concentrated lye and water, in the proportions of 1 pound of lye to 1½ gallons of water. This solution was swabbed on the steel, wire brushes and scrapers were then used, and finally the steel was thoroughly washed until all the lye had disappeared. The cost was about 1 cent per sq. ft. of surface.

After the above methods were tried, and it was found that pretty good adhesion between the asphalt and metal was obtained by painting over the shop coat with liquid asphalt made by pouring hot asphalt into benzine, or obtaining it from the manufacturer, this plan was generally followed. When the liquid asphalt was applied, the benzine evaporated, leaving a thin layer of asphalt on the steel. A pretty thick mixture was used, and after applying two coats, the layer was about $^{2}/_{16}$-in. thick.

As it was desirable to purchase asphalt in a competitive market, the specifications in the appendix were prepared, and the orders were based on the manufacturer's agreement to comply with them. Samples were then taken and sent to a testing laboratory for determination of qualities. The requirements were purposely made severe, as the office the asphalt had to perform was severe.

The product of only one of three concerns fulfilled specification No. 1, the volatile test, while all stood the acid test. All but one sample did not flow at 212 deg. Fahr. and that one did so only at 196 deg. Fahr. At 15 deg. Fahr. below zero, about half the samples were brittle and one-half were not. This was a very severe requirement, coupled with a high temperature flow point. The requirement for supporting power, No. 7 (b), 15 lbs. per sq. in. at 130 deg. Fahr., was made because the provision for depth of ballast between the bottom of the tie and the asphalt was small, and there would be great danger of pressing the ballast through the asphalt if too soft. All of the mastic tested stood this requirement.

When one track at a time was being done, the force required was about 12 men and a foreman. It took the time of three or four of them to keep up fires, cut wood, and cut asphalt, while the rest were busy heating sand and screenings, mixing mastic, and depositing it in place, and painting, cleaning, etc. When there were several bridges to be done, seven or eight more men were necessary to clean and paint the next one ready for the asphalt.

The equipment for one gang was as follows:

		Each.
1	Asphalt heater 3 bbls. capacity	$62.50
1	Mastic heater	105.00
2	Sand and screening heaters	20.00
	Shovels, spuds for stirring mastic, brooms, wire brushes, smoothing irons	....
2	Pay-off pails	5.00
1	Dipper	2.00

The asphalt mastic mixer was 8 ft. long, and had doors for firing at one end and on both sides. Anything longer was found to be impracticable. The sand heaters were made of sheet iron.

During the progress of the work, the cost of asphalt fell from $60 to $40 and even $35 per ton, due to the competition. This, as well as other matters, caused the unit price to vary considerably. The information is presented in Table A.

CONCLUSIONS.

(1) Asphalt mastic is not suitable for filling the troughs of solid floor bridges, because of its shrinkage when cooling, thus defeating the objects of its use, protection of the steel, and the formation of a solid, compact mass, with such close adherence to the steel as to be water-tight. It is felt that ample trial was made of it, and that, too, with different mixtures of the best asphalt to be found. The advice of the manufacturers or dealers was freely accepted, till it was discovered that they were simply experimenting as well as ourselves.

(2) It is quite within reason to consider, in the light of the tests, that an asphalt covering next below the ballast, either over mastic or concrete, is not an efficient water-proof coating. When the inspection was made in January only one bridge (track 4 at Archer avenue), prepared with this, was not leaking, but it is entirely reasonable to doubt that it is the asphalt rather than the concrete which is performing the satisfactory service. The requirements of ductility and hardness conflict. When the asphalt is made soft enough to resist tearing apart under temperature changes, it is too soft to bear the load of traffic, a fact which has been also proved on other railroads. It is impossible to provide for a sufficient depth of ballast to overcome this objection.

(3) Ordinary concrete has not sufficient strength in itself to resist the forces tending to tear it apart at the column lines of bridges in two or more spans. Consequently leaks developed at every place of that kind. Although it has not been proved by trial, it is quite likely that reinforced concrete will prove effective, and it will probably be tried this year.

(4) Concrete is an effective filling material for troughs, because it adheres firmly to the steel, protects it from corrosion, and can be made practically water-tight, either by the use of concrete rich in mortar, or by a solution of soft soap and alum.

Its objections are that it is:

(a) Difficult to remove in case repairs are necessary, or in view of the replacement of, or addition to, the bridge, on account of constant improvements in the property.

(b) Heavy, and adds considerable dead weight to the bridge.

(c) Costly, on account of the quantity, and the great care necessary to make a satisfactory job.

(5) Something more than filling the troughs is necessary, however. A top surface is required, graded to carry the water to the sides and to the ends of the bridge. Concrete alone is not suitable, unless in considerable thickness. To meet this condition, it must be reinforced. Nothing definite in regard to the woven wire mesh used at Archer avenue has yet transpired, because the track, No. 1, where it was used, has not yet been put in service for traffic. Similar construction at Forty-sixth street on the Pittsburg, Fort Wayne & Chicago, was effective up to January, except in the case where the concrete was frozen. The writer is inclined to favor the use of small rods, from ¼ to ⅝-in. thick, rather than the wire, on account of making better use of the steel, and, quite likely, greater economy.

Table A.—Brighton Park.

	Track No.	Price of asphalt, pr ton.	Area bridge, sq.ft.	Total cost.	Cost per sq.ft.	Protection.
34th St.	1 & 2	60	1,581	$403.28	$0.255	Concrete bottom; asphalt top.
	3 & 4	40	1,581	309.11	.195	
	5 & 6	40	1,430	294.78	.206	All asphalt.
	7, 8 & 9	40	2,145	356.23	.167*	All asphalt.
35th St.	1 & 2	60	2,041	501.64	.246	Concrete bottom; asphalt top.
	3 & 4	40	2,041	344.05	.168	
	5 & 6	40	1,846	361.60	.196	All asphalt.
	7, 8 & 9	35	2,769	610.82	.220	All asphalt.
36th St.	1 & 2	60	2,041	456.27	.223	Concrete bottom; asphalt top.
	3 & 4	40	2,041	335.46	.164	
	5 & 6	40	1,846	440.19	.238	All asphalt.
	7, 8 & 9	†35 & 60	2,769	665.95	.240	All asphalt.
Archer Ave.	1	..	871	326.78	.375	Conc.; wire mesh
	2	..	871	366.78	.420	Hydrex., con. top.
	3	..	871	366.78	.420	Hydrex. on con.
	4	40	871	370.36	.425	Con. bot.,asp. top.
Englewood.	Streets.					
	Wright.	35	936	295.34	.316	All asphalt.
	Wallace.	35	486.5	165.89	.341	"
	Lowe.	35	936	303.32	.326	"
	Union.	40	936	515.60	.550	"
	Murray.	40	2,376	1,526.98	.642	"
	P., F. W. & C. Railway.					
46th St.	Bridge No. 1	..	520	175.69	.338	Concrete and wire mesh.
	2	..	520	144.92	.279	
	3	40	520	226.72	.435	Concrete, asphalt
	4	..	520	176.50	.439	Conc.; wire mesh
47th St.	..	40	5,531	1,976.61	.357	Con. bot.,asp. top.
51st St.	1	35	3,349	1,414.45	.422	All asphalt.
	2	35	2,292	850.09	.370	Concrete bottom; asphalt top.
	3	..	2,074	754.10	.360	
	4	40	2,278	785.70	.344	
	5	40	2,156	604.76	.280	
	6	40	2,521	913.69	.362	

*The cost on this bridge is low, due to fact that considerable material was used which was furnished by asphalt company by mistake, for which no charge was made.

†6,102 tons at $35; 2.85 tons at $60.

Archer Ave.: Track No. 1, Eastbound freight; No. 2, Eastbound passenger; No. 3, West bound passenger; No. 4, Westbound freight.

(6) The Hydrex felt covering, track No. 3, at Archer avenue, has as yet given no cause for complaint, but this is a case where time is especially needed to determine the result, because its effectiveness depends on its strength against puncture by the ballast, which is a very thin layer under the ties. It has been much used by the Chicago & Western Indiana.

(7) If, however, the Hydrex felt should be broken up by the ballast, there is a remedy, where there is a sufficient depth of ballast, by laying a concrete sidewalk on top of it, as at track 2, Archer avenue, to bear the loads transmitted by the rolling stock. This concrete need not be waterproof.

(8) In the case of trough floors transverse with the tracks, there seems to be no help for it except to fill them up with a rich concrete, unless indeed a drain hole is cut in each, and a gutter underneath be provided, a plan which should not be resorted to except in case of necessity for a long bridge. After this is done, one has the choice of several different ways for providing a waterproof covering.

(9) When the troughs are placed parallel with the track, a much less thickness of concrete filling can be used, if a suitable method for protecting the portions of the troughs sticking up above the concrete can be devised. It is quite certain, where columns are used, that the concrete must be reinforced at the column lines, and other expansion places. If a plaster of cement is put over the ex-

posed troughs it may possibly have to be reinforced also, on account of its bulk.

The work described in the foregoing was performed under the direction of Mr. N. Neff, Engineer Maintenance of Way, and his assistant, Mr. C. L. Barnaby, Chicago Terminal Division, and they also furnished the data for the compilation of this article.

APPENDIX.

Pennsylvania Lines West of Pittsburg—Southwest System.

Specifications and Instructions for Water-Proofing Metal and Masonry Structures.

I. *Pure Gum Asphalt.*—1. Asphalt shall be used which is of the best grade, free from coal tar or turpentine, and which will not volatilize more than one-half of 1 per cent. under a temperature of 450 deg. Fahr., for 10 hours.

2. It must not be affected by a 20 per cent. solution of ammonia, a 25 per cent. solution of sulphuric acid, a 35 per cent. solution of muriatic acid, nor by a saturated solution of sodium chloride.

3. (a) For metallic structures exposed to the direct rays of the sun, the asphalt should now flow under 212 deg. Fahr., and should not become brittle at 15 deg. Fahr. below 0 deg. when spread in a layer ⅛-in. thick on thin glass.

(b) For structures underground, such as masonry arches, abutments, retaining walls, foundation walls of buildings, subways, etc., a flow point of 185 deg. Fahr. and a brittle point of 0 deg. Fahr. will be required.

II. *Preparation of Surface of Structure.*—4. (a) Before applying the asphalt to a metal surface, it is imperative that the metal be cleaned of all rust, loose scale and dirt; and, if previously coated with oil, this must be entirely removed. When the asphalting is done during the summer months, between May and September, the clean, dry metal shall be painted with two coats of cold asphalt paint, free from oil, made by thinning pure gum asphalt with benzine, before the hot asphalt is applied. When the asphalting is done during the winter months, this coating will be omitted, but the metal shall be warmed to the satisfaction of the engineer, before the hot asphalt is poured on. The warming is best accomplished by covering the metal with hot sand, which should be swept back as the hot asphalt is applied.

(b) When water-proofing masonry structures, if the surface cannot be made dry and warm, it should be first coated with the asphalt paint applied cold. This is particularly necessary for vertical surfaces.

III. *Application of Coating.*—5. The asphalt should be heated in a suitable kettle to a temperature not exceeding 450 deg. Fahr. If the temperature should run above 450 deg. Fahr., for any length of time, it will result in "pitching" the asphalt. Before the "pitching" point is reached, the vapor from the kettle is of a bluish tinge, which changes to a yellowish tinge after the danger point is passed. The asphalt has been sufficiently cooked when a piece of wood can be put in and withdrawn without the asphalt clinging to it.

6. (a) The first coat shall consist of a layer not less than ¼ in. thick of pure asphalt poured from buckets on the prepared surface and thoroughly mopped over.

(b) The second coat shall consist of a mixture of clean sand or screenings, free from earthy admixtures, previously heated and dried, and asphalt, in the proportion of 1 asphalt to 3 of sand or screenings by volume; this is to be thoroughly mixed in the kettle and then spread out on the surface with warm smoothing irons, such as are used in laying asphalt streets.

(c) The third or finishing coat shall consist of pure hot asphalt spread evenly in a layer not less than ¼ in. thick over the entire surface, and then sprinkled with washed roofing gravel, torpedo sand, or stone screenings, to harden the top.

7. (a) The built-up thickness of the three coatings described in Section 5 should be 1½ in. at the thinnest place for steel bridges and 2 in. for masonry arch bridges.

(b) This built-up asphalt covering must not perceptibly indent when at a temperature of 130 deg. Fahr., under a load at the rate of 15 lbs. per sq. in., and it must remain ductile at a temperature of 15 deg. Fahr. below zero on metal structures, and at 0 deg. Fahr. on masonry structures under ground.

IV. *Concrete Filler.*—8. In the case of steel trough floors, the trough will first be filled with Portland cement concrete, mixed in the proportions of 1 cement, 3 sand and 3 broken stone, and the surface will be finished 1½ in. below and to the same shape as the asphalt surface. The concrete is to be placed against the clean steel, free from rust, oil, paint or dirt. A plan for drainage may be necessary in each case, because that is affected by the length and grade of bridge and by the direction of the troughs.

The long Orenburg & Tashkend Railroad, which gives an all-rail route from the Russian provinces of Central Asia to European Russia, is to be opened for regular traffic July 14. The length of the line is about a thousand miles. There are to be three trains a week for the present, which will run through in four days.

Table for Calculating Cubical Contents of Piling.

The accompanying table for calculating the cubical contents of piling was gotten out by Mr. E. O. Faulkner, Manager Tie and Timber Department of the Atchison, Topeka & Santa Fe. It is based on the prismoidal formula, the instructions for its use being as follows: Find the diameter of each end of the pile by taking the mean of the longest and one at right angles thereto, in each case working to the nearest half inch. Multiply the tabular number corresponding to the large and small diameter of each pile by its length in feet.

Table for Calculating Cubical Contents of Piling.

Large diam. (inches)	Small diameters (in inches.): 6.	6½.	7.	7½.	8.	8½.	9.	9½.	10.	10½.	11.	11½.	12.	12½.	13.
8 in.	0.27	0.29	0.31	0.33	...	...	...	...	...	...	...	...	...	...	...
8½ "	.29	.31	.33	.35	0.37	...	...	...	...	...	...	...	...	...	...
9 "	.31	.33	.35	.37	.39	0.42	...	...	...	...	...	...	...	...	...
9½ "	.33	.35	.37	.40	.42	.44	0.47	...	...	...	...	...	...	...	...
10 "	.36	.38	.40	.42	.44	.47	.49	0.52	...	...	...	...	...	...	...
10½ "	.38	.40	.42	.45	.47	.49	.52	.54	0.57	...	...	...	...	...	...
11 "	.41	.43	.45	.47	.50	.52	.55	.57	.60	0.63	...	...	...	...	...
11½ "	.43	.45	.48	.50	.52	.55	.58	.60	.63	.66	0.69	...	...	...	...
12 "	.46	.48	.50	.53	.55	.58	.61	.63	.66	.69	.72	0.75	...	...	...
12½ "	.49	.51	.53	.56	.58	.61	.64	.66	.69	.72	.75	.78	0.82	...	...
13 "	.52	.54	.56	.59	.61	.64	.67	.69	.72	.75	.79	.82	.85	0.89	...
13½ "	.55	.57	.59	.62	.64	.67	.70	.73	.76	.79	.81	.85	.89	.92	0.9
14 "	.58	.60	.62	.65	.68	.70	.73	.76	.79	.82	.86	.89	.92	.96	.9
14½ "	.61	.63	.66	.68	.71	.74	.77	.80	.83	.86	.90	.93	.96	1.00	1.0
15 "	.64	.66	.69	.72	.74	.77	.80	.83	.86	.90	.93	.96	1.00	1.03	1.0
15½ "	.67	.70	.72	.75	.78	.81	.84	.87	.90	.93	.97	1.00	1.04	1.07	1.1
16 "	.71	.73	.76	.79	.81	.84	.87	.91	.94	.97	1.01	1.04	1.08	1.11	1.1
16½ "	.74	.77	.79	.82	.85	.88	.91	.94	.98	1.01	1.04	1.08	1.12	1.15	1.1
17 "	.78	.80	.83	.86	.89	.92	.95	.98	1.02	1.05	1.08	1.12	1.16	1.19	1.2
17½ "	.81	.84	.87	.90	.93	.96	.99	1.02	1.06	1.09	1.13	1.16	1.20	1.24	1.2
18 "	.85	.88	.91	.94	.97	1.00	1.03	1.06	1.10	1.13	1.17	1.21	1.24	1.28	1.3
18½ "	.89	.92	.95	.98	1.01	1.04	1.07	1.11	1.14	1.18	1.21	1.25	1.29	1.33	1.3
19 "	.93	.96	.99	1.02	1.05	1.08	1.11	1.15	1.18	1.22	1.26	1.29	1.33	1.37	1.4
19½ "	.97	1.00	1.03	1.06	1.09	1.12	1.16	1.19	1.23	1.26	1.30	1.34	1.38	1.42	1.4
20 "	1.01	1.04	1.07	1.10	1.13	1.17	1.20	1.24	1.27	1.31	1.35	1.39	1.43	1.47	1.5

The State Railroad Commissions.

In 1903, as its first brief in its campaign for increased powers the Interstate Commerce Commission issued an elaborate statistical report on state regulation of railroads. This showed that in 189 there were 28 state railroad commissions. This number increase to 30 in 1902 (after the adjournment of the state legislatures). Si states which in 1890 were without commissions established ther during this period, although subsequently two of these states abo ished their commissions. Four states which in 1890 had commis sions abolished them before 1902, but in two cases subsequently re established them. The Interstate Commerce Commission classifie railroad commissions as "strong" and "weak," calling a commis sion "strong" when it has rate-making power and "weak" when i has no such power. Of the 28 commissions existing in 1890, 1 were "strong" and 13 were "weak"; while of the 30 existing i 1902, 20 were "strong" and 10 were "weak." Of the eight com missions established or re-established during the period, all bu one were "strong," showing a very general tendency to give suc bodies power over rates. Since 1902 one commission, in Colorad has been abolished and three new commissions, in Indiana, Wash ington and Wisconsin, have been established, all of these three thi year. There are therefore now in existence, 32 state railroad com missions. The Colorado commission which was abolished was "weak" commission. The Indiana, Washington and Wisconsin com missions are all "strong." Thus of the 32 now existing, 23 com missions are "strong" and nine "weak" against 20 "strong" an 10 "weak" in 1902. Evidently the tendency toward "strong" com missions which was exhibited up to 1903 has been continued unt the present time. The situation is shown in the accompanying table

State Railroad Commissions, 1905.

State.	Present Com. founded.	Powers.	State.	Present Com. founded.	Power
Alabama	1881	Strong.	Mississippi	1884	Stron
Arkansas	1899	Strong.	Missouri.	1875	Stron
California	1876	Strong.	N. Hampshire	1844	Stron
Connecticut	1853	Weak.	New York.	1883	Weak
Florida	1897	Strong.	North Carolina.	1891	Stron
Georgia	1879	Strong.	North Dakota	1889	Stron
Illinois	1871	Strong.	Ohio.	1867	Weak
Indiana	1905	Strong.	Rhode Island	1872	Weak
Iowa	1878	Strong.	South Carolina.	1878	Stron
Kansas	1901	Strong.	South Dakota	1889	Stron
Kentucky	1880	Weak.	Tennessee	1897	Stron
Louisiana	1898	Strong.	Texas.	1891	Stron
Maine.	1858	Strong.	Vermont	1835	Weak
Massachusetts	1869	Weak.	Virginia	1877	Weak
Michigan	1873	Weak.	Washington	1905	Stron
Minnesota	1871	Strong.	Wisconsin.	1905	Stron

The Indiana Commission was created by the Newhouse bil which was approved by the Governor on February 28 and becam a law on April 15. The appointment and official term of the In diana Commission began on May 1, when it organized with Unio B. Hunt, Chairman and William J. Wood and C. V. McAdams as th other commissioners. The commissioners receive a salary of $4,00 a year and serve for four years. The commission has genera power to supervise traffic and adopt necessary regulations to gover car and train service. It has power upon the filing of complain to investigate rates, to set aside existing rates and substitute othe

rates therefor. Such rates are to go into effect upon the order of the commission, unless suspended upon appeal to the Appellate Court. In the event of appeal a bond is to be executed by the railroad company or companies involved which shall provide for repayment to shippers of the difference between the two rates in case the decision of the commission is affirmed by the Appellate Court. If the commission's decision is not affirmed, the old rate remains in force and the bonds are void. The commission also has power over switching charges, the location and maintenance of side tracks, and crossings of railroads with other railroads and with electric lines; and has much to do with the physical conditions of railroads. The provisions of the railroad commission law apply also to express companies doing business in the state. Besides all this, the commission has power to inquire into interstate traffic. If this is being carried on in violation of the Interstate Commerce law demand is to be made by the commission upon the transportation company to comply with that law. On the transportation company's failure to comply with this demand, application can be made by the Indiana commission to the Interstate Commerce Commission for relief.

The Washington Commission was created by the Crane-Dickson bill, which passed the Senate by a vote of 36 to 4, and as amended by the Senate, passed the House by a vote of 71 to 10. The law went into effect on June 7 and the commission was organized on June 23, with H. A. Fairchild, who was appointed for a term of six years, Chairman; John S. McMillin (term of four years), and John C. Lawrence (term of two years), as the other two Commissioners. The regular term of office is six years and the salary is $4,000 a year. The commission has power to fix freight rates within the State of Washington, subject to review by the courts on appeal. It may alter an existing rate when, sitting as a board of arbitration or inquiry, it finds that such rate is unjust. If the railroads dissent, they may appeal to the Superior Court of Thurston County (Olympia), in which the case takes precedence of any on the calendar. The commission sits as a board of arbitration when complaint is made of an unjust or discriminatory rate, and as a board of inquiry when it investigates a rate on its own motion or initiative. It has authority, through the courts, to enforce its own orders. It may, when the railroads fail to agree, make joint rates. It may summon any railroad official or employee as a witness, and may compel the attendance of witnesses. It also has the right to call for the records and books of a railroad company. Under the railroad commission law every railroad is expressly prohibited from charging more for a shorter than for a longer haul over the same line and in the same direction when the shorter is included in the longer distance.

The Wisconsin commission, which was discussed in the *Railroad Gazette* of June 23, page 716, though classed as a "strong" body, has rate-reviewing rather than rate-making powers. Rates can be attacked only after 10 days' notice and altered only after due hearing and investigation. Changes then ordered by the commission are to go into effect pending appeal. Under the Railroad Commission law the railroads may alter existing rates as often as they like, provided the proposed changes are published 10 days beforehand and the commission is notified of the change and does not take steps to show it unreasonable. Wisconsin has in the past had a single railroad commissioner, elected every two years, with a salary of $3,000, and with very limited power. The new commission is to consist of three members with salaries of $5,000 a year each and a regular term of six years. The members of the commission are Professor B. H. Meyer, of the University of Wisconsin; Halford Erickson, Commissioner of Labor and Industrial Statistics, and John Baines, a lawyer. It is provided in the railroad commission law that one commissioner shall have a general knowledge of railroad law and each of the others a general understanding of matters relating to railroad transportation. No person appointed a commissioner may be pecuniarily interested in any railroad, either in, or outside of, Wisconsin. Both the commissioners and the secretary are prohibited from holding any other position while in office.

Besides these three states in which new railroad commissions have actually been established, the legislature of Nebraska at its recent session provided for what might be called a potential commission, which will perhaps be established in 1906. The Cady bill, which passed both houses of the legislature and received the Governor's approval, proposes an amendment to the constitution of the state which reads as follows: "There shall be a State Railway Commission, consisting of three members, whose terms of office, except those chosen at the first election under these provisions, shall be three years, and whose salaries shall be $3,000 each per annum. Of the three commissioners first elected, the one receiving the highest number of votes, shall hold his office three years, the next highest two years, and the lowest one year. The powers and duties of such commission shall include such regulation of rates, service and general control of common carriers as the legislature shall provide by law." The constitutional amendment provided for in this bill is to be voted on at the general election on Nov. 8, 1906. Although this proposal gives to the people the decision as to whether or not there shall be any railroad commission at all, it reserves to the legislature the extremely important right of practically fixing the duties and powers of the commission, if created; and this not only at the time of its appointment but at any time in the future when the legislature shall see fit to contract or expand the commission's powers.

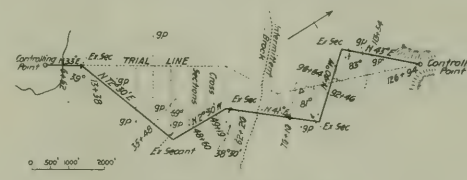
The recently established commissions have many points of similarity. All three would be classed by the Interstate Commerce Commission as "strong." In determining their powers the precedent of the "weak" but eminently successful Massachusetts commission has been entirely disregarded. Apparently the people, or the legislatures, of Indiana, Washington and Wisconsin feel that more good can be accomplished by a railroad commission with positive power than by a body which compels obedience not by constituted authority but by the prestige of its own impartial observation. It will be interesting to observe how far this belief is justified.

Locating a Railroad Line Through a Forest.

BY J. A. MACDONALD.

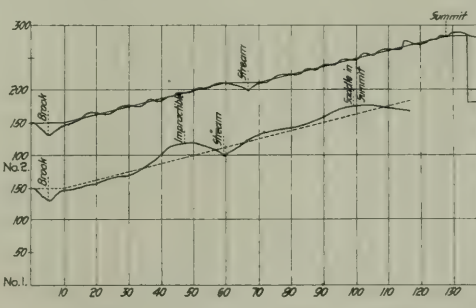
In easy country, running a line through a forest is but little more difficult than running a line over a prairie, a gang of axemen doing the only additional work. But in rough and difficult country locating a good line through a thick forest is perhaps as hard a problem as the locating engineer is likely to meet with. The writer was recently engaged in a survey of this kind on a line 15 miles long through virgin forest for most of the distance with only occasional vistas of open country.

Where the land was fairly level comparatively no difficulty was experienced. Township maps were made and with the assistance



Plan of Located Line.

of the local inhabitants the latitudes were easily obtained, but on coming to deep valleys and high ridges much trouble was encountered. Often it answered to back up one or two stations on coming to very high or very low ground and turn an angle to get around the difficulty but there were places where half a dozen back-ups would not have aided in getting a good location. Backing up is a poor way of getting on with a railroad location although it is frequently necessary in running a line through thick forest. The aneroid barometer and pocket compass are essential for this kind



Profile of Trial Line and Final Location.

of work and save much trouble in crossing ridges and summits and in starting and arriving at controlling points.

In this article will be described the method of getting from one controlling point to another which was the summit of the line on a ridge about two miles distant. Exploring ahead from the starting point the aneroid showed that the lowest available crossing point on the ridge was between 120 and 150 ft. higher than the controlling point two miles back. As the limit of grade was 1.25 per cent. this did not in itself seem a formidable difficulty but midway between was another ridge or more properly a table, the elevation of which it was difficult to accurately determine with the aneroid. Furthermore the ground on top of this intermediate ridge was wet and swampy, and covered with a thick growth of scrub spruce. It was

therefore decided to traverse the line by as direct a course as could be obtained from the maps on hand. These maps were made from compass surveys for the owners of the lands at various times, and could not be relied upon as strictly accurate. However, the controlling point on the summit ridge was located as accurately as possible on the maps and also the starting controlling point. An angle of 65 deg. turned to the left appeared to approximately answer the desired course at the starting point, and this course was followed until the intermediate ridge was reached, levels being taken at each chain. As it was of importance to cross the summit ridge at the controlling point previously located, a back course was started from that point, levels being taken as before. On reaching a point about where the first course was stopped it was found that the back course was about 1,000 ft. to the east. This, however, did not matter, and the two courses were joined by a direct line. This done, the levels were plotted on the profile and correct elevations obtained. The trial line profile is shown as the lower line on the accompanying plot, and it is a rough looking line indeed. The deepest cutting to grade meant going down 35 ft. in the swamp on the ridge and this, of course, was impracticable.

The next step was to cross-section the trial line with transit and level, running out on either or both sides of the course until grade level was reached. The grade assumed was the maximum and this was drawn on the profile. These cross-sections were taken every 500 ft. or 1,000 ft., and a grade line was drawn on the plan through these grade points. This line was necessarily very circuitous and was in reality nothing more than a grade contour line which would hardly answer for railroad location. After plotting this grade contour line on the plan the final location was drawn in. This was a compromise between the trial line and the grade contour line. The courses of the final location line were ascertained from the map with scale and protractor, and the line started. It was not always possible to keep on the precise course as determined from the plot, but the line was kept as closely to the course as the typography of the land would admit. This finally located line is shown as the heavy line on the plan. On developing the profile it proved to be a very good line as will be seen from the upper profile. On account of avoiding the swamp on the intermediate ridge it was necessary to develop the final course 2,800 ft. longer than the air line between controlling points.

The South African Railroad System.

Through the courtesy of Mr. W. W. Hoy, Chief Traffic Manager, we have received an early copy of the report of the Central South African Railways for the year ending Dec. 31, 1904. Railroad history in South Africa has to be taken and understood as a whole before the statements of any of its principal component roads are of great interest or value. South African railroads have been undergoing a development not unlike that which took place in the American West in the '70s and '80s, and it is well worth while to digress a moment from the report at hand to consider the general railroad position of that part of the African Continent that is dominated by Great Britain and by British influence.

The first railroad built in South Africa was in Natal, out of Durban as far as the Point, which was opened in 1860; but what might be called the main stem of the South African railroad systems is the system of lines comprising the Cape Government Railways in Cape Colony. When the Cape Colony lines were taken over by the British Government, in 1873, there was a railroad mileage of 63 miles, from Cape Town to Wellington via Stellenbosch and Wynberg, all part of what is now known as the Western System. Extensions were made rapidly. In 1875 the Western System, which now extends in a general northeasterly direction across Cape Colony along the boundaries of the Orange River Colony and the Transvaal to a connection with the Rhodesian Railways, had in all 103 miles of road built on the way to Kimberly, and a beginning had been made of the Eastern System out of East London, running northwest towards the Orange river, which separates what was then the Orange Free State from Cape Colony. In 1876, the first bit of the Midland System of the Cape Government Railways was built out of Port Elizabeth, extending directly north, likewise in the direction of the Orange river. Thus in that year there were well defined beginnings of the three present main stems of the Cape Government system—the Western, Midland, and Eastern—all of which start along the southern coast, while the two outer lines incline in towards the inner until they are connected up either directly or by spur lines in the vicinity of the Orange river. In that year the total mileage in the government system was 247. Ten years after that, it had increased, in 1886, to a total of 1,598, of which 717 was in the Western System, 589 was in the Eastern System and 291 in the Midland. This mileage remained practically the same for several years, but further important increases were made in 1890 and in 1892. The mileage in 1892 amounted to 1,890 miles and underwent little change from that time until after the Boer war.

The Cape Government Railways may be described as comprising substantially the entire railroad system of Cape Colony. The Western System, as already mentioned, now connects with the Rhodesia System at Mafeking, about 125 miles north of the Vaal river in British Bechuanaland. The Midland and Eastern systems both depend for their most important through traffic on their connections with the Central South African System. This system was formerly practically limited by the boundaries of the Orange Free State. It will be recollected that the Orange River Colony, as it is now known, was called the Orange Free State from 1854 until 1900, when it was annexed by Great Britain after joining in the Boer invasion of neighboring British territory. The present system of Central South African Railways was built by the Cape Government Railways as the northern part of that company's system, commencing with the extension to Bloemfontein in 1900. They were rapidly extended north as far as Viljoens Drift, near the Vaal river, where a connection was made over the lines of the Netherlands Company to Johannesburg and Pretoria, in 1902. The total mileage of this northern division in 1892 was 360, and the entire division was made up of what was practically a bee line across the center of the Orange Free State in a northeasterly direction from the Orange river to the Vaal river with only one branch, which was the spur from Springfontein to the Orange river at Bethulie, 27 miles. The former arrangement was that the Orange Free State should receive a certain share of the profits accruing to the Cape Government Railways from the operation of this important connecting link between their lines and the chief traffic centers of the up-country; but on Jan. 1, 1897, the Orange Free State bought the lines outright for £2,501,040, for which it issued securities and gave as first payment the share received from the earnings. At that time, in 1897, the gross earnings of this portion of the system (now the Central South African Railways) were £2,347 per mile, and working expenses were £951; so that the lines earned 29.8 per cent. on their capital stock as issued to the Orange Free State. Extensions were then rapidly undertaken and there can be no better evidence of the way the country was growing than to say that in those prosperous times, when great dividends were being earned, passenger traffic amounted to 29.3 per cent. of the total earnings. In other words, the lines were crowded, and were reaching out as rapidly as possible.

At the time of the Boer war, in 1899, the railroad map of South Africa showed the Cape Government Railways, joining at Vryburg the Bechuanaland Railway to Bulawayo, almost due northeast, and at two or three other points joining the Orange Free State Railways, which ran from connections with the Midland and Eastern systems of the Cape Government Railways on the Orange river, through Bloemfontein, the capital of the state, to Viljoens Drift on the Vaal river, where they connected with the lines of the Netherlands Company. The Netherlands lines aggregated 717 miles, and connected up important traffic centers, with their lines to Pretoria, Johannesburg, Krugersdorp, Elandsfontein, Vereeniging and the Springs. On the east coast, the Natal system, comprising the railroads of Natal and Zululand, had some 500 miles open at the time of the war, from the port of Durban to the Transvaal at Volkrust. There was also an important line known as the Beira Railway in the extreme northeast, which ran from the Port Beira in Portuguese East Africa across into Mashonaland, formed under the auspices of the Chartered Company, headed by Cecil Rhodes, in July, 1892, to make a connection with the Mashonaland Railway and the Beira Junction Railway through from Salisbury, Mashonaland, to the sea, at Beira, Portuguese East Africa. At the time of the war the Bechuanaland Railway, which was formed in May, 1893, to build from Vryburg northward to the Zambesi, and which reached Bulawayo, 579 miles from Vryburg, in October, 1897, was worked by the Cape Government at cost as part of the Cape system, and the company was to receive for 10 years a subsidy of £20,000 per year from the Imperial Government and £10,000 per year from the Chartered Company.

After the war, there was a radical re-arrangement of these properties. The Bechuanaland Railway became the Rhodesia system, which also now included a branch reaching out toward Victoria Falls, northwest of Bulawayo, and a branch on the northeast to Gwelo, where a connection was made with the Beira system. The lines in the Orange Free State and the Netherlands Company lines in the Transvaal had made plenty of trouble during the war, until they were seized by the British Government and operated under the name of the Imperial Military Railways. After the close of the war, when the name of the Orange Free State had been changed to Orange River Colony, its railway system and the Netherlands Railway system besides, were thrown together under the name of the Central South African Railways, and it is this company, strategically and geographically, the center of the South African system, that now makes its report.

The mileage of this system, reckoning the integral parts which did not formerly belong to it, was 1,109 in 1898; 1,367 in 1903; 1,432 in 1904, and 1,540 at the beginning of 1905. Its present status is that it connects with the Midland System of the Cape Government Railways at Norvals Pont, near the Orange river, at the bor-

ler between Cape Colony and the Orange River Colony; with the Natal Railways at Brackwal in Natal, and at Charlestown on the borders of Swazi Land, and with the foreign line running out of Delago Bay from Lourenço Marques at Komati Poort in the Swazi Land border of the Transvaal. All traffic to Pretoria, Johannesburg, Machadodorp, Vereeniging, Kroonstad and Bloemfontein must pass over the Central South African Railways.

The lines are 3 ft. 6 in. gage, which is standard of the South African system. Their physical characteristics are those of heavy grades and curves. Much of the system may fairly be compared to the Denver & Rio Grande, in this country. There is a heavy traffic in both directions, and the lines are thoroughly modern in their equipment and in their management. Nineteen hundred and four was a bad traffic year and severe retrenchment was undertaken, but the extensions were nevertheless continued, reaching out primarily towards more traffic connections with the Western and with the Rhodesia part of the South African system, and also into the northern country. Gross earnings (£4,587,778) amounted to 12s. 4.4d. per train mile. Expenditure amounted to 7s. 9.3d. per train mile, and net earnings to 4s. 7.1d. per train mile. Passenger traffic was about a third of the total. The characteristic of the operation has been to improve the lines and to reduce freight rates, so that the added mileage of the haul has not materially increased the earnings, at least not proportionately. As with most railroads, coal constituted much the heaviest traffic. Next in order came general merchandise, railroad stores, goods conveyed at military rates, grain and cereals and timber. The manager says in his report that whatever else the British occupation may or may not have done, one distinguishing feature is that, taking the year 1898, the last normal year before the war, and 1904, two years after the war, the internal trade of the Transvaal and Orange River Colonies has increased itself by nearly two-thirds, excluding coal, bricks, other minerals and railway material. It is rather surprising to the American reader to learn that the company has under consideration the electrification of one of its suburban lines in order to handle the heavy passenger traffic.

The heaviest through business in South Africa, both passenger and freight, is that between Cape Town and Johannesburg; a joint traffic over the Midland System of the Cape Government Railways and the lines of the Central South African Railways. The main line

The South African Railroad System.

in the Orange River Colony has been relaid with 80-lb. rails and a through passenger service, in limited trains, is now carried three hours faster than it was formerly on the inland journey, and one hour and a half faster on the coastward trip. The running time from Cape Town to Johannesburg is 45¾ hours and the down trip is made in 45 hours (1,014 miles).

A year or so ago, a writer in one of the British economic magazines pointed out that there was ample need for new construction in the Transvaal region. This was formerly prevented, in large measure, by the restrictive treaty between the late governments of the South African Republic and the Orange Free State. By this convention the Transvaal agreed not to make railroad extensions westward except with the consent of the Orange government. This was done, of course, to conserve the through traffic of the Free State lines. But with Federated South Africa, a federated system of railroads was at once feasible and desirable, and the complex scheme of extensions shown on the accompanying map has been planned with that in view.

The New Fleet on the Great Lakes.

BY RALPH D. WILLIAMS.
Editor of the *Marine Review*.

Never in the history of the business have the shipyards of the Great Lakes enjoyed the prosperity that they are now enjoying. At the beginning of the present year there were 47 ships of all classes building on the Great Lakes, of which 22 were bulk freight carriers and three were package freight carriers. It is interesting to note, as showing the rapid growth of the business of the bulk freight carrier, that the 22 steamers building at the beginning of the year could carry 226,000 tons of ore on a single trip, as against 230,000 tons of ore which could be carried in a single trip by 40 steamers that were building two years ago. In other words, in two years' time the carrying capacity of the lake freighter has nearly doubled, such has been the increase in mean dimensions. The 22 ships building at the beginning of the year, if confined to the ore trade exclusively, could move in a single season approximately 4,500,000 tons of ore. In addition to this work actually scheduled at the beginning of the year, the shipyards had orders to lengthen seven existing vessels by 72 ft. each. As a commentary on these lengthening orders it is interesting to add further that one of these ships was launched only three years ago. The purpose of lengthening these ships was to minimize the discrepancy which exists between them and the latest design of ore freight carrier.

A significant feature of this building program is the fact that the United States Steel Corporation, which has the largest fleet of vessels on the Great Lakes, gave orders for the construction of four ships exceeding in dimensions anything on the Lakes. These ships are 569 ft. over all, 549 ft. keel, 56 ft. beam and 31 ft. deep, and have a carrying capacity of well over 10,000 tons of ore. These are the first orders that the Steel Corporation has placed with the Lake shipyards since the corporation was formed. Coincident with the placing of these orders it offered for sale 16 of its smaller ships. These have now all been sold. They were all of them of the whaleback variety and their combined carrying capacity was no greater than the four new ships mentioned.

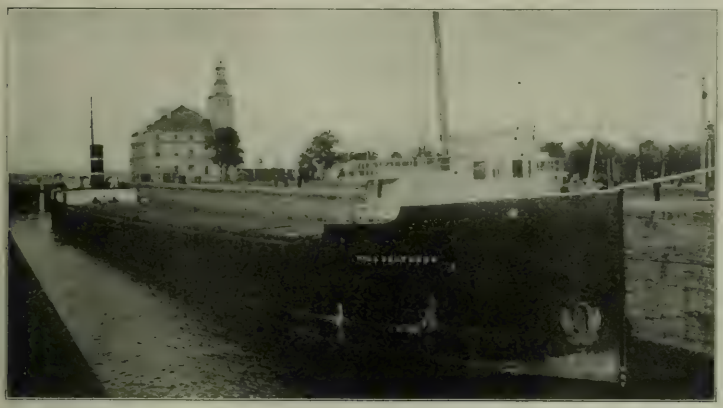
Such a building program ought to satisfy the most ravenous shipbuilder, but the end is by no means yet. By the first of June orders had been placed with the Lake shipyards for 17 additional vessels for delivery in the spring of 1906. Never before in the history of the Lakes have orders been given for ships a year ahead. That 17 such orders should be placed would have been beyond belief a year ago. It merely emphasizes the manner in which the trade of the Great Lakes is growing. As a rule, orders are not placed until fall for spring delivery, at which time trade for the following year may be fairly well gaged. Of the 17 ships for 1906 delivery, one of them is of 6,500 tons capacity, two of 8,000 tons capacity, five of 9,000 tons capacity, and the balance of 10,000 tons capacity and over. The average carrying capacity of all the ships now building for delivery during the present year and next year is a trifle over 9,000 tons, proving conclusively that the ore trade of the Great Lakes, which is, of course, the dominating trade, is gravitating inevitably to the big ship. The new ships now under order and dropping off the stocks can move in a single trip 370,500 tons of ore. In a full season they can move 7,220,000 tons of ore. In other words, this year's new crop of ships could move almost the entire ore commerce of the Great Lakes even as late as 1894, when 7,748,000 tons of ore were brought down the lakes. Any single one of these ships could have moved the entire ore commerce of the Great Lakes even so late as 1865, when 236,000 tons of ore were shipped from the upper lake ports. The movement of ore for the present year is predicted at 30,000,000 tons, and will safely approximate that figure. The vessel capacity on the

James E. Davidson, 524 ft. Long, Great Lakes Engineering Works.

James P. Walsh, Built by Craig Shipbuilding Co., Toledo—500 ft. Over All.

Great Lakes, however, must now be equivalent to a movement of 45,000,000 tons, showing that the smaller class of vessels must inevitably seek some other trade than the ore trade.

What will become of these smaller vessels is a problem, as the lumber trade is a dying trade, and neither grain nor coal can be depended upon in the same manner that ore can. The freight rate has been hammered down so low that there is practically no money in the ore trade for the small ship. The operating expenses of a 10,000-ton steamer are not much greater than those of a 3,000-ton steamer, while the former can carry more than three times as much cargo. As illustrative of this, the steamer "Manola," built by Pickands, Mather & Co. in 1890, has precisely the same engine power as the steamer "E. H. Gary," one of the giant ships built for the Steel Corporation. The "Manola" could carry 3,000 tons per trip. The "Gary" on the same fuel consumption carries over 10,000 tons. In fact, her largest cargo to date is 10,887 tons. The vessel owner after long experience has realized that the economical vessel is the steamer of large capacity and low power. That is why the steamers are gradually growing larger as the channels are being deepened for them, and why the consort system has been entirely abolished. There is not a barge now building on the Great Lakes, and there probably never will be again, though even 10 years ago the steamer and its consort was the prevailing mode of ore transportation on the Lakes.



Steamer Ball Brothers, 500 ft. Long, American Ship Building Company.

During the past two years, shipbuilders have exhibited great boldness in the design of the ore carrier. It is now a changed ship. Until three years ago all hatches were spaced 24 ft. centers. That is, it was 24 ft. from the center of one hatch to the center of the other. All hatches are now being spaced 12 ft. center, that is to say, it is 12 ft. from the center of one hatch to the center of the other. This leaves a deck strip of only 18 in. between hatches, and the deck is therefore almost a continuously open hole from pilot house to engine. The engines of the Lake freighters are, of course, crowded as far aft as it is possible to get them. By this system vessel hatches have been practically doubled in number, thus affording greater convenience in loading and greater despatch in unloading.

Three years ago, longitudinal rigidity was secured by stringers and stanchions extending from the sides of the vessel. These projections interfered with the unloading machines and it became necessary to obviate them in some manner if the utmost despatch was to be secured in unloading. Their place is now taken by a girder, straight in some ships and curved in others, extending from side to side of the ship directly between the hatches. This system leaves the hold absolutely unobstructed and is the accepted design of the lake freighter to-day. The system has marvelously facilitated the great unloading machines, the steamer "Geo. W. Perkins," with a cargo of 10,514 tons, having been unloaded only last week in four hours and ten minutes. The great unloading machines with automatic clam shell buckets grab from 10 to 12 tons of ore at a time and make a trip a minute. This cargo was actually unloaded directly into the cars, the car moving very slowly under the machines and receiving the contents of the buckets as it went along. Four of these buckets will fill a car. The "Perkins" took on this great cargo in 89 minutes, 9,000 tons of it being the work of the first 35 minutes. She was in port altogether 180 minutes, which included shifting. Ships of special design, docks of special design and unloading machines of special design all working in unison have brought this incredible despatch about. It is not to be found elsewhere in the world.

The following are this year's orders for new ships:

New Vessels for Ore Carrying Fleet.

Yard.	Name.	Carrying capacity gross tons.	For whom building.
Lorain ...	"Ball Bros.".....	8,000	G. A. Tomlinson, Duluth.
Lorain ...	"J. C. Wallace"....	10,000	Acme Steamship Co., Duluth.
Lorain ...	"S. M. Clement."...	8,000	Capt. John Mitchell, Cleveland.
Lorain ...	"Philip Minch."...	8,000	Henry Steinbruner, Cleveland.
Wyandotte	"Amasa Stone"....	10,000	Pickands, Mather & Co., Cleveland.
Wyandotte	"L. C. Smith".....	10,000	U. S. Trans. Co., Syracuse.
Cleveland.	"F. L. Robbins."...	6,000	W. H. Becker, Cleveland.
W.Bay City	"Sylvania".....	9,000	G. A. Tomlinson, Duluth.
W.Bay City	"Socopa".....	9,000	G. A. Tomlinson, Duluth.
Lorain ...	"W. A. Rogers."...	10,000	Niagara Trans. Co., Tonawanda.
Cleveland.	"L. C. Hanna"....	9,000	Mahoning S. S. Co., Cleveland.
Wyandotte	"P. Stackhouse"...	9,000	Mahoning S. S. Co., Cleveland.
Cleveland.	"W. A. Paine".....	8,000	C. L. Hutchinson, Cleveland.
Chicago ..	"E. H. Gary".....	10,000	Pittsburg S. S. Co., Cleveland.
Chicago ..	"W. E. Corey"....	10,000	Pittsburg S. S. Co., Cleveland.
W.Superior	"G. W. Perkins."...	10,000	Pittsburg S. S. Co., Cleveland.
W.Bay City	"H. C. Frick".....	10,000	Pittsburg S. S. Co., Cleveland.
Ecorse....	"J. E. Davidson."...	9,000	G. A. Tomlinson, Duluth.
Ecorse....	"Hoover & Mason."	9,000	G. A. Tomlinson, Duluth.
Ecorse....	"W. G. Mather"...	10,000	Cleveland Cliffs Iron Co.
Ecorse....	"Peter White".....	9,000	Presque Isle Trans. Co., Cleveland
St. Clair...	"G. H. Russel."...	7,500	Gilchrist Trans. Co., Cleveland.
St. Clair...	"F. J. Hecker".....	7,500	Gilchrist Trans. Co., Cleveland.
Toledo ...	"James P. Walsh".	8,000	C. O. Jenkins, Cleveland.
Lorain ...	Unnamed.....	9,000	C. L. Hutchinson, Cleveland.
Cleveland.	Unnamed.....	6,500	Capt. John Mitchell, Cleveland.
Cleveland.	Unnamed.....	10,000	H. A. Hawgod, Cleveland.
Wyandotte	Unnamed.....	9,000	Wilson Trans. Co., Cleveland.
Lorain	Unnamed.....	10,000	Capt. C. L. Hutchinson, Cleveland.
Lorain ...	Unnamed.....	10,000	Capt. John Mitchell, Cleveland.
Bay City..	Unnamed.....	9,500	Gilchrist Trans. Co., Cleveland.
Bay City..	Unnamed.....	9,500	Gilchrist Trans. Co., Cleveland.
Wyandotte	Unnamed.....	8,000	Hugh McMillan, Detroit.
Wyandotte	Unnamed.....	9,000	E. D. Carter, Erie.
Cleveland.	Unnamed.....	8,000	W. C. Richardson, Cleveland.
Ecorse....	Unnamed.....	10,000	Jones & Laughlin, Pittsburg.
Ecorse....	Unnamed.....	10,000	Jones & Laughlin, Pittsburg.
Ecorse	Unnamed.....	10,000	Globe Steamship Co., Duluth.
Toledo ...	Unnamed.....	8,000	L. S. Sullivan, Toledo.
	Total, in one trip	370,500	
	Total, season of 20 trips..	7,220,000	

Hulett Clam Shell Machines Unloading the James C. Wallace (552 ft. Long.)

Picked up on the Road.

BY G. H. H.

It is always interesting to the outsider to note how some big roads "don't do it." At a station on a fairly large city on a big and progressive line, if we take the general passenger agent's word for it, the ticket office is not opened for a fast train making a regular stop at that point. Why? Because it is composed entirely of parlor cars, and tickets cannot be sold, as they do not know whether there are any vacant seats or not. Oh, yes, there is plenty of time to hear; an hour and a half, after leaving the last station above, and the train slows down through an important junction station. Seats? Well, the car I entered had four of its 24 occupied. But you see the G. P. A. was too busy advertising the superiority of his road and the magnificence of its service to look after such minor matters as the comfort and convenience of its passengers.

Superheated steam is a profitable thing in a locomotive and the statement applies as well to compound as to simple engines. In the case of the former, however, there is still some doubt as to just how the superheating should be done. That is to say, whether the whole energy should be devoted to the steam before it is admitted to the high-pressure cylinder, or whether there should be a reheating and added superheating between the two cylinders. The point is one that will probably require some time and more expense to settle and is under investigation at the present time in Europe. When our friends over there have demonstrated to their own satisfaction which is the better plan we may hope to see some attention paid to the subject here. Meanwhile, to quote an oft repeated phrase used by the progressive American railroad man: "We will let the other fellow do the experimenting."

We hear much at all times and in all places regarding the variables that enter into all matters of railroad operation, and of the impossibility of applying any specific formula to any wide range of operations whatever they may be. It would seem that this should hold true regarding the guarantees that are asked and offered on cast-iron wheels. To be sure, when these wheels are under freight equipment, they may travel from one end of the country to the other, though under the per diem system of accounting, cars are more apt to make the majority of their mileage on the home road. If this is the fact it would seem reasonable that roads having a clean level track should get a greater mileage out of their wheels than those among the mountains or on sandy plains. In both these latter cases the wear is perceptibly faster and the service more severe with a corresponding decrease in the life of the wheel. But to the outside layman it seems as though it would be a rather difficult job to so adjust the guarantee as to be fair to all interested parties.

The truth of the old saying that "trifles make perfection and perfection is no trifle," seems to be lost to sight in the operating circles of most railroads in view of the weightier matters of the law. Apropos! It was a hot July day and the car was baking hot with nearly every window open. A brakeman came down through the car just before a 3,000 ft. tunnel was reached. Why did he not warn the passengers and tell them to close the windows? He had not been so instructed and of course it would never enter his head to do it of his own accord. So the car was filled with gas and smoke for the remaining 50 miles of the run, all because a small matter had been neglected by the man higher up.

The superintendent of motive power of a big trunk line, in speaking of high capacity cars and the efficiency of the cast-iron wheel, told me recently that one of the greatest causes of anxiety to the operating officers of his road was the high percentage of chances of trouble due to a freight train causing a passenger wreck. Where the traffic is heavy and freight trains long, passenger trains are passing them for a very appreciable portion of the time. If, then, the liability of an accident to passenger trains is increased by this in the open, what shall be said of tunnels? It would seem to be quite in accord with the principles of the absolute block to debar a freight train from entering a tunnel in one direction while a passenger train was moving through it in the opposite. But as the absolute block has not yet reached the point of practical adoption in this easy going land of ours, we will probably have to bide a wee before freight trains will be excluded from tunnels in which there is a passenger train. I sometimes wonder if we shall have to wait for a half million dollar accident to teach the lesson, after which there will be a legislative awakening.

While it is quite true that railroad rolling stock is not built to be wrecked or make a fine appearance on the scrap heap, it is equally true that the scrap heap and the remnants of a wreck are sometimes the most valuable object lessons as to what should be imitated or avoided in car or locomotive construction. Consider, for example, the value of strong platform construction in a bad wreck. In a certain case an engine ran into an open switch at a speed of about 70 miles an hour, went down a bank, rolled over on its side and slid over the ground in that position for about twice its length. It rested on its wide firebox and cylinders and did not even bend its rods, while the tank was absolutely uninjured. A postal car went down the bank and rolled over and had all the paneling stripped off from one side. The other cars had the corners damaged, one being entirely torn away. The platform on this injured car was not damaged in the slightest and was as straight and true after the accident as when turned out of the shop. This statement holds true of the platforms on all of the other cars of the train. The platform must have been of an exceedingly strong construction to have withstood this strain and probably paid for itself many hundreds of times in the immunity from dangers which it provided in the case of this accident alone. The corners of other cars were not carried away, which is attributed to the fact that the ends were strengthened by a heavy plate extending from side sill to side sill, up the sides and across the roof. Such structures seem to be good insurance policies, that make their returns, if any, in a satisfactory, if uncalculable, manner.

Some surprise, much disgust and a great deal of unreasoning censure has been developed by the condition of the air in the New York subway. People have jumped to the conclusion that because there was an odor and the temperature was high that things down there were about as bad as they could be. As for odors, we have, first, the rubbing of the contact shoes on the third rail, quite enough to produce what nostrils trained to such things will readily recognize as the odor of friction. Not altogether agreeable, but not injurious. Then comes the odor of oil. Of course it is warm down there. Suppose the steam generated in the power plant were to be led in pipes along the subway, and from 8 to 10 per cent. of it were to be discharged into that hole in the ground with an even distribution throughout the entire length. You would expect a rise of temperature would you not? Well, if there is any truth in the theory of the conservation of energy, then every particle of heat that is taken up by the engines in the power house and transformed into energy and motion is bound to reappear again as heat in the subway; and that would seem sufficient in quantity to raise the underground temperature many degrees.

Graphic Train Logs.

BY PAUL T. WARNER.

A train log in the form of a speed curve, which shows at a glance all stops and variations in speed on the run, is an interesting record, easily prepared with the help of an ordinary watch. A note is made of the time—in hours, minutes and seconds—of passing each mile post; also of the arriving and departing times at stations, and at any intermediate stops which may occur. In this way the elapsed time between mile posts is usually correct within one second, and the total time between terminals is absolutely correct. Check readings made when passing the principal intermediate stations should also be secured where possible. A time card giving the mileage is of great assistance in plotting the curve, and a profile of the division—if one can be secured—adds much valuable information. Data regarding the engine and train, as well as other interesting points connected with the run, can frequently be obtained.

The four curves here reproduced were prepared by the writer in the manner indicated. Fig. 1 shows a run on the Atlantic City division of the Pennsylvania Railroad. Train No. 629 runs via the Delaware River Bridge, and satisfactory readings between mile posts could not be secured until after reaching the main track of the West Jersey and Seashore, some distance out of Camden. For convenience in plotting, the distances are laid off from the Atlantic City end. This train is scheduled to run the 69.4 miles from Broad St. Station to Atlantic City in 80 minutes, at an average speed of 52 miles per hour, and in the present instance was on time, covering the 30.6 miles from Winslow Junction to Drawbridge in 26 minutes 28 seconds, an average of 69.3 miles per hour. The train was made up of nine cars, estimated to weigh about 310 tons, and was hauled by Class E-2 locomotive No. 1986 (4-4-2 type). An approximate profile of the road is reproduced, and the effect, on the speed, of short grades is, in several instances, plainly to be observed. This is especially noticeable near mile posts 48, 40, 19 and 11. Near Winslow Junction the train was slowed to scoop water. The almost level stretch after passing Egg Harbor was covered at an average of about 72 miles per hour, which, according to the usually accepted formulas for train resistance, represents at least 1,700 horse power. This run, it should be noted, is by no means exceptional for the Atlantic City division, as the 60-minute trains via Camden maintain considerably higher speed than that recorded here. (*Railroad Gazette*, June 24, 1904.)

Fig. 2 shows a run on the New York Division of the Pennsylvania, the average speed, deducting stops, being 52.1 miles per hour. Train No. 102 runs from Broad St. station to Jersey City, 89.4 miles, in 107 minutes, equivalent to 49.9 miles per hour. The engine, in this instance, was No. 612, Class E-2-A (4-4-2 type with Belpaire boiler), and the load was light, consisting of two Pull-

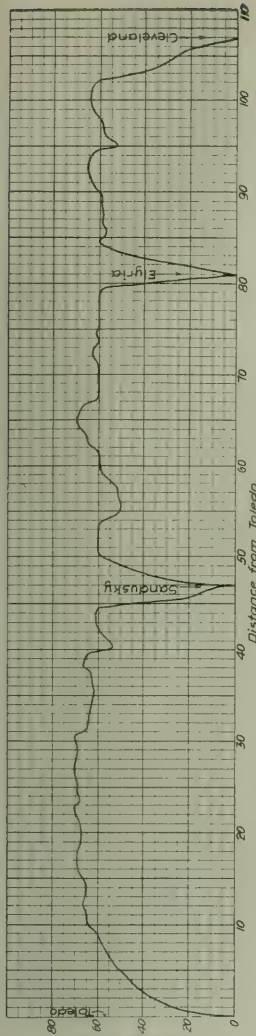


Fig. 4—Log of Run from Toledo to Cleveland—Lake Shore & Michigan Southern.

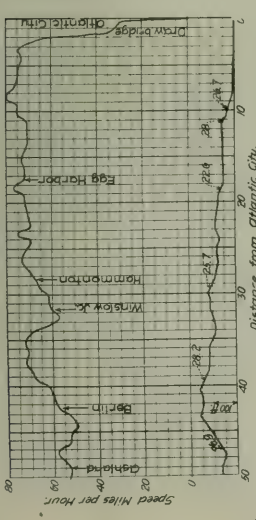


Fig. 1—Philadelphia to Atlantic City—P. R. R.

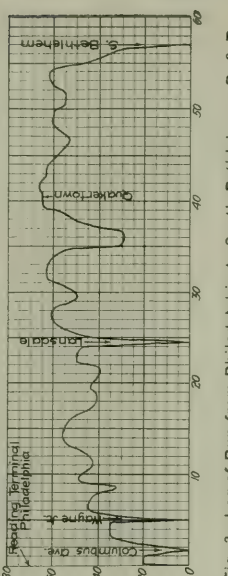


Fig. 3—Log of Run from Philadelphia to South Bethlehem—P. & R.

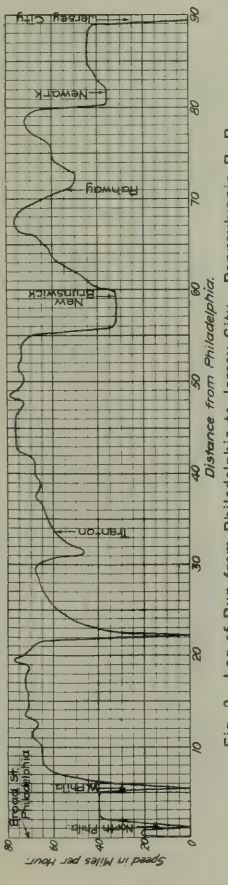


Fig. 2—Log of Run from Philadelphia to Jersey City—Pennsylvania R. R.

mans and three coaches. Station stops were made at West Philadelphia and North Philadelphia, and there was a short dead stop for a signal after passing mile post 22. The speed reduction at mile post 31 was made for the curve near Morrisville, which, since the opening of the new stone bridge across the Delaware, has been abandoned. Track elevation and change of line at New Brunswick and Newark necessitated slow running through both cities, and there was also a reduction in speed while passing through Rahway. Jersey City was reached about one minute ahead of time, after crossing the "meadows" at a moderate speed. This curve is strongly suggestive of higher speed in the future, when the various improvements, both under way and contemplated, will have been completed.

Fig. 3 shows a run on the Bethlehem Branch of the Philadelphia & Reading. This 57-mile stretch of double track, besides handling a fair amount of local and freight traffic, carries all the Philadelphia connections of both the Central Railroad of New Jersey and the Lehigh Valley Railroad. Train 319 runs through to Scranton *via* the Central Railroad of New Jersey, and is scheduled to reach South Bethlehem in 88 minutes, averaging 38.8 miles per hour. The road is crooked and hilly, and there are three station stops for this train. The load was light, consisting of one combination car, one coach and one Pullman (all vestibuled), and was hauled by Central Railroad of New Jersey engine No. 604, a 4-6-0 type with 19 in. x 26 in. cylinders and 69 in. drivers. The average speed, deducting time for stops, was 43.5 miles per hour. Speed was reduced near mile post 9 on account of track repairs, and also at mile post 35 to pass through Perkasie tunnel; all other variations are directly due to grades and curves. The fastest mile was timed in 54 seconds, shortly after passing Quakertown. The curve probably shows about the best performance possible on a line having as many grades and curves as this one.

Fig. 4 is the record of a run, over the Toledo division of the Lake Shore and Michigan Southern, which was made by mail train No. 32. This train leaves Chicago at 3.00 A. M., and between Elkhart and Toledo runs *via* the "old road" through Southern Michigan, which is single tracked. On this occasion No. 32 was detained between Hillsdale and Adrian by an opposing freight, which had become stalled on a grade and so failed to make a meeting point in time. Class I, engine No. 601 (4-6-0 type), which was hauling the train, left Adrian 33 minutes late and made up 10 minutes to Toledo, where engines 668 and 661 (Class J, 2-6-2 type) were coupled on. The load consisted of six mail and express cars, two coaches and one Pullman. Cleveland was reached two minutes ahead of time, the average speed, deducting stops, being 52.2 miles per hour. This is a very favorable stretch for fast running, and with so much power at the head of the train the locomotive work was easy. There is one long grade of 15.84 ft. per mile west of Elyria, but it had no noticeable effect on the speed, which was very well sustained—especially between Toledo and Sandusky. The engines making this run were among the earlier of the 2-6-2 type used on the Lake Shore, the new class K engines having just gone into service.

These runs were all made under ordinary conditions, and are representative of the every day work that is being done on American railroads.

Accident Bulletin No. 15.*

The Interstate Commerce Commission has issued Accident Bulletin No. 15, summarizing the records of the railroad accidents in the United States during the three months ending March 31, 1905. The number of persons killed in train accidents was 232, and of injured 3,713. Accidents of other kinds, including those sustained by employees while at work, and by passengers in getting on or off the cars, etc., bring the total number of casualties up to 909 killed and 14,397 injured. These reports deal only with (*a*) passengers and (*b*) employees on duty.

Table No. 1.—Summary of Casualties to Persons.

	Passengers		Employees	
	Killed.	Injured.	Killed.	Injured.
Collisions	18	834	104	1,104
Derailments	9	794	70	516
Miscellaneous train accidents	1	23	30	442
Total train accidents	28	1,651	204	2,062
Coupling and uncoupling	..	.....	62	790
While doing other work about trains.	..	.....	65	3,475
Overhead bridges, etc.	..	3	21	303
Getting on or falling from cars or eng.	24	317	155	2,540
Other causes	12	343	338	2,913
Total	36	663	641	10,021
Total, all classes	64	2,314	845	12,083

The totals in this table are not strikingly different from those in Bulletin No. 11, covering the same quarter of the preceding year, though there is a decrease of 12 in the number of passengers killed in train accidents. In this item Bulletin No. 11 was swelled by one

*The *Railroad Gazette* report of the train accidents which occurred in the month of January was published in our issue of Feb. 24, p. 155; that for February on March 24, p. 275; and that for March on April 21, p. 363.

collision which killed 18 persons. In the present record the largest passenger death list was that of collision No. 24, in which 7 were killed. Particulars of this and other collisions are given below. Coupling accidents, while fewer than one year ago, do not show any marked falling off in fatalities. From the details of "coupling accidents," as given in Table 3, it is evident that a considerable percentage of the injuries classed under this head are of a kind not peculiar to this department of work, but are due to causes which occur, and probably to about the same extent, in other kinds of work.

The total number of collisions and derailments was 3,108 as shown below:

Table No. 2.—Collisions and Derailments.

	No.	Loss.	Persons—Killed.	Persons—Injured.
Collisions: Rear	511	$473,785	44	634
Butting	293	350,704	47	639
Trains separating	232	90,734	2	109
Miscellaneous	821	343,834	29	545
Total collisions	1,787	$1,259,077	122	1,938
Derailments due to:				
Defects of roadway, etc.	334	$328,326	19	506
Defects of equipment	598	439,354	7	234
Negligence of trainmen, signalmen, etc	72	43,744	7	70
Unforeseen obstruction of track, etc...	92	113,968	19	165
Malicious obstruction of track, etc....	11	20,240	3	46
Miscellaneous causes	214	244,539	24	289
Total derailments	1,321	$1,190,171	79	1,310
Total, collisions and derailments	3,108	$2,449,248	201	3,248

Derailments at derailing switches caused losses of $18,652 in this quarter, and of $29,735 in the quarter last preceding (not including personal injuries and losses of merchandise). In the present quarter two of these derailments are charged to the fault of the tower man; one to a runaway, due to bad management of the air brakes by the engineman; one to the freezing of a distant signal in the clear position, and one to a defect in the derailing switch. Other cases are reported as due to the more ordinary kinds of carelessness. In one instance the engineman had been on duty twenty hours. In the list for the preceding quarter two derailing switch accidents were reported as due to the engineman falling asleep. In another the engineman mistook the signal light; the light which should have guided him had been accidentally extinguished, but he saw some other light, which he took to be the signal light. One case was due to bad hand signaling, and in one case a signalman changed the position of a derailing switch when the train was too near to it. This signalman was 18 years old.

Following is the usual list of Class A train accidents—all in which the damage is reported at $10,000 or over; notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest:

Causes of Forty Prominent Train Accidents (Class A).

[Note.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

No.	Class.		Killed.	Injured.	Damage to engines, cars, & roadway.	Reference to record.	Cause.
					COLLISIONS.		
1	R.	F. & F.	4	2	$700	7	Empty engine ran into rear of standing freight, killing 4 passengers in caboose; caboose took fire and, with occupants, was burned up. The standing train was not properly protected, and the approaching engine was running at excessive speed.
2	R.	F. & F.	3	1	700	54	Freight, standing at water-tank, run into by following freight approaching at unauthorized speed; 3 passengers in caboose killed.
3	B.	P. & P.	1	8	2,300	29	Despatcher's meeting order incorrectly copied by one of three operators though repeated to despatcher correctly. Stop signal was displayed at meeting point, but engineman holding the incorrect order ran past this signal 400 ft.; dense fog.
4	B.	P. & F.	2	3	3,064	61	Both enginemen and both firemen of "double-head" freight forgot about passenger train; these men on duty 19 hours.
5	B.	P. & F.	0	7	3,133	31	Operator (4 months in this place and 4 months' experience in telegraph work elsewhere) delivered clearance card instead of meeting order. This operator (at the meeting point) was to have delivered clearance to the other train if it had arrived first. In sending a meeting order to the meeting point the despatcher should direct the operator to take special precautions, but failed to do so.
6	B.	P. & F.	0	6	4,700	10	Two engines coupled together, going to assistance of passenger train stalled in snow, collided with passenger train. Passenger brakeman had placed torpedo signals, but these were not heard. He is censured for not using fusees also. The engines, however, had been notified by one flagman some distance back.
7	B.	F. & F.	2	2	4,800	62	Operator (in service 3 weeks, experience elsewhere, 1 year) wrote name of wrong station in meeting order.
8	R.	F. & F.	0	1	5,000	6	Engineman (50 years old), intoxicated, ran at excessive speed and did not heed flag.
9	B.	F. & F.	0	2	5,000	36	Operator neglected to deliver order. Both engines had electric headlights, and 1 engineman admitted that he had seen the light of the other train several miles away, but thought that it was on a sidetrack.
10	M.	F.	0	0	5,100	39	Part of train left standing on grade without hand-brakes set.
11	B.	P. & F.	0	7	5,118	32	Passenger train, stuck in snow, did not send flag ahead. Freight engineman ran unreasonably fast, having been informed about passenger train.
12	B.	F. & F.	0	1	5,800	34	Block-signal operator, 16 years' experience, turned eastbound freight into siding against westbound empty engine (standing), having forgotten about presence of empty engine.
13	R.	F. & F.	0	2	6,656	27	Engineman approached yard at unauthorized speed; on duty 22 hrs. 35 mins.; 9 locomotives damaged.
14	M.	P. & F.	1	1	6,800	66	Freight encroached on time of passenger train; men at fault on duty 18 hrs.
15	B.	P. & F.	0	19	7,300	33	Block-signal operator gave yard engine time against passenger train after despatcher had refused to do so; passenger train approached at unauthorized speed.
16	R.	F. & F.	0	6	7,600	35	Conductor and engineman disregarded meeting order; reported by railroad company as "criminally responsible." (See note in text below.)
17	B.	F. & F.	1	4	7,800	12	Conductor, engineman and brakeman failed to identify train on sidetrack. (See note in text below.)
18	R.	P. & F.	2	23	10,800	57	Engineman of eastbound freight encroached on time of westbound passenger, having "gained the impression" that he had 3 hours 30 minutes against it when he had only 30 minutes. Conductor did not act promptly to stop train.
19	R.	P. & F.	2	6	13,175	1	Passenger train, without headlight, collided with engine standing in yard without red lights displayed.
20	R.	P. & F.	1	5	13,900	2	Freight encroached on time of passenger train in consequence of failure of two watches. (See note in text below.)
21	B.	P. & F.	3	12	14,200	8	Freight encroached on time of passenger train in dense fog; conductor relied on another conductor to flag him to the meeting point, but the other conductor claims he had not accepted that responsibility.
22	B.	F. & F.	4	6	15,731	21	"Double-head" freight train ran past meeting point. (See note in the text below.)
23	B.	F. & F.	2	3	19,635	63	Engineman fell asleep and ran past meeting point. (See note in text below.)
24	R.	P. & P.	7	142	44,000	51	7 passengers killed, some of them suffering from fire: engineman, running at high-speed at night, ran past distant signal without observing its position, and then ran 900 ft. past home signal, striking preceding train, which had been stopped because of a hot journal.
	Total		35	269	$213,012		
					DERAILMENTS.		
1	D.	F.	5	1	$800	49	Excessive speed; work-train running with tender first.
2	D.	P.	0	2	2,775	17	Derailing switch open; distant signal (9 p. m.) frozen in clear position; signalman negligent.
3	D.	F.	1	2	3,900	68	Track distorted by solar heat (Mar. 29.)
4	D.	P.	1	1	9,148	73	Landslide; watchman had passed over track just before; damage partly due to fire; gas tank exploded.
5	D.	F.	0	0	10,000	42	Flange of wheel of tender broken.
6	D.	P.	0	8	11,000	78	Unexplained; speed 35 miles an hour; tender derailed on good track.
7	D.	P.	1	13	12,400	76	Rails maliciously loosened.
8	D.	P.	0	1	14,725	74	Burning bridge (3 p. m.).
9	D.	P.	0	30	15,741	18	Rock fell on track (night).
10	D.	P.	0	19	18,700	15	Broken 80-lb. rail; 12 years old; internal flaw.
11	D.	F.	1	0	19,800	24	Runaway (4 trespassers killed). (See note in text below.)
12	D.	F.	0	0	20,000	16	Broken wheel; wheel excessively heated by brakes; defective casting.
13	D.	P.	0	56	22,500	48	Baggage car of rapidly moving train blown off track by explosion of boiler of engine of another train passing in opposite direction on adjacent track.
14	D.	P.	1	20	25,360	77	Excessive speed on curve. Engineman was making his first trip over this division; had made 20 round trips to learn the road.
15	D.	F.	3	1	25,500	20	Runaway; men in charge of train had neglected to test brakes at head of grade; depended partly on hand-brakes, but did not apply them soon enough. The first brakeman on the train had had 9 months' experience; the second, 6 months, and the third, none.

No.	Class.		Killed.	Injured.	Damage to engines, cars, & roadway.	Reference to record.	Cause.
				DERAILMENTS.—(*Continued.*)			
16	D.	P.	1	40	65,000	41	Broken rail at entrance to bridge; 8 cars and bridge destroyed. Rail, 85-lb. 3 years old, was split longitudinally for 5 ft.; internal defect. Train running about 50 miles an hour, drawn by two heavy Atlantic-type engines.
Total.....			14	194	$277,349		
Grand total.			49	463	$490,361		

The most notable accident in this list, collision No. 24, occurred on a road thoroughly equipped with automatic block signals, the cause being bald inattention to signals on the part of an engineman whose record had been good. For about 12 miles this engineman, running at high speed, closely following the other passenger train, had encountered successive signals about three-fourths of a mile apart, all indicating "all right." As he approached the distant signal which was against him, that signal was obscured by the smoke from a locomotive on another track, and he passed the signal without knowing its indication. He gives no satisfactory explanation of this, from which the conclusion is drawn that he had assumed that the signal indicated "all right," with no other ground for such assumption than that he had found the preceding signals "all right." But he knew that he had passed a distant signal, and thus was bound to prepare to stop at the home signal. Not only did this man ignore the distant signal, but evidently after passing it he allowed his attention to be drawn away, for he did not observe the home signal until he was quite near to it. The distant signal which was obscured by smoke ought to have been seen by the engineman 1,070 ft. before reaching it.

The fireman of this engine, who ordinarily watches for signals when practicable, had seen all the signals for several miles, but at this particular point he was engaged in putting coal into the firebox and did not give his attention to the signal. The fire in this wreck broke out in less than one minute after the collision. It was rapidly spread by gas escaping from broken pipes beneath the cars, and was started, no doubt, by the ignition of this gas by the fire in the wrecked locomotive or the flames of the lamps or by friction. The three rear cars of the foremost train and the three leading cars of the second train were burned up.

In collisions No. 1 and No. 2, taken together, seven passengers were killed while riding in caboose cars attached to the rear of freight trains. In connection with these cases it may be observed that it has long been generally recognized that the lives of passengers are not so safe on freight trains as on passenger trains.

In three of the accidents in this list the men at fault had been on duty for an excessive length of time; in one case, 19 hours; in another, 22 hours 35 minutes, and in a third, 18 hours.

Collision No. 8, due to the reckless conduct of an engineman who was intoxicated, is the first case of this kind which has come to notice since the accident records have been kept.

In collision No. 16, a butting collision between two heavy freight trains, eastbound train No. 8 received orders to meet westbound No. 5 at A and No. 7 at B. On arrival at A, No. 5 was met, and the eastbound (No. 8) immediately received a second order to meet No. 7 at A instead of B, and to meet second No. 7 at B. The conductor and engineman read and signed this order, and then immediately went to their train and started out, utterly disregarding the order. The conductor and engineman claim to have been under the impression that they were to meet only one train at A, but this one train was met before they received the second order. The fireman of No. 8 was disciplined for failing to read the order when it was handed to him by the engineman. This fireman's experience was one year. The conductor and engineman had each had several years' experience.

Collision No. 17 was due to the failure of the men on train No. 1, westbound, to identify an eastbound train standing on a side track. The fireman of the westbound, holding a lantern in his hand, stood in the gangway of the engine as, moving at about five miles an hour, it passed the engine standing on the side track. On account of escaping steam he was unable to see the number distinctly, but was satisfied that it was not the number which he was looking for (that of the engine of train No. 2). Failing to get the desired information, but wishing to save time by avoiding a stop, the engineman of No. 1, on passing the caboose of the standing train, asked the flagman, who was in the cupola, if his train was No. 2, and the flagman is claimed to have replied "yes." The flagman, however, says that he did not understand the question, did not answer "yes," and merely tried to get the engineman to repeat his question.

Collision No. 20 was due to a miscalculation of time, and both the engineman's and the conductor's watches were out of order. The conductor's was 19 minutes slow, and the engineman's had stopped at 10.56 a.m. by the minute hand being blocked by the hour hand. The engineman was fatally injured. The conductor's watch had on the previous day been thrown violently to the ground by an accident. When picked up it was running, in apparently good condition, but the conductor had not afterwards compared it with any other timepiece. Furthermore, the conductor and engineman had neglected to compare the time by their watches when they received the meeting order.

In collision No. 22 the train which overran the meeting point—the eastbound—was drawn by two engines, and the enginemen of both these engines disobeyed the meeting order. The engineman and fireman of the second engine were killed. All four men on the engines had also disregarded the rule forbidding a train to pass a passing track without receiving an "all right" signal from the conductor. The surviving engineman had "got the impression" in his mind that the meeting order specified another station five miles beyond. There was no reason or excuse for this impression, and he gives no explanation of it. His conversation with the operator at the time he received the order was such as to prove that he had read it correctly. He was unable to state positively that he had read the order to his fireman. The fireman admits that he did not read the order, though both claim that their habits in this matter had been correct. Both trains held orders to meet at W. As the eastbound was approaching W. the station signal was sounded by one of the enginemen, and the stop signal was given by the flagman, under direction of the conductor. The signal was answered from the engine, but the train did not reduce speed; and the conductor, seeing that they were going to pass the station, had the flagman get out on top of the train and endeavor to give an effective stop signal to the enginemen. He failed to get them to notice his signal, and his lamp went out. On account of the speed of the train and the possibility of meeting the opposing train at any moment, the flagman and conductor were afraid to attempt to go over the seven non-air cars in order to open the angle cock and apply the air-brake. The conductor is held at fault for failing to have his three brakemen in the proper positions on the train to pass along the hand signals when approaching a meeting point. These brakemen were also at fault for not being in proper positions on the train.

Collision No. 23 occurred about 5 a.m., and was caused by one of the freight trains running past a side track, where it should have waited for the train from the opposite direction. The engineman of this train had fallen asleep and a brakeman on the engine with him (who was killed) probably also had fallen asleep. The fireman of the train was not sufficiently familiar with the road to know that he was running past a station, there being no station lights at the point in question. The engineman had been awake about three minutes before the collision. The report of the railroad company says that he had voluntarily overworked himself, failing to ask for rest, and concealing the actual facts from his superior officers. After a run of 14 hours, preceded by a short rest, he lay off for 2 hours 55 minutes, and then entered upon the run of 10 hours which terminated in the collision. At the end of his 14-hour run he told the roundhouse foreman that if needed to go back he would be ready to go whenever called.

The fireman had been on the road only three months, including the time spent in learning. He also had worked the excessive hours above mentioned. The brakeman who was killed on the engine had had eight months' experience. The conductor tried to signal the engineman to stop, but, as before stated, the brakeman on the engine, who should have seen this signal, was probably asleep. The conductor and one of his brakemen, the latter of eight months' experience, neglected to make proper effort to apply the air-brake valve on one of the freight cars in the train.

Derailment No. 11 was a runaway of a train over 10 miles of a crooked road. It was due to the negligence of trainmen in leaving the cars of the train standing on a grade without having enough hand brakes applied to keep them from moving. The train was stopped in a tunnel by the bursting of an air-brake hose. While making repairs a new trainman was overcome by gas and smoke, and the engine had to be detached from the cars to carry this brakeman out of the tunnel to save his life. While the engine was detached the air leaked out from the brake cylinders of the cars in the train and this caused the runaway. When the cars struck the engine (which had started to return) the engineman was knocked off and the fireman jumped off. The conductor of the train did not board it when it started, for the reason that he also had been overcome by gas. On eight or nine cars the hand brakes had been set before entering the tunnel, but these were not enough to hold the train. After running 10 miles, on a 1 per cent. grade, the train was derailed on a curve of 10 deg. where the outer rail was elevated 7 in. The engine and 34 cars were destroyed. The fireman who jumped off had been in the employ of the company two months.

Table No. 3, given below, showing details of accidents to employees in coupling and uncoupling cars, has been put into a new

form so as to show more clearly the circumstances under which the injuries occurred.

The subclassification in this table is designed to separate, as far as practicable, those accidents which are due to the employee's own carelessness, defective judgment, or disobedience of rules from those which are due to faults in the couplers or to non-compliance with the law by the railroad company. In a large part of the cases it is impossible to classify perfectly, as two or more causes contribute to the accident. For example, some cases fall into sub-class 24 without question; in others the circumstances are such that doubt arises. In sub-class 14 some cases are clearly due to recklessness; in other cases the man was one of reasonably cautious habits, and his error is to be classed simply as misadventure. Cases in sub-class 11 are sometimes due to palpably blameworthy conduct on the part of the injured person, and sometimes to hurried work, which a jury would readily class as excusable, if not justifiable. Other considerations like those here mentioned will occur to the reader in connection with some other sub-classes.

Sub-class 27 includes cases which it has been difficult or impossible to classify. Some of these ought possibly to go into sub-class 4 (cars not equipped with automatic couplers), and in other cases the man appears to have been only indirectly connected with coupling operations, and the accident should have been put into some other class; but it has been impossible as yet to fully clear up the facts of these cases by correspondence.

Table No. 3. Details of Table 1—Causes of Accidents to Employees in Coupling and Uncoupling Cars.

Sub class.	Causes.	Employees.—Killed.	Injured.
1	Adjusting coupler with foot	..	38
2	Adjusting coupler, cars accidentally started	1	36
3	Careless manipulation of uncoupling lever	..	8
4	Cars not equipped with automatic coupler	..	11
5	Coupler broken, using link and pin, or chain	2	16
6	Coupling damaged cars	3	32
7	Coupling with chain or other emergency appliance on curve too sharp for automatic coupling	..	7
8	Coupling with chain or other emergency appliance because of uneven track	..	1
9	Coupling or uncoupling safety chains	..	16
10	Fingers or hand caught bet. uncoupling lever & body of car	1	148
11	Uncoupling without using lever (unnecessary)	..	29
12	Uncoupling without using lever, uncoupling lever not in working order	5	88
13	Foot caught in frog, switch or guard rail	7	14
14	Opening or closing knuckle when cars were near together, miscalculated speed	6	44
15	Opening knuckle when cars were near together, engine accidentally started	3	11
16	Opening knuckle, part of defective coupler fell on foot	..	18
17	Opening knuckle, lost footing	2	10
18	Riding on car to uncouple, slipped off	1	4
19	Struck by object at side of track	..	35
20	Caught by unexpected movement of car, due to slack running in	6	62
21	Caught by unexpected movement of car, due to mistake or misunderstanding in giving hand-signals	..	4
22	Uncoupling moving cars and lost footing	4	54
23	Parts hard to move, causing delay	..	40
24	Went between cars unnecessarily and contrary to rule	4	15
25	Hand caught between projecting load and end of next car	..	8
26	No witness (fatal injury)	16	..
27	Other causes	1	35
28	Unexplained	..	6
	Total	62	790

Table No. 3a.—Nature of Injuries to Employees in Coupling and Uncoupling Cars.

Injuries.	Trainmen.	Trainmen in yards.	Yard trainmen.	Other employees.
Loss of feet	1	1	2	..
" legs	4	1	..	..
" arms	3	3	1	..
" hands	1	3	1	..
" fingers	9	6	11	2
" toes	..	..	2	..
Fractured skull	..	..	..	..
" leg	..	..	2	1
" arm	2	3	3	..
" collar bone or ribs	4	5	7	1
" other bones	4	3	4	1
Contusion of head or body	16	20	59	4
" or laceration of feet	19	15	27	..
" " " " toes	2	4	9	..
" " " " legs	3	3	22	..
" " " " arms	10	7	14	..
" " " " hands	27	25	50	3
" " " " fingers	77	52	148	4
Dislocation	..	..	..	..
Internal injuries	3	6	21	1
Sprains	7	6	13	1
Shock	1	1	..	..
Miscellaneous	2	6	10	1
Total injuries	195	170	406	19
Killed	16	16	27	3
Total killed and injured	211	186	433	22

RECAPITULATION.

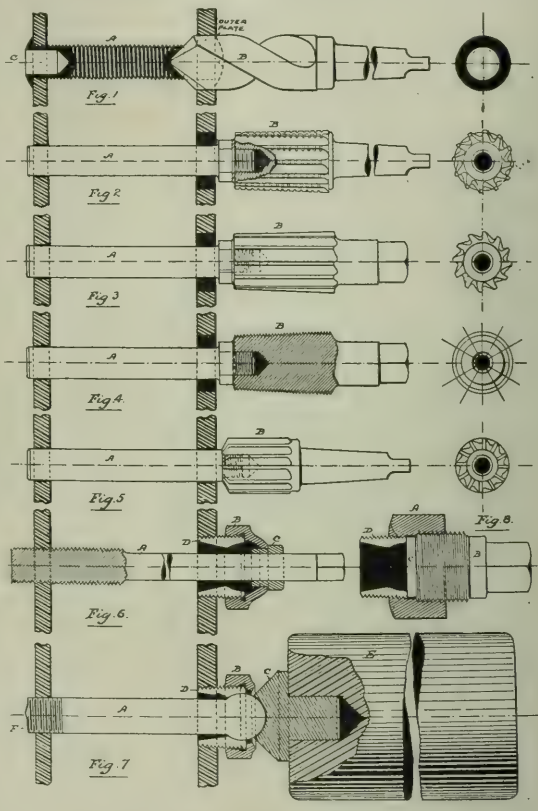
Killed	62
Injured	790
Total killed and injured	852

Firebox Staybolts.

At the April meeting of the Railway Club of Pittsburg, Mr. B. E. D. Stafford presented a paper on locomotive water space stays in which he discussed the advantage accruing from the use of flexible staybolts. The use of a rigid staybolt from which the threads had been cut away between the sheets was touched upon and it was held that it has been found that the reduction of the diameter in the water space has not been of any material benefit to the life of the staybolts. The flexible staybolt has the preference over the full threaded bolt to the extent that deposits, carbonates and sulphates of lime and magnesia, which precipitate from the waters used, do not adhere so closely and do not impair the quality of strength of the iron to such a marked extent as when threaded. Then, too, the instant staybolt irons are heated to the degree of firebox temperatures, all characteristics change, and all valuations based on a cold test are naturally questioned as serviceable values.

Staybolt breakages occur in large numbers in sections of the country where bad water exists, and during a period of four years, at which time the fire sheets are renewed, and in some instances less than three years, the staybolt breakage ranges from 30 per cent. to 60 per cent. of the horizontal installation of water space stays. In good water sections the breakage ranges from 10 per cent. to 20 per cent. in four years, and 30 per cent. to 50 per cent. in six years.

Four years ago when in the bad water section, the author ran across a lot of engines whose fire sheets were being removed on



Method of Installing Flexible Stay Bolts.

account of buckling and cracking, showing a permanent set. After closely observing the stays, which were very rigid and showing no signs of deflection, it was found that the iron was of a close, short, fibrous structure, dense and hard, proof as to high tensile strength, and the thought occurred that the fire sheets were held too rigid to allow for expansion without bending, and finally cracking. These sheets had not been in service for more than 18 months, and it was decided after discussion to apply new bolts of a material somewhat softer, of long fibrous structure, with a tensile strength of 48,000 and about 32 per cent. elongation, a good serviceable staybolt iron, and see if the new sheet of the same material would buckle in like manner. This was done, and two and a half years later the sheets were as straight as could be expected, considering the hard water condition, showing no permanent set nor indication of cracks, although a few broken stays had been renewed.

It is of the most vital importance to the success of the flexible water space stay that good work be always done in the installation of the complete bolt. There is no excuse for leakage when proper attention is given to methods of installation of a flexible stay, and in tapping the taper holes, which are made in the outer sheet to receive the sleeves, such should be carefully inspected and all

plugs and sleeves screwed up to a steam tight fit, and all plugs and all caps which make their seat on the end of sleeve should be screwed up tightly, using graphite in the threads, for by the unscrewing of the caps we are allowed to inspect the staybolt proper, when thought advisable.

Tools for installation are shown on tool sheet, also method of removing old rigid water space stays and enlarging the holes in outer sheet for flexible stays.

Referring to tool sheet, Fig. 1 is the method of removing the old bolt by using an enlarged twist drill, following the prick punched center of old bolt, drilling through outer sheet and using a reduced diameter of drill through inner sheet, collapsing the end (C), or separating such by a Wagstaff drill, leaving the hole in outer sheet enlarged ready for roughing reamer for the flexible staybolt sleeve.

Fig. 5 is a butt mill, which enlarges the hole in like manner, from tap drill size.

Fig. 2 is a roughing reamer (B), with guide bar (A), to be used in air drill to quickly straighten and size the hole in outer sheet.

Fig. 3 is a finishing reamer, with guide bar, for exactly sizing each hole previous to tapping.

Fig. 4 is a taper tap with guide bar, ¾ inch taper to the foot, 12-V threads, for finish tapping the hole in outer sheet to receive the sleeve.

Taper tapping differs from straight tapping. The reamed hole should always be of exact size for the tap to give good full threads. The tap should not be used to enlarge the hole, for this process is both unmechanical and detrimental to the tap.

A straight tap of the right diameter used before the taper tap, facilitates the tapping operation and relieves the taper tap from great strain and clogging.

Fig. 6 shows the method of tapping the inner sheet with the regular staybolt tap to aline with the installed sleeve. A cap (B) of the style (D) flexible stays is used as a means for holding the bushing (C), which holds the shank of the tap in line.

The sleeve is screwed into the outer sheet by the stud nut shown in Fig. 8, and as it takes nearly two turns to make a steam-tight fit, after the sleeve just fills the tap hole, it is necessary that the tapping operation should be gaged accordingly.

Fig. 7 shows the style (D) both installed ready for riveting over the end (F). B is a cap such as is used for the flexible stay, cut away for the admission of a dolly bar, bucking tool or holder-on. This cap protects the sleeve face where the cap makes a steam-tight joint during the riveting operation.

The dolly bar or holder-on is made of a piece of axle, 4 or 5 in. in diameter. C is a tool steel plug inserted therein, hardened and tempered.

The style of bolt here shown can be put in place with an alligator wrench on the firebox end or by means of a slot in the head.

Flexible staybolts should not be installed alternately, which has been done in some cases, for it is but a short time before the rigid water space stay has to be taken out and the flexible stay incorporated to effect a sensible installation.

There is no rule to apply regarding the selection of the installation for flexible water space stays other than to cover completely the natural breaking zone of each style fire-box.

The cost of flexible stays range from 40 cents to 70 cents a piece, complete, with bolt.

The cost of installing the flexible water space stay with proper tool equipment and systematic methods should not exceed 25 cents per bolt, and when installed in large quantities the cost should be as low as 15 cents per bolt.

In comparing the relative cost of maintaining a fire-box for four years having rigid staybolts in which the breakage amounted to 40 per cent. with a similar box in which 40 per cent. of the bolts were flexible the author showed that the outlay for staybolts in the former would be $600 as against $328 for the latter.

The stresses which tend to rupture a staybolt are:—That which operates to tear the bolt apart, the tensile stress; that tendency to break it, transversely or cross wise, due to expansion of fire sheet, the transverse stress; and that due to shear which tends to strip the threads from the bolt and hole in the sheet.

The fact that staybolt breakages have in no sense diminished, regardless of the quality of iron used and the many modifications of the forms devised in the rigid stay in the effort to provide flexibility, notwithstanding that water spaces have been widened, leads us to conclude that the fire-box as now constructed is too rigidly stayed to allow of economic and safe working where cost of maintenance of the complete machine is more or less affected in consequence of the expense accruing from the fire-box and staybolt charges of repairs incident to the constant disintegration and destruction of material, the result of shock, strain, vibration, corrosion and heat.

The force which works on the fire sheet in its course of expansion, due to high temperatures of furnace heat, throws a stress on the uttermost fibers of the rigid staybolt far in excess of the tensile stress, and as it is a reversal or vibratory stress the effect on the structure of the staybolt iron is too severe to warrant safe conclusions as regards maintaining a reasonable factor of safety.

The transverse stress breaks the rigid staybolt, not the tensile stress, and to enable the expansive forces to take their natural course with least resistance the flexible staybolt has been designed as a water space stay, as the most perfect means of affording and maintaining flexibility under all conditions of fire-box service, adding to the life of both sheet and staybolt.

New City Ticket Office of the Alton at Chicago.

A short time ago the Chicago & Alton moved its Chicago city ticket office into new quarters in the Rector Building at the corner of Clark and Monroe streets. The design and arrangement of the office is quite unique in character, some idea of which is conveyed by the accompanying engraving. The idea dominating the interior design was to give to it the appearance of a comfortable waiting room and office in a railroad station, the treatment of the walls, the design of the furniture and the general arrangement being in accordance with this idea. The color scheme harmonizes with the green granite base and the Bedford stone of the exterior of the building. The woodwork is weathered oak of a gray tone and the wainscot and piers are red brick laid in white mortar.

New City Ticket Office of the Alton at Chicago.

The ceiling is sand float plaster finished in white enamel and treated with heavy oak beams. The floor is of vitreous tile in colors to harmonize with the rest of the interior. There is a commodious fire-place with logs, andirons and built-in seats, a large table with top 8 in. thick, and numerous easy chairs, all in Mission style. Above the fire-place is a clock with delft dial and white enamel hands and figures. The metal work of the electric light fixtures is finished in verde antique bronze, the fixtures being of special design. Other features of the office are in keeping with those described, the general effect of the interior being most pleasing.

Railroad Decisions in July.

The following decisions in railroad cases were handed down by the United States Supreme Court and the Federal courts during July:

Protection of cars undergoing repairs.—A car repairer assumes the risk of injury by working under a car liable to be moved by contact with other cars, where he fails to protect himself by signals as required by a rule of the company. Canadian Pacific Railway Co. vs. Elliot, 137 Fed. Rep. 904.

Liability of lessor railroad.—The Ohio statue requiring a railroad company leasing its railroad jointly liable with the lessee on all right of action accruing to any one for any negligence or default growing out of the operation or maintenance of the road or in any wise connected therewith applies only to liabilities growing out of its duties as a carrier and not out of its duties as an employer. Beltz vs. Baltimore & Ohio R. Co., 137 Fed. Rep. 1,016; Axline vs. Toledo, Walhonding Valley & Ohio R. R. Co., Fed. 169.

Fellow servants.—A railroad section hand working on a rail-

road dump car and the engineer on the locomotive attached thereto are fellow servants. O'Connor vs. Atchison, Topeka & Santa Fe Ry. Co., 137 Fed. Rep. 503.

Engineer killed by landslide.—The death of an engineer caused by a landslide encountered in the night while running through a mountainous country is to be charged to accident for which the company cannot be held liable and is a risk assumed by deceased. Kinzel vs. Atlanta, Knoxville & Northern Ry. Co., 137 Fed. Rep. 489.

Fellow servants.—A fireman on a passenger engine is a fellow servant of a conductor of passenger train approaching in an opposite direction for whose negligence, causing the death of the fireman, the railroad is not responsible. Crosly vs. Lehigh Valley Railroad Company, 137 Fed. Rep. 765.

Georgia "tracing act."—The action against a railroad company under the Georgia statute known as the "tracing act," which requires a connecting carrier to trace and locate the prior carrier responsible for injuries to goods in transit is one for a penalty and cannot be converted into one on contract by amending a declaration. Venable Bros. vs. Louisville & Nashville R. R. Co., 137 Fed. Rep. 981.

Delayed trains.—A rule of a railroad company requiring a flagman to be sent out immediately when a train is delayed so that it may be overtaken by another will apply to a transfer train of another company using the main tracks of the company promulgating the rule running on the time of a passenger train. Northern Pacific Ry. Co. vs. Cummisky, 137 Fed. Rep. 508.

Railroad aid subscription.—Where the subscription provides that the selectmen of the town are authorized for and on the behalf of the town to contract with the railroad company which contract shall embody the terms and condition of the vote, the making of the contract is merely authorized and not required to entitle the receiver of the railroad to the benefit of the subscription on compliance with the terms of the vote. Paige vs. Town of Rochester, 137 Fed. Rep. 663.

Interstate Commerce Commission.—A Federal circuit court will not suspend the operation of a decree entered in a suit brought by the Interstate Commerce Commission under the provision of the statute enjoining railroad companies from violating an order of the commission affecting rates pending an appeal therefrom, where it does not appear that the damage to defendants from its enforcement will be greater than that which would result to shippers from its suspension. Interstate Commerce Commission vs. Southern Pacific Co., 137 Fed. Rep. 606.

Presumption of negligence.—Injuries to a passenger by the derailment of a car in which he was riding while passing over a switch creates a presumption of negligence on the part of the carrier. Michigan vs. Grand Trunk Western Ry. Co., 38 Fed. Rep. 37.

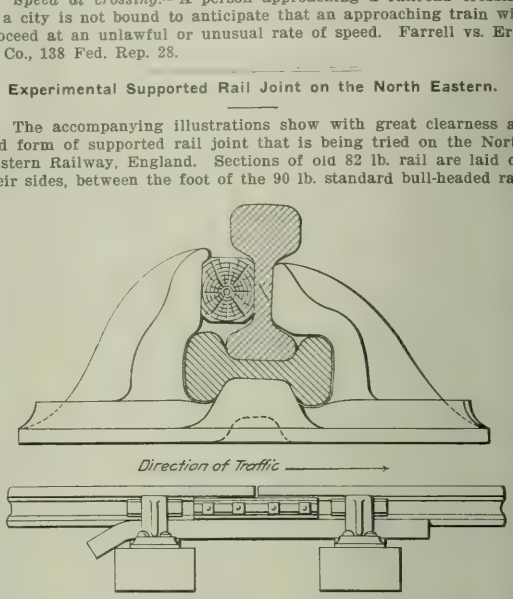
Release of damages for injuries.—Mental impairment and partial loss of sight from injuries by a railroad employee in a collision are not covered by a release, which after enumerating the injuries sustained as "bruises of his body, right leg and right arm, and a scalp wound," recites that "to maintain amicable and pleasant relations and avoid all controversy in respect to said matter," and for a monetary consideration the employee releases the railroad company from all claims of any kind and character whatsoever arising from the injuries and damages sustained in the manner or upon the occasion aforesaid, and the results of those injuries. (U. S. Supreme) Texas & Pacific Railway Co. vs. Dashiell, 25 Supreme Court Rep. 737.

Taxation of railroads.—A statute does not violate the fourteenth amendment of the Constitution of the United States because it provides a method of taxing railroads different from that applied to the property of other corporations or individuals, although the latter may incidentally own or operate railroads. Michigan Railroad Tax Cases, 138 Fed. Rep. 223.

Speed at crossing.—A person approaching a railroad crossing in a city is not bound to anticipate that an approaching train will proceed at an unlawful or unusual rate of speed. Farrell vs. Erie R. Co., 138 Fed. Rep. 28.

Experimental Supported Rail Joint on the North Eastern.

The accompanying illustrations show with great clearness an odd form of supported rail joint that is being tried on the North Eastern Railway, England. Sections of old 82 lb. rail are laid on their sides, between the foot of the 90 lb. standard bull-headed rail



Cross Section, North Eastern Supported Joint. (The Lower Cut Indicates a Variation.)

and the specially constructed chair. These special chairs weigh 60 lbs. each. The chair fastenings, fish plates and bolts are the regular North Eastern standard. It will be seen that the fit of the standard 90 lb. section into the side of the old 82 lb. is quite excellent, although this would presumably not hold true with other weights.

A Unique Way of Supporting a Rail Joint; North Eastern Railway.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.

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VOL. XXXIX, No. 6. FRIDAY, AUGUST 11, 1905.

The chapter on lubrication, one of the series of articles by Mr. George R. Henderson on the "Cost of Locomotive Operation," which is printed this week, deals with a very important and interesting subject. The cost of lubrication for locomotives is only a small item, comparatively speaking, and yet, strange to say, there is no one detail of locomotive operation which is more carefully watched and kept down to the lowest possible figure. Some roads have even gone to the extreme of doling out a fixed allowance of oil per engine-mile, to the great disgust of the enginemen whose excuses for lost time due to hot bearings soon lose any originality in the eyes of the master mechanic or superintendent. It is quite true that most enginemen waste more oil on the outside of the bearings than ever finds its way to the wearing surfaces, but because one engineman uses more oil than another it is not a positive indication that he is more careless and wasteful. No two engines run alike, no two steam alike, nor do they wear their bearings alike. Many an old engineman has uttered his opinions of such "new-fangled notions" in strong and eloquent language, and then thrown up his job in disgust. How much oil should be applied to a bearing cannot be laid down by rule; lubrication requires intelligence and careful watching, with a little margin of safety at the expense of economy. It is cheaper to waste a gallon of oil than to delay a train an hour or so on account of a hot bearing, and it might be cheaper yet to instruct the enginemen in a general way how much oil is required for proper lubrication, how often it is required and more particularly *where* it is required.

While locomotive lubrication has been so carefully watched and such economy practiced, in the matter of car journal lubrication little or nothing has been done. In a 50-car freight train there are about ten times as many bearings as there are on an engine to get hot if insufficiently lubricated, or to waste oil along the roadbed if filled too full. A heated car journal can waste as much energy at the draw-bar and delay a train just as long as a hot bearing on the engine, and yet the inspection and maintenance of journals is given much less attention. A freight car journal seldom is repacked, and often is not oiled between periods when the car goes to the shop—periods which may vary from one month to three or four years. The inspection at interchange points is usually superficial as regards the condition of the journals, inasmuch as they are not a source of much danger even if in bad condition. If they do need attention the job is left to a dollar-a-day repair man, who has no idea of how much or how little oil the bearing needs. He either puts in too little or fills the box up to the top with oil and waste, and allows a pint or two of lubricant to leak out around the dust guard. With 100,000 lbs. capacity cars proper lubrication is essential, for the journals are often subjected to loads even heavier than in locomotive bearings. If these cars are handled in dumping machines at coal and ore docks, little or no surplus oil is left in the bottom of the box when beginning the return trip, and if the packing dries up, as it will in time, the bearings are pretty apt to get hot. Broken axles have been known to result from such a cause, although rarely, but when a train is held up and has to limp into a siding behind time there is often the chance of a rear-end collision. Not a few accidents of this kind have occurred, a very recent one being the collision on the Pittsburg, Ft. Wayne & Chicago, at Clifton, Pa., last March, when a passenger train stopped on account of a hot box, and was run into by a following train, with the loss of seven lives. The damage resulting from that accident alone would have paid for all the oiling and inspection needed to prevent such an occurrence again on that road for years to come.

A regular passenger train carrying white flags in front and yellow flags at the rear is an unusual sight which was observed at Albion, Pa., recently. It is unusual only in a general sense, however; on the road where this practice is in vogue, the Bessemer & Lake Erie, the sight has been a familiar one for many months, and the practice seems to be satisfactory to the superintendent, the trainmen and all concerned. The use of yellow at the rear was adopted because of the adoption of green for "proceed." Yellow is the caution color, and it is the only one of the three colors—green, red and yellow—which can be used without inconsistency on the tail end of a train. The continued use of green for tail signals, after it has been made the standard color for "proceed," is, of course, highly inconsistent. Even if its use for proceed is confined to fixed signals, the inconsistency remains as a constant indication of an imperfect system, however long-continued may be the immunity from harmful results. Why should not every road which uses green for "proceed," proceed to abandon the use of that color for any other indication? The Bessemer & Lake Erie uses a yellow light in caution fusees. The use of green in fusees on a road where green is a proceed color involves a glaring contradiction; so glaring,

indeed, that one would be loath to believe that such a contradiction would be tolerated anywhere, were there not evidence of its actual existence. Inconsistencies and contradictions seem often to be tolerated in railroad practice on the ground that safety can be maintained in spite of them; yet it is familiar knowledge to the older generation of railroad officers that defective regulations have caused collisions after being in force without doing harm for 10 or 20 years; for so long a time that those who did not study the subject accepted them as perfect regulations.

The white flags at the front of the B. & L. E. train were there for the same purpose that they are used on engines throughout the country—to denote that the train was an extra; and it was an extra, so far as rights are concerned, as are all of the passenger trains on the Conneaut Branch of that road, because the block system is in use and no classification of trains is necessary. The abandonment of time-tables on this branch has been heretofore noted in the *Railroad Gazette*. Until quite recently the only time-table provided for the passenger trains was the advertising folder printed for the use of the public; but schedules for the trains are now shown on a page in the main line employees' time-table (and described as "extras") for the convenience of work-train conductors and other employees who need to know at what hours the passenger trains are expected. This full use of the block system has now been in force on this 16-mile branch for over six years, and with marked satisfaction. Besides the three passenger trains there are about 20 freight trains each way daily during the busy iron ore season. There is a piece of double track four miles long about the middle of the branch, but even with this the number of meetings to be made is so large that if there were no block system, and meeting orders had to be written out, repeated and delivered to conductors, the delays would materially reduce the capacity of the road. To insure vigilance in the towers, enginemen are required to adhere strictly to the rule not to accept a clear block-signal unless they see it moved from the stop to the clear position after they have called for it. There is no permissive blocking. This abolition of time-table rights and despatchers' written orders has now been extended over eight miles of the Meadville-Linesville branch and over a gauntlet of 1½ miles on the main line at the south end of the road. It would be perfectly safe, and a relief to passengers, to go one step farther in smashing the train-despatchers' traditions, and abandon all engine flags. A white flag gives a slovenly appearance to an engine (except for about one day, when it is new) and even adds to the disagreeable aspect of an engine that has run 200 miles since it was wiped. If an indication is really necessary, a pair of metallic enameled disks which could be easily cleaned would be much more suitable. But, with telegraph offices everywhere, and rights always conveyed by semaphore signals, why have anything? It seems to us that the simplification of operations above-described is highly commendable, and worthy of imitation. The abandonment of written train orders affords marked relief in managing train movements; and to assume that we cannot get the benefit of this relief except on a four-track road, running a hundred trains each way daily, is taking a very narrow view. It is true that with an increase in speeds or in the number of fast trains the B. & L. E. would probably feel the need of electrical control of levers between one tower and another; but the cost of that would be small compared to the security afforded by it.

One of the most significant things about this action of the Bessemer & Lake Erie is its decision *not* to abandon the time-table and written train orders on a 25-mile section of the main line where the stations have been provided with interlocked signals, and all other necessary preparations have been made. And for what reason? For the reason that it is difficult to retain a sufficient number of thoroughly reliable signalmen. The country is so thinly settled that living conditions are very unsatisfactory, and good men will resign their places rather than put up with the unpleasant features. The *Railroad Gazette* has preached the merits of the block system, in season and out of season, for many years; and in doing so has always included, as a vital element, the need of employing, in manual blocking, thoroughly competent and well trained signalmen. It is therefore gratifying to see this recognition of the principle. Too often railroad superintendents seem willing to put up with 18-year-old boys, or persons with more years but less brains, or those with a modicum of ability but a minimum of training. Evidently the B. & L. E. prefers to endure the troubles that it has rather than voluntarily bring in a new kind. With the electric staff or other electric locking, safety could be assured with as low a grade of men as any superintendent's conscience would permit him to employ; but safety alone is not the only desideratum; traffic must move smoothly as well as safely, and to insure this there must be good men in the towers. The Bessemer & Lake Erie will have to take a leaf from the experience of the Panama Canal Commission, and provide imported civilization for its lonely signalmen!

THE ROCK ISLAND ORGANIZATION.

Early in 1904 the Rock Island changed its organization from a divisional to a departmental one, and a diagram showing the new organization was printed in the *Railroad Gazette*, Feb. 19, 1904. In accordance with the amended organization, the chief engineer, the engineer of maintenance of way, the general manager, the purchasing agent, the engineer of tests and the supervisor of the insurance fund reported direct to the fourth vice-president. Each department was kept as distinct as possible, with the result that the division superintendent, who is really the basing point of a divisional organization, was reported to only by trainmasters, chief despatchers, station agents and yard masters; that is to say, he had no direct authority over the maintenance of his division and the management of its equipment. The supervisors reported direct to the engineer of maintenance of way, who in turn reported to the fourth vice-president; and the general superintendent of motive power, reporting to the general manager, had charge of the local superintendents of motive power, the mechanical engineer, electrical engineer and master mechanics, who in turn received reports from the road foreman of equipment, the foreman of car repairs and the roundhouse foreman. According to the old schedule, the division engineers reported to the division superintendents, who were under the authority of the district general superintendent. We called attention at that time to the fact that Mr. Loree's first important work after coming to the Presidency of the Baltimore & Ohio was to change the character of its organization from a departmental to a divisional one, while his first important work as President of the Rock Island System was to reverse this method of handling the road. The reason given for the change in 1904 was that the tremendous growth of modern traffic had so changed operating conditions that it is extremely hard to find a division superintendent who can solve operating and maintenance problems with equal brilliancy. Now, after a year and a half experience with this system and another change of the chief executive, the Rock Island is going back to a purely divisional organization. This is to be accomplished gradually and will not be completed until the President, Mr. Winchell, returns from Europe in the fall. At that time a new diagram will be gotten out, which will be shown in the *Railroad Gazette*. Those directly concerned with the working out of the departmental organization devised by Mr. Loree say that the trouble was that the division superintendents did not have any power except in purely traffic questions. When two or three of them got together for a conference, any decision involving maintenance had to be referred back to the department head. This occasioned delays and made it impossible to clean up the work of these conferences.

The Rock Island Company—which controls the Chicago, Rock Island & Pacific Railroad Company, which in turn controls the Chicago, Rock Island & Pacific Railway Company and the St. Louis & San Francisco; while the Chicago, Rock Island & El Paso and Chicago, Rock Island & Gulf roads operate independently but merge their accounts in the system reports—has a total mileage of about 13,000. Theoretically, great efficiency could be secured by having each department of this system in charge of an expert who would give his entire attention to his own specialty; but, as one railroad man expressed it, a company owning three or four department stores would never think of having one man in the central office look after his entire fancy goods department, another man look after groceries, another shoes, etc. He would inevitably place a competent manager in charge of each store and sub-divide his organization in that way. The division superintendent is really the man who corresponds to the local manager in this case, and the lesson of the Rock Island is that he must have full power. We wish to again make reference to the saying of Mr. Arthur Hale, that whenever a department escapes from the hands of the superintendent it is only too apt to forget that the object of a railroad is to provide transportation; that the engineer will build yards to hold cars instead of to move them, and the master mechanic will think more of his performance sheet than of the amount of tonnage moved.

BOSTON STEPS IN.

On April 27 last the Interstate Commerce Commission, sitting as a board of arbitration, gave its decision as to the adjustment of the port differentials on export traffic between Boston, New York, Philadelphia and Baltimore. The decision left Boston's position unchanged as regards New York and made slight alterations in the differentials from the New York rate allowed Philadelphia and Baltimore—alterations which tended on the whole to reduce these differentials, although in the case of ex-lake grain Philadelphia was allowed a differential of 3 mills a bushel which it did not previously possess. At the time the decision was given and while the evidence was being submitted, New York and the southern ports were loud in their protestations, but comparatively little was heard from Boston. Boston now takes a prominent part in the discussion, supposedly settled, by presenting a report through its Chamber of Commerce committee on differential freight rates, in which it attacks vigorously the findings of the commission. On the questions of fact, the reader will find a sufficiently full statement in the abstract of this report which is printed on page 139. The illuminating part of this document is the abuse which Boston aims at the Commission—and aims with great accuracy—for inconsistencies of thought and judgment in making its decision and for an effort to please everybody by a compromise fair to nobody. Boston accuses the Commission of enunciating as facts statements contradicted by the evidence submitted; of striving to create an artificial division of the export traffic between the different ports; of strangling competition through a so-called equalization of advantages, and of advocating the beauties of a healthy struggle between localities in one paragraph, while in another paragraph it taxes traffic from New York because New York has advantages in the struggle. In one place, says Boston, the opinion lays stress upon distance as the most important factor, while in another it ignores its former view and conceives it to be of no consequence. The Boston committee upholds the dissenting opinion of Commissioner Clements (*Railroad Gazette*, May 26, 1905), and concludes with the sturdy statement that Boston would prefer to rely upon its own pluck, industry and foresight to secure its just proportion of the export traffic; but that if the advantages of a port are to be capitalized; if lack of facilities is to command a premium and their development is to constitute a handicap; if legislation is to compel what civic pride, local energy and liberal investment should command, then Boston wants its fair share in the distribution of favors.

Entirely apart from the questions of fact submitted for consideration, who can say that there is any other equitable reason for a differential than its fundamental use as a means for preventing railroad rate wars? The commission may talk wisely about the advantage of distance, or of grades, or of shipping facilities, and in effect penalize these advantages in order to give less favored ports a chance, but everybody knows that the justice of such a decision lies only in its convenience. That is where the weakness of Boston's position lies. In the absence of some kind of a differential basis for handling the great export traffic in certain staple, raw commodities from the West to the Atlantic ports, there have always been hurtful rate wars, and there probably always will be hurtful rate wars. These wars are stopped by certain railroads getting together, in such a way that the Elkins Act and other Acts do not notice them, and agreeing to live and let live. When an agreement of this sort is made, openly or tacitly, no one is in much of a position to complain, for the railroads sacrifice just as much traffic as the ports do, by agreeing to any kind of division.

When such a division is made by government, however, the whole aspect of the case changes at once. In this case the decision was an arbitration requested by the contracting carriers, who are therefore estopped from complaint; but should any one desire a practical and timely illustration of the way Federal rate regulation would be likely to work, let him consider that this decision of the commission, clearly representing its best thought on the subject, had the weight and force of statute, and was handed down not at the request of the carriers but, at the demand of some angry port which felt that it was not receiving its share of the traffic. The student of economic conditions is invited to read carefully the statement of what Boston now thinks of the Interstate Commerce Commission, and then reflect how it would be if all the ports and all the railroads not specifically benefited were getting out memorials like that—memorials filled with taunts and cogent arguments which would be quite unanswerable, were the decision law instead of arbitration.

RACING WITH LOCOMOTIVES.

High speeds for long distances are now very common on English and American railroads, and "record-breaking" runs are reported every few weeks. To what extent any given performance does actually surpass previous performances of the same kind is, however, in most cases hard to determine, and the reader of the accounts is likely to have left in his mind quite vague notions of what has been accomplished. Possibly the reader is not annoyed so much as the editor. Most readers have, we suppose, quite definite notions of the speed capabilities and the actual performances of one or more locomotives concerning which they are individually well informed; and as almost any published record can be so interpreted as to show that the other fellow's engine has not beaten one's favorite, why, there is no occasion for anything but satisfaction; but the editor, with his cold and lofty impartiality, and his duty to make an accurate comparison, has numberless difficulties. On short runs—from one to five miles—comparisons are perplexing enough, with the differences in grades, in weight of train, size of engine, weather conditions and other things; but when it comes to runs of 100, 200 and 300 miles the differences in favoring and hindering conditions are, in present circumstances, beyond fair computation, and the student of records finds himself constantly in the dark. Possibly, as we have said, the editor is the only person who cares anything about this darkness, but, really, when it is considered that these truly notable performances are the result of great skill, energy and patience on the part of a large number of men, it seems a matter of regret that the work cannot be measured more accurately and by universal standards. And if one has in his breast even a small spark of the sporting spirit, he must desire to see the efforts of different roads intelligibly compared. A mere statement of the distance, rate of speed, number of cars and the allowances of time for stops affords but scanty ground for a discriminating judgment.

These reflections have been elicited by the statement that on July 21 the westbound "Pennsylvania Special," with four cars, was run 300 miles on the Fort Wayne road at 66.18 miles an hour. This includes three stops, which are reckoned to have consumed nine minutes. The run was from a point east of Crestline, Ohio, to Whiting, Ind.* Now, this is a very interesting event; but whether or not it is a "world's record" is a question concerning which one is left delightfully uncertain. The Lake Shore runs of June 12 and 13 were decidedly faster, but they were made with 3-car trains. The Lake Shore trains were run for a special purpose. This 300-mile dash was with a regular train, done just to make up lost time. The Lake Shore times were from start to stop; the Fort Wayne train appears to have had a flying start. The roads were, of course, different and there may have been other circumstances which ought to be mentioned in comparing the two runs.

The best runs that we can find for distances around 200 miles have been made from Erie to Buffalo on the Lake Shore, indicating, perhaps, that the grades, curves and city speed-limits are particularly favorable on that line; but is that really the case? Or, has Engineman Tunkey some knack (which he has imparted to some of his fellow runners on that division) by which he distances all competitors?

To have an ideal race it would be necessary to take a long stretch of double track, drive away all other trains, and start the locomotives side by side, as horses are raced. It would be interesting thus to compare different makes and designs of locomotives, but it would be desirable to have driving wheels of the same size on all of them, and to have the other conditions of the race, including the weight of the trains and number of axles, bear equally on both contestants.

Shall we ever have such a race? Probably not—or at least not for any great distance. It would be too costly even for a sporting millionaire. Not that our millionaires cannot spare the money; but they can get more satisfactory entertainment in other ways. No steam locomotive has been built entirely for speed. Every engine is designed to haul a train. Indeed, if we consider speed, pure and

*The best speed that has been made on the Fort Wayne road for a distance of 200 miles is 71.5 miles an hour. This was with the special train of three cars which was run from Chicago to Pittsburg, June 8. On the same run a distance of 100 miles was traversed at the average rate of 77.2 miles an hour, and a distance of 50 miles at 79 miles an hour. The Lake Shore & Michigan Southern's special of June 13, consisting of three cars, was run 525 miles at 69.53 miles an hour; and 183 miles (Cleveland to Buffalo) at 73.2 miles an hour. The Twentieth Century Limited of the Lake Shore, westbound, on May 25, 1903, is recorded as having made 241.4 miles (Cleveland to Elkhart) at 66.12 miles an hour; but there appears to have been a deduction for a stop at Toledo. This train consisted of four cars, weighing about 250 tons. A writer in the *Railroad Gazette*, of Sept. 16, 1904, says that on May 9 of that year a train of five cars was run from London to Plymouth, England, over the Great Western, 246 miles, at 70.5 miles an hour. This included one stop. The weight of the cars is not given.

simple, the steam locomotive has not yet been tested to its limit over long distances, for every long run has been made with three or more cars. The only very fast run with less than three cars that we can recall is one which was made over the New York Central from Albany to Syracuse on September 24, 1895—148 miles—with two cars, in 2 hours 10 minutes, equal to 68.23 miles an hour; and that was for eight years the best record for that distance. If nobody builds a locomotive for speed alone, we may expect that the automobile will beat it, one of these days. Already an automobile has run 73½ miles an hour for 50 miles. This machine has an advantage in its low center of gravity and the elastic nature of its road and its bearing on it. To properly compete with it the steam locomotive will have to leave off its train and lighten its tender, and perhaps do a lot of other things.

We are not writing for the purpose of inciting any millionaire (or any railroad company) to devote money to making better speed; they might perhaps do more good by developing a flying machine; we simply call attention to one of the reasons why steam engines do not go faster. But, whether we do or do not ever have racing of locomotives under equal conditions, there will be considerable interest in knowing as fully as possible the conditions of those races which do take place. (The railroad managers usually aver that they are not racing; but if that is the case, they ought to muzzle their advertising agents.) Any one of the "Sunday Supplement" newspapers would, no doubt, be glad of the opportunity to make a record of the differences between the Lake Shore's 500-mile race course and that of the Fort Wayne, for the privilege of publishing an exclusive report of a contest in speed; but the trouble would be, probably, that the reporter would not possess a sufficiently discriminating judgment. Whether any competent railroad man is ready to try it, we do not know. At the best, the task would involve the weighing of some dozens of handicapping circumstances and conditions on each road; and some all-wise person would have to balance these. Possibly the task would be found to be so intricate as to drive us back to the position of the railroad managers—"we are not racing."

The Texas Damage Suit Industry.

The address on Texas damage suit cases, printed in this week's paper, gives some examples of the way the damage suit industry is conducted that would be most amusing if they did not indicate a state of corruption which, if not actually connived at by public sentiment in Texas, has at least been allowed to assume much greater proportions there than anywhere else in the Union. It is ridiculous that railroads operated certainly with ordinary care and skill should be obliged to pay in a single year 3.09 per cent. of their gross earnings in damages. The same hostility towards corporations in general and railroads in particular, which has been found good politics in many another state, seems to have become deep-seated in Texas, although Texas needs new railroads for its development as much as any state in the Union. There have been some recent evidences that the better public spirit in Texas is awakening to the injustice and short-sightedness of these perpetual attacks on the railroads. For example, the Hunt County (Texas) Grand Jury in its report June 11, 1905, said: From the testimony before us we conclude that certain lawyers in Greenville have secured before the convening of court, a full list of all the jurors summoned for the whole term, and have sent out men to notify all the jurors (these men pretending to follow some other business) and to find out how each juror stood on a certain character of cases; and, if unfavorable, the cases these lawyers represented were fully stated to the juror so that he would be disqualified to sit on the trial of the case, and in some instances the jurors had been told not to come to court. Then the lawyer would report to some member of the sheriff's force the number of men who would not be present of those who had been summoned as jurors and would advise the sheriff to fill up the panel with certain specified men, and on the Monday morning named these men would appear and get on the jury for the week. The Grand Jury said it had further evidence that a Greenville lawyer had requested men to be in Greenville on a certain Monday morning in order to get on the jury when he had cases to try; also, that while the jury was deliberating on the case in which a certain lawyer was interested, and when they were not kept together at night, he invited them to go to the opera house with him at his expense.

This kind of thing has been frequently pointed out by the railroads, but it is unusual and encouraging to have it come to the notice of the Grand Jury. In one case which is on the court records the complainant confessed that for fifty cents he induced one of the crew of a freight train to allow him to ride on a car of lumber. While getting back on the car after a stop for dinner the train started forward and because of a defective handhold he fell to the ground. Simultaneously, some of the lumber which had been negligently piled fell on him, breaking his arm so that amputation was necessary; wherefore, he prayed the court through his lawyer to mulct the railroad company for $40,000 damages. Of course, this man was a trespasser. With lawyers who make their living on contingency fees in cases of this kind and with juries packed as enumerated, it is not surprising to find a case stated where a brakeman who lived in Kansas, was employed on the Atchison, Topeka & Santa Fe and was injured in Colorado, moved to El Paso and established residence in Texas in order to sue there. Not long ago a man was convicted of suborning witnesses, and was fined and imprisoned. He testified: "Well, it's this way. Whenever you hear of an accident you get on the spot as quick as you can and get the injured man to sign a contract with your lawyer to defend him and then you also work up evidence. Another thing is that whenever in conversation you hear any man express himself as friendly to corporations you take his name and report it to the lawyer you are working for, and the name will be scratched if it ever goes on a jury list." The man who engages in this type of professional service in Texas is known as a booster. The Texas daily press has recently concerned itself far more than in previous years with this topic, and the best papers are taking a very helpful stand for decent and honest trials. They are also inclined to discuss the equity of constant payments for actual hurts. For example, the Tyler *Daily Democrat-Reporter* says: "A man building a house for another falls from the scaffold and is seriously and permanently injured, yet he never thinks of suing the owner of the house for damages. The same man will hop off a moving train and smash his nose against the ground and sue the company for damages, and nine times out of ten he will recover."

The ambulance chaser and the shyster lawyer will be always with us, but if Texas has gotten to the point where it sees that such a state of affairs exists and condemns it through its influential journals, half the battle is won. It is hardly to be expected that the next few years will see progress in the damage suit business like that from $223,749 in 1891 to $1,873,777 in 1904. The general welfare of the state will surely be benefited by the decline of this particular industry.

Information to Carry Around.

Heads of departments of railroads nowadays cannot possibly carry in mind even the principal information pertaining to various details of their departments, although the extent to which one is able to do so is an important factor in the successful administration of his department. As long as he is in his office there may be little or no necessity for the exercise of such ability. Away from headquarters, however, there may be and usually is constant need for various facts and information pertaining to department affairs. To have essential data of this nature arranged in some form so as to be immediately and quickly available would be highly useful under such circumstances. And it is comparatively an easy matter to have this information prepared in some compact and convenient shape to carry around. By tabulation and orderly classification and arrangement of data, a great mass of information can be condensed into comparatively small compass. A lesson can be taken from the engineering pocket books in this respect. We know of a Superintendent of Motive Power who has an admirable plan of this sort. He makes use of a loose-leaf, leather-bound, marginal-indexed book, having pages 4¼ x 7¼, the size being convenient for the coat pocket. An examination of this volume reveals data comprehending practically all vital information pertaining to his car and locomotive departments. Among other things is a table of the total number of men in his employ classified by stations, or points, showing monthly salary or hourly rate for each; a list of the total number of men at each point by months and the number at all points classified by occupations; shop and office total payrolls by divisions and months, also by stations; recapitulation of locomotives by divisions, showing the number and kind on each, whether working, in shop or waiting, etc.; a comparative statement of motive power department expenses and results by months; locomotive performances on coal and oil; car mileage and cost of repairs to passenger and freight cars by months; cost of certain shop operations; costs of important supplies, of parts of cars and locomotives, and of labor of applying; tractive power of the various types and classes of locomotives owned, their tonnage rating, horse-power, principal dimensions, names of builders, etc.; and a large amount of other such information ready to hand not only for his own constant reference, but to enable him to supply instantly any information asked for regarding his department in conferences with his superior officers.

The wisdom and advantage of some such practice is too evident to need argument. A busy officer might probably feel that he has not the time to prepare such a book and keep it up to date. This is not necessary, however, as the work should be delegated to some subordinate in the office whose duty it would be to regularly prepare

current data, and to make such revisions in the permanent data as may be necessary from time to time.

A press despatch says that the Pennsylvania has issued orders "that hereafter the water supply for passenger cars must be handled by men wearing white gloves and white duck overalls, which must at all times be clean. The object is to insure that the water shall be free from contamination."

Good! That would be an excellent idea on many roads that we could name. And on some of them the present practice suggests the desirability of sundry other improvements: such as galvanized iron pails not brown with sediment (or age); ice-barrows clean enough to be distinguishable from grease-receptacles; drinking cups of such material and color that the passenger can see for himself that they are clean, and not be obliged to take them on faith; men who in handling water and ice will have clean hands as well as clean clothes. Many men are so innocent of any notion of strict cleanliness that their conduct is laughable. One observed by the writer the other day came into a coach at a division terminal and, removing the cover of the drinking-water tank, felt for the surface of the water with his hand, to see if there were need of replenishing the supply! This was nothing very dangerous, either to the prospective consumer of water or to the microbes disturbed by the unceremonious inspection; but a trifle funny. Why not have a glass front in water-receptacles? Of course, all this has to do with superficialities, after all. The most important assurance to be given to the passenger is that the drinking water is clean and pure at the point where it is procured; and as a constantly increasing proportion of our passengers live in cities, where suspicion of the quality of water becomes second nature, it will not be strange if the demand for purity and cleanliness increases.

NEW PUBLICATIONS.

The Organization of Ocean Commerce. By J. Russell Smith, Ph. D., Instructor in Commerce, University of Pennsylvania. Published for the University, Philadelphia, 1905; Ginn & Co., 29 Beacon Street, Boston, Mass., Selling Agents. 155 pages, 6¼x10 in.; with a Map.

Dr. Smith has given a very careful and a very full discussion of a branch of transportation which has not received the attention it deserves. He gives by far the best account we have seen of the charter traffic, which forms so important a part of ocean communication. By including in his book a statement of the trades which are respectively adapted for line steamers and for charter steamers and by going fully into the economics of each of these types of ships, he shows that in the vast majority of the many hundred of ports upon the ocean the bulk of the commerce is limited to a very small variety of articles, often a single article; and that, again, is only shipped during a part of the year. It is most likely to be a raw product, cheap and heavy, which must be carried at as low a rate as possible. This, then, is not work that can be done by the carefully organized line of vessels. This simpler, unorganized and cheaper service falls to the independent vessel that is for hire and works as a unit wherever there is work to be done. Such vessels carry a large share of the world's trade, and are utilized for any trade that may go in shipload lots. Economy is much more to be desired than speed in their operation. For example, the Baron Eldon, built in 1899, with a dead weight capacity of 6,100 tons, burns only 22 tons of coal a day at nine knots, which is at present about the equilibrium in speed, above which additional speed costs more in outlay than it adds in income, and below which a lessened speed costs more in loss of earning power than it saves in operating expenses. Dr. Smith describes in great detail the exact way in which this charter traffic is handled, and it is extremely interesting to read of the competition for temporary cargoes at ports in odd corners of the world and of the routes which are planned so as to afford the ship a back haul, if possible. Chapter 3 is devoted to line traffic as compared with charter traffic, and gives the general rules clearly and fully. Chapter 4, on ocean freight rates, explains the tendencies of these rates, and among other interesting things recounts how the quick return of prosperity from a period of depression occurring in 1898 and 1899, at the same time with the onset of the Boer war, which took a large amount of tonnage out of ordinary service, caused a great demand for vessels and occasioned much new construction, an over-production of which has kept the traffic very dull ever since. There are also interesting chapters on the leading steamer routes, on coal supply and coaling stations, the effects of the Panama Canal on trade routes, the competition of steam with sailing vessels, etc. We know of no other book that gets the salient points of the rules of ocean commerce into such small space and expresses them so clearly.

Railway Provident Institutions. Relief and Insurance Departments, Pensions, Hospitals, Savings Funds, Libraries and other Welfare Work on Railroads in English-Speaking Countries. Published by M. Riebenack, Philadelphia.

This is a reprint, amplified with much additional matter, of the paper prepared by Mr. Max Riebenack, Comptroller of the Pennsylvania Railroad, for the Seventh Session of the International Railway Congress; and it makes a book of 400 pages, about 5 in. x 7 in. An abstract of the main parts of Mr. Riebenack's paper was given in the *Railroad Gazette* of January 6 last, having been condensed by the author for an address before the National Civic Federation. Mr. Riebenack's material was gathered from all countries in the world using the English language, that being the scope of his inquiry as laid down by the Congress; and he gives the data classified by countries. In the United States he had responses from 140 roads, and in Great Britain and Ireland from 34. The present work is systematically arranged and elaborately indexed, and it covers not only ordinary relief and insurance associations and departments, but everything concerning pensions, hospital service and libraries, and much information about the Young Men's Christian Association and the railroad brotherhoods. The book appears to have been published by Mr. Riebenack himself.

TRADE CATALOGUES.

Draft Gear.—The Bradford Draft Gear Co., Chicago, has a new design of spring draft gear, and has issued a catalogue illustrating and describing it. It is made with one, two, three or four parallel springs, the three-spring design being the standard gear. The greatest amount of space is therefore devoted to the latter, all of the details being illustrated and fully described. There are two half-tones from photographs showing a four-spring gear applied to the steel underframe of a Union Tank Line car. Other designs, including twin-spring for low-bodied cars, designs for passenger cars, locomotive pilots and elevated railroad cars are shown, also a design of friction gear. There is also a copy of a report by Prof. Goss, of Purdue University, covering tests of two Bradford gears under static load.

New Nevada.—The passenger department of the Southern Pacific has issued a pamphlet of 65 pages, profusely illustrated, in which the future of the State of Nevada is set forth in the glowing terms of the land promoter. It contains a large amount of information on the agricultural and mineral resources of the state, the irrigation projects now under way and statistics of the principal cities and towns in the state.

Electric Railroad Construction.—J. G. White & Co., New York, are distributing an announcement of the organization of the Canadian White Company, Lim., of Montreal, to carry on an engineering and general contracting business in Canada. The announcement contains a partial list of the work now under contract by J. G. White & Co., of New York.

Dielectric Products.—A little pamphlet issued by the Dielectric Manufacturing Co., St. Louis, Mo., gives prices of insulating materials made by that company. It is rather more than a price list, describing briefly the properties and advantages of some of the special products. The pamphlet is a neat piece of work both in design and composition.

Reinforced Concrete.—The Cummings Structural Concrete Co., Pittsburg, sends a pamphlet telling of the advantages of reinforced concrete in general and describing some interesting patented methods of construction used in the Cummings system. It also gives measurements and details of several structures built on this system by R. A. Cummings.

Roofing.—The Standard Paint Co., New York, sends the July issue of *The Exchange.* This number emphasizes the economy in painting Ruberoid roofing every few years with Ruberine, as only in this way can the user get the best service out of the roofing. As usual, it devotes considerable space to suggestions to agents.

Turret Lathes.—The latest bulletin of the Gisholt Machine Co., Madison, Wis., describes the wing rest or auxiliary tool post holder which is supplied on Gisholt turret lathes when specified. The attachment is a useful and convenient one for turning pieces of extra length or diameter.

Electric Generating Sets.—The Crocker-Wheeler Co., Ampere, N. J., is distributing Bulletins Nos. 56 and 57 describing small generator sets from 2½ k.w. to 21 k.w. capacity. These sets have Crocker-Wheeler dynamos and are furnished either with Forbes engines or with Case engines.

Railroad Employees and Rate Regulation.

The following extract from a recent issue of the *Railroad Trainmen's Journal* shows that three, at least, of the brotherhoods of railroad employees are in accord with the attitude taken by Lucius Tuttle, President of the Boston & Maine, in his address last spring in which he pointed out that Federal rate regulation was certainly undesirable from the standpoint of the employee:

The leading organizations of railroad employees have taken a

position to the effect that it would be unwise and unbusinesslike to arm any government commission with the authority to prosecute, defend and judge so important a matter as the rate that shall be paid for the transportation of freight on our railroad systems.

The right of supervision, the power to demand and enforce fair treatment to shippers, and other rights, that are clearly within the power of government are not questioned. It is the proposition to place in the hands of a commission, the members of which have no training in railroad operation and who do not know the necessities of rate making, the full power to make a rate, bring their own arguments to defend it, enforce their decision and practically operate a railroad without being responsible for the results to the company. As railroad employees we know that when railroad revenues are affected we must assist to make good the reduction. We do not anticipate wage reduction but we can reasonably look for increased burdens that are difficult to oppose in the operation of any business where perfected machinery and public demand make it possible.

The position of the Brotherhood of Locomotive Engineers was thus expressed in its official publication: We believe the Esch-Townsend bill will have to be very much modified before it can pass the Senate; but every sub-division of the B. & L. E. in the states should take an interest in this subject, which they ought to feel is very near to them, for the interest of the railroads, in a large sense, is their interest, not that it would result in the reduction of wages, but would, in all probability deter any advance and would likely make it more difficult to sustain what we have, and it would be a good move either to see or write each Congressman and Senator, and express disapproval of any measure which would take from the railroad management the rate-making power. Let the law be amended, if necessary, to give the commission power to cure such evils as are complained of, and give it unqualified authority to enforce the Interstate Commerce law.

The Order of Railway Conductors made its position known in the following resolutions passed by the recent convention:

Resolved, That we respectfully represent to Congress the inadvisability of legislation vesting in the hands of a commission power over railroad rates, now lower by far in the United States than in any other country; that this low cost of transportation is the result of the efficiency of American railroad management and operation, which have built up the country through constant improvement in service and development of territory, while at the same time recognition has been given to the value of intelligence among employees, in contrast to foreign methods where high freight rates and lowest wages for employees obtain; that the freight rates of this country average only 2 per cent. of the cost of articles to the consumer, thus making the freight rate an insignificant factor in the selling price, numerous standard articles being sold at the same price in all parts of the country; and be it further

Resolved, That regulation of rates by a government body would, in the opinion of this convention, result in litigation and confusion, and inevitably tend to an enforced reduction of rates irrespective of the question of the ability of the railroads to stand the reduction, especially in view of the increased cost of their supplies and materials; and be it further

Resolved, That the proposed legislation is not in harmony with our idea of the spirit of American jurisprudence, inasmuch as it contemplates that a single body shall have the right to investigate, indict, try, and condemn, and then enforce its decisions at the cost of carriers, pending appeal, which is manifestly inequitable; and that if there is to be legislation on this subject it should be such as would secure and insure justice and equity, and preserve equal rights for all parties concerned, but in view of the facts, legislation affecting rates is not called for at this time, and would be inadvisable.

The Brotherhood of Railroad Trainmen made its position known through the adoption of the report of its committee on reports of Grand Lodge officers, at its recent convention held at Buffalo, N. Y., May, 1905, which reads, in part, as follows:

The usual acceptance of the term "rate regulation" is rate reduction. Regulation of freight rates is never thought of as to be applied to raising a prevailing rate by the power of a court or commission. The real issue, then, of rate regulation is one of rate reduction, which means a loss of revenue to the railroad companies, and just how far reaching this loss would be is a matter for conjecture.

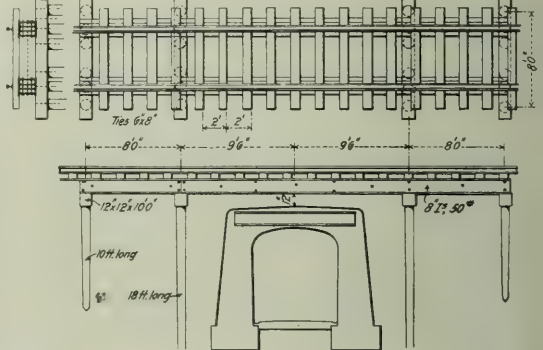
The proposition now before the people of the United States is one that proposes to clothe the Interstate Commerce Commission with the power to make a rate, and to permit the railroad companies, or the shipper, to appeal to a court if the rate fixed is not regarded as fair. With this proposition there naturally goes an arbitrary power to fix a rate without holding the Commission responsible for disadvantageous results. The controlling idea, which is to take from the railroad companies what rights they have under existing laws for their protection in fixing and maintaining a maximum rate, is decidedly unfair.

This organization does not stand as an apologist for railroad wrongdoing, or as a champion of the railroad corporations as against the rights and interests of the general public. It does not seek to interfere between the railroad companies and the public in the proper administration of law. It believes that there have been abuses in railroad rate making and maintenance that have discriminated against certain interests, and in favor of other interests, which were positively wrong and should be discontinued, and which, we think, can be done under the laws as we now have them. Practices of discrimination are not condoned, but there is a remedy for them within the present law. Its application would be a far different matter from authorizing any court, or commission, with the power to fix a rate regardless of the effect of such a rate on the business operation of the railroad company affected.

We believe the laws should be enforced against discrimination, rebates and preferentials, thus insuring fair and equal treatment to all concerned, but we do not believe in empowering any commission with the authority to make a rate. As railroad employees, we feel that the railroad companies must be protected from imposition and unfair legislation, and be allowed to manage their business fairly to the end that good service and wages be maintained, and a fair profit on railroad investment be assured.

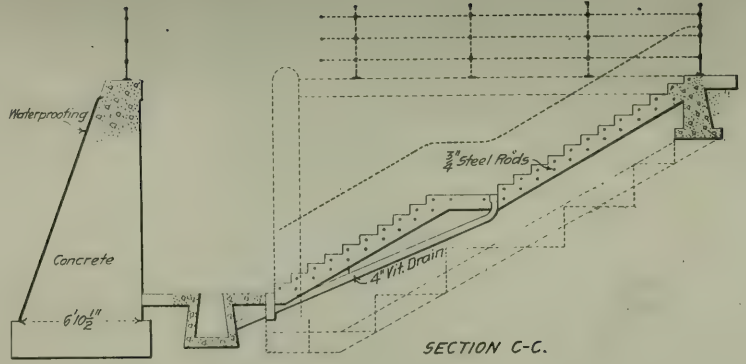
Reinforced Concrete Passenger Tunnel—C. R. R. of N. J.

The accompanying illustrations show the plans of a reinforced concrete passenger subway, or tunnel, which the Central Railroad of New Jersey is now building under its main line at Netherwood, N. J. The tunnel proper is 96 ft. long by 6 ft. wide at the base and has a maximum height of about 7 ft. 8 in. The side walls have a maximum width of 3 ft. at the base and a minimum width of 2 ft. 3 in. at the top. They are reinforced, as indicated in the cross section, by ¾-in. medium open hearth steel rods. The roof is rein-

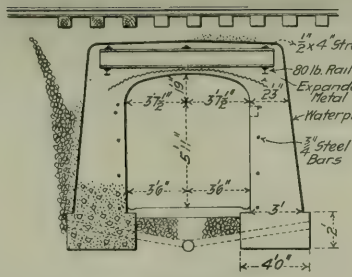


Plan and Elevation of Temporary Trestle, Concrete-Steel Passenger Subway, C. R. R. of N. J.

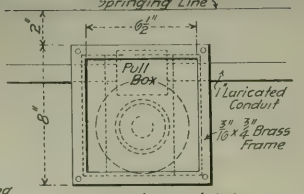
forced with expanded metal and 12-in. I beams placed at 22-in. centers, resting on 80-lb. rails. The I beams are held in position by means of three ½ in. x 4 in. flat iron strips, as shown. The foundation for the floor consists of 7½ in. of concrete laid on a broken stone foundation. The finished surface of the flooring and steps is of 1 in. cement mortar composed of one part Portland cement and two parts sand. To give this finish a dark color 2 lbs. of lamp black is mixed with every barrel of cement. The concrete in the foundation and abutments to elevation, and in all retaining walls and foundations for steps and flooring is composed of 1 part cement, 2½ parts sand and 5 parts broken stone. The concrete in the roof of the tunnel is of 1 part cement, 2 parts sand and 4 parts broken stone. The stone in the concrete for the footing courses is of trap rock and does not exceed 1½ in. in any direction. Stone not exceeding 1 in. in any direction was used for the concrete in the floor, steps, retaining walls, abutments and the roof of the tunnel. The expansion joints are located as shown in the illustrations and the adjacent portions of the wall are separated by two layers of building paper. The outer surface of the structure, as indicated in the drawing, is water-proofed; the water-proofing being applied as follows: First, a hot coating of "Hydrex" compound was applied; this was allowed to thoroughly dry, and four layers of Hydrex water-proofing felt, laid shingle fashion, was cemented together by hot Hydrex compound. A ledge, or shoulder, is formed in the side walls of the steps under which shoulder the water-proofing is flashed, so as to prevent water from getting in behind the water-proofing. The drainage system—which is one of the most important features in connection with subway work—is well taken care of. It consists of catch-basins, located as shown, connected with 4-in. drain pipes to a 6-in.



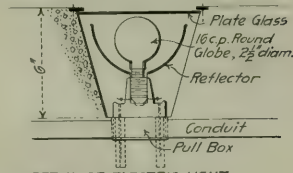
SECTION C-C.



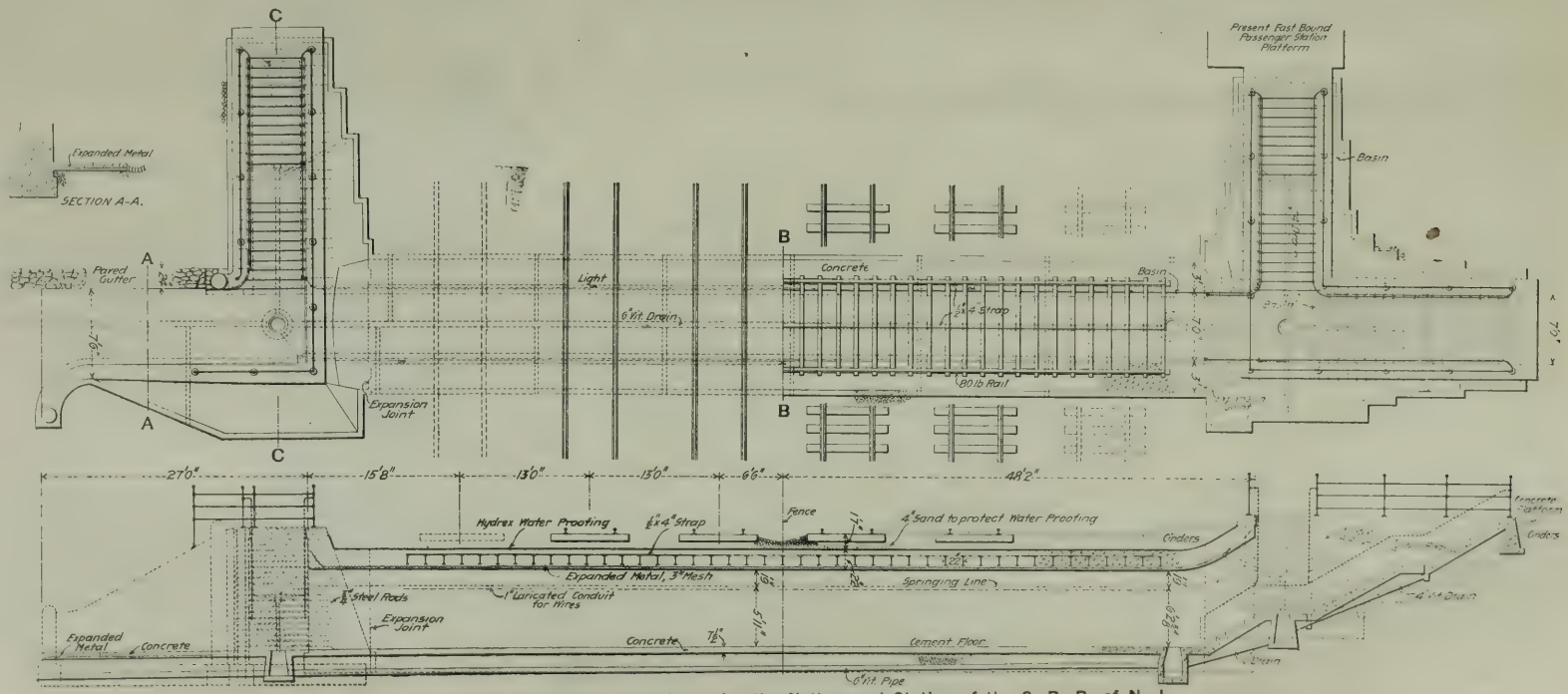
SECTION B-B.



Looking at Face of Wall



DETAIL OF ELECTRIC LIGHT.



Concrete-Steel Passenger Subway for the Netherwood Station of the C. R. R. of N. J.

main drain pipe having a rake of 2.15 ft. in 100 ft. and an outlet 210 ft. from the mouth of the subway. All pipe is salt glazed vitrified stoneware sewer pipe. The pipe outside of the steps and tunnel bottom is joined by caulking the sockets with rope-yarn gaskets and then filling with cement mortar of one part of cement and two parts of sand. All pipes under the steps and floor of the tunnel are laid with open joints. Five electric lights are placed in the tunnel as shown in the illustration. The center light is wired separately from the others, and the wires for this light are arranged so that it can be turned on by a switch in the ticket office of the station. The other four lights are on one circuit and are also arranged to be turned on and off from the station. The wires for the lights are carried in a loricated conduit of 1 in. inside diameter, built in the concrete walls of the tunnel. In other subways along the line of the C. R. R. of N. J. ordinary 16 c. p. incandescent lamps held in sockets and projecting out into the subway are used. Considerable annoyance has been occasioned by the frequent breaking of these lights, and to overcome this the lights in the Netherwood subway are to be made as shown in the detailed drawing, and placed in recesses in the walls of the tunnel. To facilitate work in the subway during the construction the four main tracks had to be raised 12 in. and carried on a temporary trestle made as shown in the accompanying illustration. For the above illustrations and information we are indebted to Joseph O. Osgood, Chief Engineer, C. R. R. of N. J., in whose office the subway was designed.

The North-Western's New Line to Milwaukee.

The Chicago & North-Western has three lines out of Chicago. One runs due west to Omaha, another northwest to St. Paul and Minneapolis, and the third north along the lake shore through Milwaukee. All three leave the city as double-track lines. From Wells street station to Clybourn Junction, three miles out, the latter two are combined as a four track line. The road has its heaviest suburban traffic on the lake shore line, which traverses an almost continuous series of populous suburban towns all the way to Milwaukee. The freight and through passenger traffic on this line is also extremely heavy, and long ago the combined traffic had attained a volume that taxed its two tracks beyond their capacity, particularly at the south end, where the suburban traffic is densest.

The first measure of relief to be adopted was the building of the Mayfair cut-off some 15 years ago. As will be seen from the accompanying map, it leaves the main line at North Evanston, running southwest to Mayfair Junction and south to large freight yards at 40th street, Chicago, enabling all through freight traffic to be diverted from the very busiest portion of the main line, to the 40th street yards, and through them south to Wood street yard when necessary.

As the growing volume of suburban traffic extended northward, further relief became necessary, and it was first proposed to build a third track as far as Lake Forest. However, this plan was abandoned in favor of the construction of a third and fourth track from Lake Bluff southward a short distance west of the existing line to juncture with the Mayfair cut-off, which enabled through passenger and freight traffic to be diverted from the shore line between Lake Bluff and Chicago. This new line, built two years ago as the Chicago Northern, is 22.2 miles long.

But the line north of Lake Bluff soon evidenced the need of enlarged capacity. The Rockford line, or Kenosha division as it is known, joins the Milwaukee division at Kenosha, Wis., 52 miles north of Chicago. This branch line contributes a considerable traffic, the ice business in the summer time being particularly heavy as the line traverses a lake region where a large amount of ice is harvested. In order to avoid interference with the passenger traffic as much as possible, which, of course, is heaviest in the day time on account of the suburban trains, as many as possible of the freight trains were run at night. But the situation was far from satisfactory and it was therefore decided to extend the third and fourth tracks through to Milwaukee.

The idea at first was to have these tracks adjacent to the existing line, but this was abandoned for several reasons. One was the presence of several small cities on the line, such as Kenosha, Racine, etc., where additional right-of-way across the town would have to be bought at large expense. Also the multiplication of grade crossings at these places was a serious objection. Furthermore, an investigation showed that by building this third and fourth track as a separate line a short distance west of the shore line, not only could much lighter maximum grades be obtained, enabling larger tonnage trains to be hauled, but also all towns, with their accompanying grade crossings, would be avoided and with them the need of frequently reducing speed or stopping whether traffic and operating conditions required it or not.

The new line, work on which began May 1st, is about 53 miles long, and it probably comes as near to being an air line as any equal length of road in this part of the country. Starting from Chicago and State Line Junction on the Chicago Northern, a mile and a half southwest of Lake Bluff and about a mile west of the shore line, it runs northwest on a nine mile tangent to a point 3¾ miles west of the latter, where 13 deg. of 30-min. curve occurs. There is then a 13 mile tangent followed by 6 deg. of 30-min. curve; a 10 mile tangent and 7 deg. of 30-min. curve; a 4½ mile tangent and 4 deg. of 30-min. curve; a 7 mile tangent and 12 deg. of 30-min. curve; then five miles of tangent to connection with the Milwaukee division near St. Francis, three miles from the Milwaukee station. From this point the new line continues as third and fourth tracks of the Milwaukee division on the old right-of-way as far as the Bay View interlocker just south of Kinnikinnick river, where there is a double-track bridge. The work in Illinois is being done under the name of the Chicago & State Line Railway, while that in Wisconsin is under the name of the Milwaukee & State Line Railway. The former has 16½ miles and the latter practically 36 miles, including the two miles from St. Francis to Bay View, making something less than 53 miles total.

Chicago & North-Western's New Line to Milwaukee.

As would naturally be inferred, the work on most of the line is moderate. The maximum gradient is $^{3}/_{10}$ of one per cent., or 15 ft. to the mile, against $^{6}/_{10}$ of one per cent. on the old line. The curves, as already stated, are all 30 min. There are several fairly heavy cuts and fills. On the first three miles from the south end there is heavy borrow work. For the next five miles the work is light, but at mile eight there is a 56,000 yd. cut. In miles nine and ten there are two cuts aggregating about 100,000 yds. Mile 12 has a 83,000 yd. cut, miles 16 and 17 have each a 56,000 yd. cut, and 19 and 20 each 55,000 yd. cuts. The next 18 miles is all moderate work, but miles 48 and 49 have a 190,000 yd. fill and 49 and 50 a 340,000 yd. cut starting at the north end of 49 and extending through 50. This cut is through St. Francis hill, and it will have a maximum depth of 35 ft. It was stated that the maximum grade will be $^{3}/_{10}$ of one per cent. This should except the grade coming out from Milwaukee through the cut, which will be $^{6}/_{10}$ of one per cent. This was to avoid carrying the bottom of the cut below the surrounding drainage level.

Root river crossing is the only bridge of any size on the line. It occurs about five miles north of a point opposite Racine and consists of five 70-ft. deck girders which ultimately will be placed on masonry piers. Temporary pile piers will serve until the line is completed so that the masonry material can be hauled in cheaply. All subway abutments will likewise be of piling temporarily. The culverts are cast-iron, three sizes of pipe being used, viz., 24 in., 36 in. and 48 in. There are some 1,500 ft. of the last and a considerably greater amount of the 36 in. The highway crossings are mostly at grade, the country being too flat in most cases to permit grade separation at reasonable cost. Out of 50 such crossings, seven are overhead and three underneath. There are four railroad crossings which include the Elgin, Joliet & Eastern, the Chicago & Milwaukee interurban electric lines branch from Lake Bluff to Rockefeller, the Kenosha division of the North-Western, and the Racine branch of the Chicago, Milwaukee & St. Paul. All of these will be interlocked. The three steam road crossings are to be all-electric

and that of the electric road probably mechanical. The line will be laid with 90-lb., 33-ft. rails. The 30-ft. rail has been standard on the North-Western heretofore. White oak ties and gravel ballast will be used throughout, the minimum depth of ballast under the ties being 12 in.

Although there are no towns on the line, six stations have been provided for. No names have been assigned to them and at the present time they are distinguished by numbers. No depots will be built as it is not expected that any local business will develop because of the proximity of the old line and of the Chicago, Milwaukee & St. Paul. These stations will have necessary passing tracks, a telegraph office, etc. Station 4, the crossing of the Kenosha division, will be the most important, because of the interchange of traffic between the two lines. It will have coaling and watering facilities, ash pits, etc., storage tracks, Y connections between the two lines, and a large building for employees. The other stations have two passing tracks, each 4,000 ft. long in the clear, giving capacity for 100 cars.

This new line, with its light grades and curves, will enable fully 30 per cent. greater loads to be hauled than the present line. It will be worked at first by the telegraph block system. Later on, if conditions require, automatic block signals will be installed. The completion of the line will relieve the present line of all through freight and passenger traffic. It will also permit a material reduction to be made in the running time of through trains between Chicago and Milwaukee, should such a condition become desirable or necessary. An interesting and important feature of the scheme is the flexibility of operation which will be afforded by the several connections between the two lines. These cross-connections will enable trains to be diverted from one line to the other as operating and traffic conditions require.

As already stated, construction work was actively begun May 1st. It is expected that the line as far as Kenosha division crossing will be completed and in operation not later than Dec. 1st of this year. This will relieve greatly the present line by cutting off from it the freight traffic to and from the west over the Rockford line. Most of the remainder will probably be completed this year, but the contractors have until July, 1906, to finish on account of the St. Francis hill cut, which is so situated that only one steam shovel can work on it.

The work is being done under the supervision of Mr. E. C. Carter, Chief Engineer of the Chicago & North-Western, Mr. C. T. Dike being Resident Engineer in charge of construction. The contract for clearing, grading, track-laying, surfacing and ballasting was let to Winston Brothers Company, Minneapolis, Minn.

Switch Engines for Bridge Service at Cincinnati.

The Chesapeake & Ohio recently placed in service eight locomotives of the type shown in the accompanying illustration, for use over the Cincinnati bridge. They pull heavy trains from Covington, Ky., on the C. & O., to Ivorydale, Ohio, on the C. H. & D. They weigh 142,500 lbs. in working order, have 20-in. x 28-in. cylinders with piston valves, and a tractive power of 30,600 lbs. Superintendent of Motive Power Walsh, of the C. & O., reports that in the three months that they have been in service they have given excellent results. They were built at the Richmond works of the American Locomotive Company.

Six-Wheel (0-6-0) Switching Engine for the Cincinnati Bridge.

Doctors and Damage Suits.

The following extracts are taken from a paper entitled "The Doctor and the Damage Suit," recently read at Galveston by Mr. T. Fay, General Manager of the Southern Pacific Texas lines, and printed in the *Houston Chronicle*:

According to the reports of the Railroad Commission, there have been paid by Texas railroads on account of personal injuries, from 1891 to 1904 inclusive, the following amounts:

1891	$223,749	1896	$187,102	1901	$1,455,573
1892	281,726	1897	172,799	1902	1,765,655
1893	295,012	1898	568,915	1903	1,940,551
1894	333,338	1899	655,739	1904	1,875,777
1895	164,768	1900	1,018,637		

The same authority gives for the fiscal year ended June 30, 1903:

Ratio of income to commission valuation of properties ..... 6.11 per cent.
Same year, ratio of payments for injuries to gross earnings ..... 3.09 per cent.

Startling as are these figures when considered only as an item of operating expense, they become a source of anxiety and even of alarm to the managements of this important commercial interest when compared with similar data from adjacent states and territories in which transportation conditions are substantially the same.

From data for the year 1899 supplied by a large number of railroad systems operated in the west and southwest, many of which are allied with railroad interests in this state, it appears that there were:

Outside of Texas ..... 1 injury for each 49 miles of road.
In Texas ..... 1 injury for each 14 miles of road.

	Per mile of road. Claimed.	Paid.
Outside of Texas amounts in suits were	$180.00	$9.48
In Texas amounts in suits were	1,208.00	82.94

By some of the lines operating systems both in and out of Texas in 1899, the following sums were paid for damages for personal injuries:

	Per mile of road.
Atchison, Topeka & Santa Fe, outside Texas	$4.19
Gulf, Colorado & Santa Fe, inside Texas	36.83
Missouri, Kansas & Texas, outside Texas	19.73
Missouri, Kansas & Texas, inside Texas	217.66
St. Louis Southwestern, outside Texas	2.29
St. Louis Southwestern, inside Texas	7.48
Southern Pacific (in 1902), outside Texas	20.00
Galveston, Harrisburg & San Antonio (in 1902), inside Texas	500.00

Not long since I had occasion to examine the record of an accident which occurred in the northern part of the state. The facts of the accident and the responsibility of the company were clear enough; a collision in the yard between a switch engine and a passenger train. One of the passengers hastened to his home and employed a lawyer, and within three days from date of accident filed suit for heavy damages. Representatives of the company endeavored to adjust plaintiff's claim for injuries, and asked permission for a medical examination by its chief surgeon, or by any reliable disinterested physician, with the view of ascertaining what would be a fair compensation. This was refused by both the attorney and his client; later on, however, the attorney submitted for consideration of the company an opinion of the patient's family physician, offering it as the only basis upon which an adjustment could be made. The opinion read as follows:

"Traumatic injury of spine; partial paralysis of lower extremities; nervous system a perfect wreck; never will be able to perform any labor requiring use of lower extremities; bladder and sexual trouble as consequence of injury to the spinal nerves; Mr. ——— is a physical and nervous wreck."

As the company was clearly liable, and had no other or better medical evidence, it paid $9,500 in settlement, and the patient, cured, as by a miracle, returned to his work, and has ever since been earning the same wages in the same line of employment as before the accident.

Another case is that of a fireman who was injured in West Texas, and brought suit for damages, claiming total paralysis of lower extremities. He was brought into court in a wheel chair, and by agreement of physicians, three of whom were appointed by his lawyers and four appointed by the company. The plaintiff's physicians testified positively that he was paralyzed, and would never walk again. Those appointed by the company testified that he was not paralyzed. A sympathetic jury believed plaintiff's phy-

sicians and gave a judgment of $15,000, which was paid by the company. Some months afterwards plaintiff was seen in the back yard of his house chasing stray chickens off his premises.

Another case was that of injury to an engineer in East Texas in a collision. The usual claim, "spinal-nervous injury," was made, which was supported by the usual medical testimony. The jury awarded him $8,000 and very soon after the money was paid he actively engaged in business, and has ever since enjoyed good health.

A freight conductor who was injured in East Texas in 1902 claimed to have sustained an injury to his nervous system, and received in involuntary settlement $1,850. The following year he was again injured and his nervous system was again deranged; he also alleged that his hearing was greatly impaired. In support of these claims he furnished certificates of several physicians. The company paid him $2,300 and a few months after this he entered the service of another company in the eastern part of the state as conductor of a construction train.

In the spring of 1904 this same man entered the service of a railroad company in the northern part of the state as switchman, and was again injured, this time claiming that the handhold on a freight car had pulled loose, allowing him to fall to the ground, striking his back, with result that his nervous system was again shattered.

An investigation of his former history showed that some four years before he had sued a railroad company for damages for injuries sustained by reason of a fall from a freight car on account of alleged defective hand-hold. The injuries complained of in the petition were "shattering of the nervous system and loss of manhood." The company settled with him and his attorneys for $800 and he left the service. In view of this fact the last company refused to make any payment for the injuries received, and a suit was instituted. The suit was continued several times, and it was ascertained that while the suit was pending he engaged in the railroad service at another point in the state, and his nervous system was again ruined, and his manhood again lost in another hand-hold accident, this being the third accident of that character in which the nervous system of this unfortunate man had been wrecked.

Another case was that of a passenger who claimed that in the spring of 1903 he was injured by slipping on a banana peel which had been carelessly left in one of the coaches, the result of which was injury to the "spine." This claim was declined by the company and a suit was instituted. Investigation of the claimant's history showed that some three years before he had a suit against another railroad for injuries alleged to have been received in a collision. The jury awarded a verdict of $2,500. While the motion for a new trial was pending the plaintiff, believing himself secure from observation, abandoned the use of his crutches, and was seen running to catch a train at the station not far from the place where the suit was pending. When these facts were brought to the attention of the court a new trial was granted.

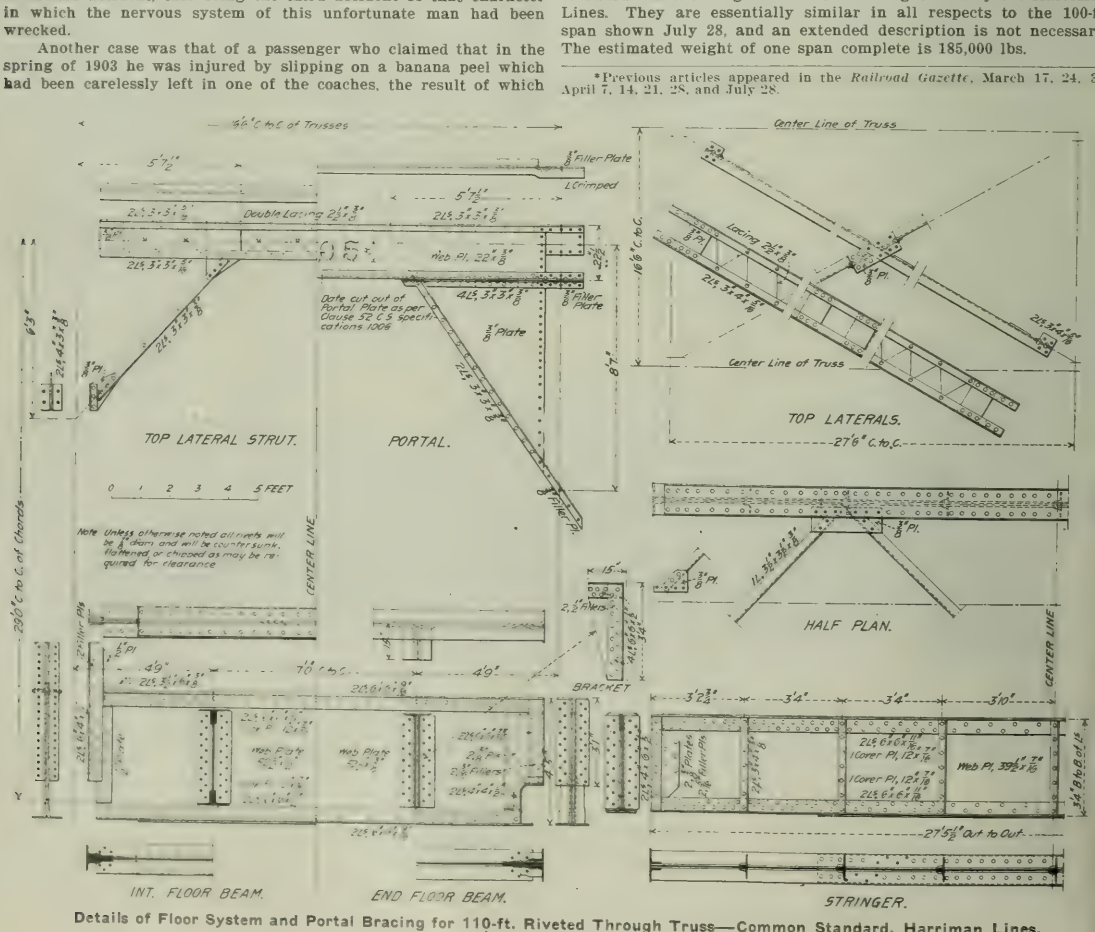
While the banana suit was pending the plaintiff moved into a remote part of the state and went into hiding. He was traced and found hard at work as a fireman at a cotton gin, his duties requiring the exercise of all his muscular powers. It was also found that after the banana peel accident he had made application to an insurance company and represented to it that he was in good health, a statement which was corroborated by the examining physician of the insurance company. The testimony of witnesses as to these facts was procured, and upon seeing the depositions on file the suit was dismissed.

I will mention but one other case which, although like most of the others, is rather remarkable in one respect: The sufferer in this instance was a brakeman who claimed to have been injured in a derailment on one of the lines leading out of Houston. The usual claim of injury to the "spine" and nervous system was made, also inability to perform manual labor—all of which was supported by medical evidence. The company paid in settlement $4,500 after suit had been instituted. Within three months from the payment of the money this physical wreck took the first prize in a cattle roping contest held in one of the cities in North Texas. I believe that the record shows that he roped, threw and tied a steer in 27 seconds.

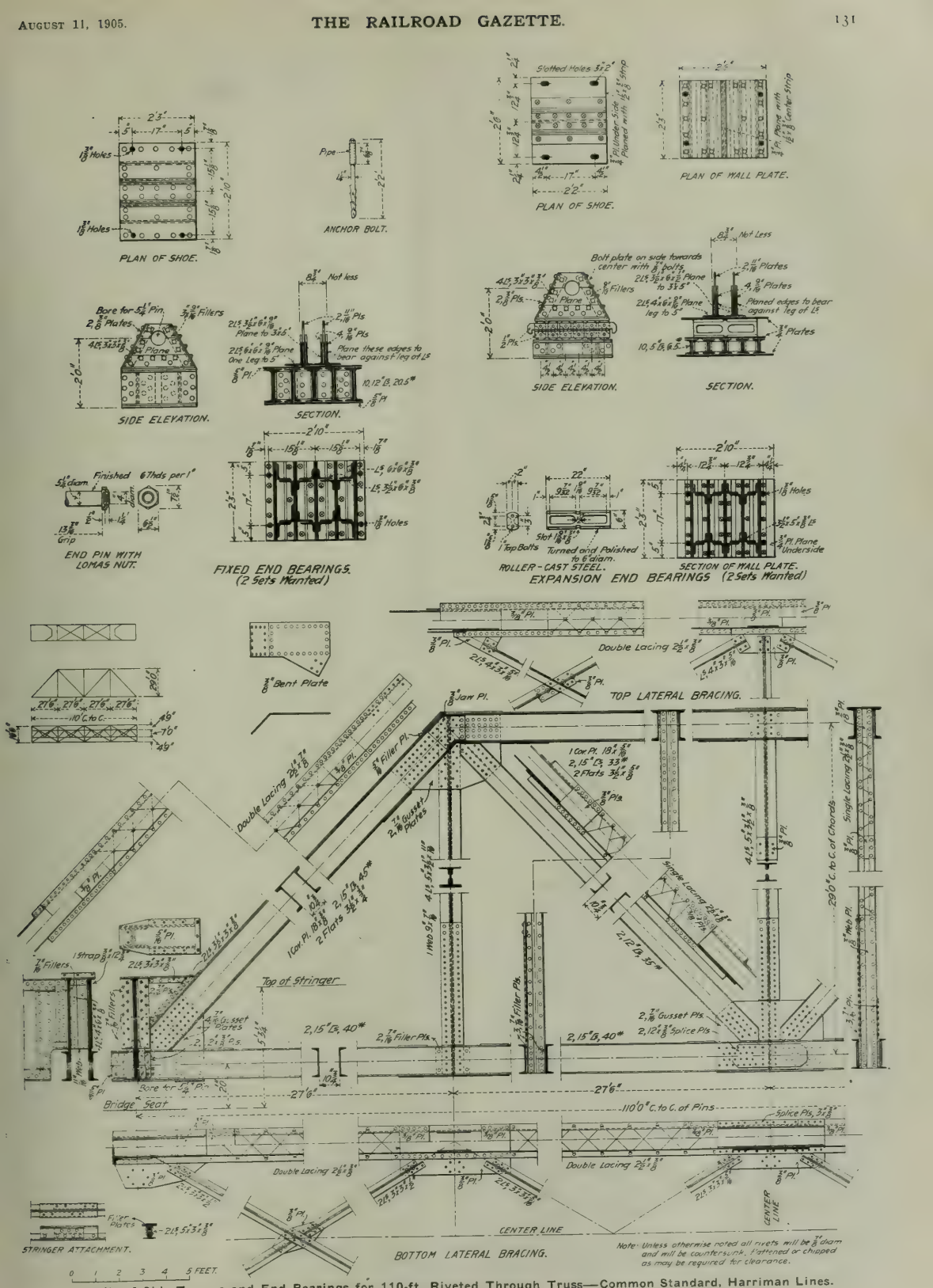
Standard Bridges on the Harriman Lines.*

The accompanying drawings show all the details of the common standard 110-ft. through riveted truss bridges used by the Harriman Lines. They are essentially similar in all respects to the 100-ft. span shown July 28, and an extended description is not necessary. The estimated weight of one span complete is 185,000 lbs.

*Previous articles appeared in the *Railroad Gazette*, March 17, 24, April 7, 14, 21, 28, and July 28.


TOP LATERAL STRUT.
PORTAL.
TOP LATERALS.
HALF PLAN.
INT. FLOOR BEAM.
END FLOOR BEAM.
STRINGER.
CENTER LINE.
Center Line of Truss
Center Line of Truss
Double Lacing
Web Pl. 22"x 3/8
Date cut out of Portal Plate as per Clause 52 C.S. specifications 1906
3/8" Plate
Filler Plate
Lacing
Web Pl.
Note Unless otherwise noted all rivets will be 7/8" diam. and will be countersunk, flattened, or chipped as may be required for clearance
BRACKET
Web Pl. 39 1/2"x 7/8
27'5 1/2" out to out
27'6" c. to c.

Details of Floor System and Portal Bracing for 110-ft. Riveted Through Truss—Common Standard, Harriman Lines.



Note: Unless otherwise noted all rivets will be ⅞" diam and will be countersunk, flattened or chipped as may be required for clearance.

Details of Side Trusses and End Bearings for 110-ft. Riveted Through Truss—Common Standard, Harriman Lines.

Street Railroad Statistics for 1904.

The following is an abstract of statistics of street and interurban (including elevated) railroads in the United States, taken from the statistical tables prepared by the *Street Railway Journal:*

For the sake of brevity only the leading states in each group are named. The New England group in the original embraced the six New England states. The Eastern states were New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Maryland, Virginia and West Virginia. The Central states were Michigan, Ohio, Indiana, Kentucky, Wisconsin, Illinois, Minnesota, Iowa and Missouri. The Southern states were the Carolinas, Georgia, Florida, Alabama, Mississippi, Tennessee, Louisiana and Arkansas, and the Western states were the Dakotas, Nebraska, Nevada, Kansas, Indian Territory, Oklahoma, Texas, Colorado, Montana, New Mexico, Idaho, Utah, Washington, Oregon, California and Arizona.

It will be seen that the Central states have the most electric mileage and the Southern states the least. Of the individual states, Ohio leads, with 3,181 miles; New York is second, with 3,175, and Pennsylvania, with 3,142, is third. Each of these states has more electric mileage than the aggregate of the entire western group of 17 states and territories. Except for California, none of this western group has as much as 350 miles, and only seven of the 17 have as much as 100 miles. Every state and territory is now represented, although in 1903 South Dakota, Nevada and New Mexico had no electric mileage. South Dakota only had four miles in 1904, and Nevada five miles. The nine central states have over seven times as much mileage as the nine southern states.

Of the entire street railroad mileage in the country, 97 per cent. was worked by electricity in 1904, the chief instances of horse, cable or dummy lines being in New York, Chicago and San Francisco. It must be recollected that all the figures given are for track mileage; not for route mileage, which would aggregate considerably less, owing to the prevalence of double track in cities. The average capitalization, total of stocks and bonds, per mile of track throughout the country, was $108,876; the average capitalization in Massachusetts, where the issuance of securities is closely watched by the railroad commission, was $49,158. The average capitalization (stocks and funded debt) per mile of *track* of the steam railroads in the country was approximately $45,683, in 1903.

Street and Elevated Railroad Mileage, Cars, and Capitalization, 1904.

States.	No. of roads. 1904.	Track mileage, Electric roads. 1904.	Electric roads. 1903.	Cable, steam and horse 1904.	1903.	Motor cars. 1904.	1903.	Grip cars and locomotives 1904.	1903.	Capital stock. 1904.	1903.	Funded debt. 1904.	1903.
New England States.													
Massachusetts	73	2,734	2,621	...	...	7,305	7,203	.....	.....	$90,339,065	$88,708,718	$44,061,000	$43,744,000
Total	149	4,606	4,410	3	3	10,495	10,188	.....	.....	150,773,018	146,369,821	103,950,405	101,110,300
Eastern States.													
New York	106	3,192	3,175	137	159	12,013	11,788	34	122	336,032,395	324,496,117	299,637,590	298,226,060
New Jersey	35	1,108	1,025	8	8	2,012	1,939	2	28	87,828,290	86,089,160	78,477,600	74,836,090
Pennsylvania	124	3,319	3,142	..	..	7,024	7,298	..	..	231,355,495	224,518,826	163,117,714	153,177,559
Total	318	9,156	8,840	145	169	24,851	24,633	36	150	743,568,286	719,517,409	657,775,404	640,791,768
Central States.													
Michigan	30	1,203	1,199	..	..	1,832	1,796	..	..	39,987,000	39,920,000	44,139,500	42,474,000
Ohio	98	3,437	3,181	2	6	4,544	4,499	..	4	178,959,000	174,910,550	106,434,500	95,182,100
Indiana	45	1,360	1,197	7	7	1,389	1,246	..	..	54,532,500	48,605,900	50,182,500	42,189,000
Illinois	55	1,986	2,080	97	117	4,571	4,378	470	467	174,059,650	168,807,910	112,639,500	107,724,000
Total	313	10,060	10,728	144	168	17,665	17,215	657	658	595,615,345	571,070,355	457,373,850	425,955,156
Southern States													
Georgia	13	356	338	7	6	468	459	..	..	19,588,000	19,441,000	16,988,000	16,793,000
Tennessee	10	292	285	7	7	498	456	14	13	9,778,500	9,674,500	10,460,500	9,708,625
Total	83	1,495	1,408	48	56	2,556	2,382	20	18	90,293,500	88,111,300	81,765,500	78,020,125
Western States													
California	38	1,668	1,321	151	150	1,545	1,420	527	595	92,761,750	86,560,400	79,498,000	78,042,000
Texas	19	400	349	11	9	656	562	..	..	15,884,500	15,807,500	14,693,000	11,979,000
Total	130	3,563	3,036	299	306	4,058	3,723	644	721	181,321,463	167,719,413	154,655,000	143,587,000
Total, United States	993	29,548	27,754	639	702	59,625	58,141	1,357	1,547	$1,761,571,812	$1,692,788,298	$1,455,520,159	$1,389,464,349

Of the coal shipments of the three principal coal regions of Germany were 3,215,954 ten-ton carloads in the first five months of this year, against 3,364,782 last year. A miners' strike greatly reduced the shipments in the principal region for several weeks, which were but partly made up by increased shipments from another district. In May the shipments were one-sixth greater than last year, and greater than ever before. The iron industry suffered less by the strike than was expected, and the production of pig iron has been about the same as last year. The coal miners estimate that about 4 per cent. more coal and 8 per cent. more coke will be produced in 1905 than in 1904.

The Cost of Locomotive Operation.

IX.

BY GEORGE R. HENDERSON.

(*Continued from page 68.*)

LUBRICANTS.

The cost of lubricating locomotives is usually not over 1 per cent. of the locomotive expenses, but nevertheless it generally receives as much attention as the cost of fuel—and sometimes a great deal more. When we consider that the latter (fuel) ordinarily runs into expense 30 or 40 times as fast as oil, there seems to be little reason for this anomalous fact unless it be the peculiar conditions under which lubricants are purchased. Very often there is an agreement with the oil company that lubrication will be effected for a specified figure, and whatever is used over that amount (per engine mile) is supplied free of cost—that is the extra cost as represented by the excess of oil used is refunded to the railroad when the annual settlement is made. At first sight this would seem to minimize the anxiety to make a *good oil record,* but the incentive lies in the fact that when the contract is renewed in one, two or five years time, if the refunded amounts have been large the unit price is increased.

As an illustration: A certain railroad was working under a guaranteed cost of oil for locomotives at $1.20 per 1,000 engine miles. The year before the contract expired, owing largely to an increase in the size of locomotives used by liberal purchases of heavier power, the cost (as charged out at the agreed prices) ran in the neighborhood of $2.00. While the amount necessary to reduce the cost during the life of the contract was promptly forthcoming, the price was raised in the new contract to $1.82. These statements and documents passing constantly through the hands of the officials are no doubt responsible for the alertness with which oil consumption is watched, as no such arrangement obtains with fuel. In fact, this supervision is carried to such an extreme that at times there is no doubt that a great deal more is expended in fuel and repairs, due to excessive friction and wear, than is saved by economizing in oil; on the other hand there is probably no article used about locomotives that is ordinarily handled as wastefully and ignorantly as lubricating oil, as is seen by the inspection of almost any roundhouse or standing yard.

Quality.—As in other articles of commerce, all kinds of oil can be obtained, although at the present time the supply has narrowed nearly down to one make of locomotive lubricant. We do not mean, of course, one grade of oil for different purposes, journals and cylinders for instance, but that the supply comes from one firm. Some years ago when competition existed it was customary for railroads to purchase oil on their own specifications, but there is comparatively little of this done at the present time.

Ordinarily a high priced oil will afford better lubrication than a low priced oil, and if all the material went where it was intended

to go, there might even be economy in using the high grade and more expensive article, but when we contemplate the manner in which locomotives are often oiled, and consider what proportion goes upon the track, or any place but the journal, the high priced material does not seem so economical. On account of the difficulty of access of many parts of the engine, and the frequent need of oiling moving parts while the locomotive is in motion, by means of a long spout can when lying on the running board, it is not to be wondered at that much is dropped on the roadbed, and this could just as well be a cheap product. These wastes will always be more or less inseparable from locomotive operation, and the recognition of this fact probably accounts for many lines using *car oil* on locomotive bearings.

Usually the locomotive lubricants consist of four distinct grades, at about the following prices:

Cylinder oil	48 cents per gallon.
Engine oil	28 " " "
Car oil	18 " " "
Grease	4 " " pound.

Of course, these are liable to fluctuation. Besides a saving of two cents a gallon can usually be made by taking the oils in tank car lots, thereby saving the cost of the barrel, generally $1, holding 50 gallons.

The cylinder oil is compounded to stand high pressure steam temperatures, and is supposed to remain stable up to 600 deg. Fahrenheit. It is not suitable for journals, although it is very difficult to prevent the men applying it to bearings when they run hot. It is apt to cause hot driving boxes by clogging up the oil passages, as it will not run when cold, and this improper use of a high priced article adds to the expense. Its sole use should be upon the valves and cylinders of the locomotive and air pump.

Engine oil is intended for the journal bearings and all running parts, and car oil for the tender journal boxes. However, some roads, as hinted above, use car oil for freight and switching engines, and *engine oil* for passenger locomotives only, thus saving 10 cents a gallon and keeping down the cost of lubrication accordingly.

Perhaps grease for crank pins, and lately for driving boxes, has done more for the hot box evil than any one thing in locomotive practice. It not only seems to take a great deal less to lubricate the bearings, but there is not the same chance for waste, the material is not thrown all over the wheels by the motion of the rods, and the heating of journals has been greatly reduced. It has been claimed that grease wears the pins and brasses faster than oil, and while this may be really true, it is a fact that there is less heating with the grease, whereas with oil, when the box becomes hot, it has to be reduced and refitted, and one such operation will remove as much brass as will wear off from the use of grease in running a great many miles.

Loss.—As above indicated, there is always more or less loss with oil, and it is very difficult to eliminate this feature. As express trains generally make very short stops, it is customary for the engineer to run over one side and the fireman over the other (unless he is engaged in taking water), and the supply is more apt to be liberal than systematic. Then there is a decided tendency, when anything runs hot, to apply cylinder oil, very much greater in cost than the engine oil, and large quantities are so used. Very often the packing (greasy waste) is removed from a journal box, which has been only recently packed, and much oil is thus wasted.

Some lubricators feed very irregularly, perhaps flooding the valves at one time, and allowing them to run dry another. Perhaps the force pump is the most regular of the several devices on the market for the purpose of cylinder lubrication, as this delivers an amount which is constant and determinate. The waste does not occur altogether on the engine, as some oil houses with oil soaked floors will attest. The receipt of oil in tank cars ordinarily stops most of the waste due to leakage, but even here it is necessary to look out for water in the oil. Sometimes it comes over with the compressed air used for elevating from the tank in the basement to the supply faucet, and sometimes with that used to force it quickly out of the tank car into the storage tanks. Modern methods of handling oil, however, have greatly reduced the item of loss in this process, and have also diminished the cost of labor, so that it is perhaps unnecessary to add any appreciable figure to the price of the oil to cover this point.

Hauling.—Generally this will add a very small proportionate expense to the cost of the oil. If purchased in barrels of 50 gallons each, the weight per barrel will run about 400 lbs., or one-fifth of a ton. At one-half cent per ton-mile rate of transportation, the barrel would cost therefore $^1/_{10}$ cent per mile, and a 500 mile haul 50 cents. If the average cost of the oil used was 25 cents per gallon, a barrel would be worth $12.50, or with the haul included $13, or 26 cents a gallon, 4 per cent. increase for the 500 mile haul, or approximately we may expect an increase in the *actual cost* of 1 per cent. per 100 miles hauled.

If the oil is received in tank cars the car must probably be returned to the point of delivery, in which case the cost of so doing should be added. However, as an approximate figure, it is believed that above mentioned allowance of 1 per cent. per 100 miles hauled will be ample.

Quantity.—If there was no waste, the quantity of oil used would be quite small. At the 1904 meeting of the Master Mechanics Association it was stated by Mr. M. K. Barnum that from tests which he had made he believed that of all the oil applied to locomotive bearings not more than one-tenth part does the actual work of lubrication! However, we will try to determine what amounts could be expected under various circumstances, and first take up cylinder or valve oil.

Naturally, the size of the cylinder and number of strokes should cause an appreciable effect upon the amount needed for lubrication, therefore the larger the cylinder the more oil that would be required. So also if the drivers were smaller and a greater number of strokes of the piston were required in traversing a given distance, the amount of oil would be increased. Thus as an ordinary rule, on account of smaller wheels, freight engines would be expected to use more oil in a given distance than passenger engines with the same size cylinders. It seems probable that the amount of work done by the pistons (outside of that depending upon their size and speed) only slightly affects the oil consumption; that is to say, as much would be required if working at one-quarter as at three-quarters cut-off. It is well-known that the most important time to lubricate the valves and cylinders is while running down grade with the throttle closed, the reason for this being that dry steam acts partly as a lubricant itself, and this is absent when the throttle is closed. Therefore it comes about that locomotive lubricators are adjusted as nearly as possible to give equal feeds whether the throttle valve is open or closed. This would indicate that the "engine mile" is the proper unit for basing the cylinder oil consumption of any particular engine, though as the tonnage hauled depends upon the size of the cylinders the ton-mile unit is satisfactory for comparing engines of different power.

If we simply consider, then, the size of the cylinder, and the class of service in which an engine is working, we can tabulate what might be considered a fair average for an engine to make per pint of valve oil.

Engine.	Service.	Cylinder diameter.	Miles per pint.
Simple.....	Passenger	17 or 18 inch.	150
"	Freight	17 " 18 "	100
"	Passenger	19 " 20 "	120
"	Freight	19 " 20 "	80
"	Passenger	21 " 22 "	90
"	Freight	21 " 22 "	60
Compound...	Passenger	16 and 26 inch	110
"	Freight	16 " 26 "	75
"	Passenger	17 " 28 "	90
"	Freight	17 " 28 "	60

Ordinarily only the most careful men will attain these figures, and the poorer ones will fall considerably below them. Thus on a large road in the northwest the month of November, 1899, showed for the divisions using the heavier passenger and freight engines, with 19 and 20-in. cylinders, averages of 63, 82 and 91 miles to a pint respectively for each division, these values being the average of freight and passenger service, and on the divisions using mostly 18 and 19-in. engines 108, 81, 105 and 122 miles to a pint. On a road in the southwest, during May, 1903, on one division we found for 18-in. engines in passenger service from 134 to 142 miles to a pint for 20-in. engines, 72 to 105 miles, and for 17 and 28-in. compounds from 50 to 123 miles per pint of oil. In freight service on the same division, the mileage ran for 18-in. engines 68 to 96 miles, and for 17 and 28-in. compounds from 25 to 81 miles per pint of cylinder oil. These figures give an idea of the irregular manner in which the consumption of oil varies with different men, and the very large effect of their "personal equation." It is quite a common thing to find engineers with absolutely no idea of the amount of oil that should be fed to an engine, and allowing the lubricator to work six or eight times as fast as it properly should, and these circumstances must be taken into account when estimating the probable average consumption.

The amount of engine oil (for bearings) should properly bear some relation to the work performed, as when working hard there is no doubt that more oil is needed, but a distinction like this is very hard to make. The quantity needed by engines of various sizes and types should undoubtedly depend upon the size of the cylinders and the number of journals, as well as the weight of the engine. But these, in a measure at least, are dependent largely upon the size of the cylinder. The number of revolutions is governed by the size of the wheel, and in going a given distance will ordinarily be greater for freight than for passenger locomotives. As there is a great uncertainty how much engine or lubricating oil will be used in any case, we therefore observe that we are practically able to use the same basis for estimates as we did with cylinder oil, viz., cylinder diameter and class of service.

By comparing different reports we find that there is ordinarily four times as much engine oil as valve oil used in a given distance, or the mileage to a pint is one-fourth that of cylinder oil. In freight service it may run nearer to one-third. Thus on the division above

cited the averages for several groups or runs of passenger engines were:

Valve oil.	Miles to a Pint of Engine oil.
85	19
71	19
102	30
120	27

and for freight locomotives.

Valve oil.	Miles to a Pint of Engine oil.
79	24
55	29
80	33
16	14
29	12
33	11
66	20

Some of these values are extremely low; these were taken from the "pool freights," which generally show less economy in lubrication, as in other supply charges.

If we take the northwestern road by divisions (passenger and freight not separated) we have:

Valve oil.	Miles to a Pint of Engine oil.
91	27
82	21
65	25
108	27
81	30
99	25
105	37
93	34
91	38
122	51

Showing that our assumption of four times the amount of valve oil in passenger service and three times in freight, for the quantity of engine oil, is sufficiently close.

As we have stated above, grease is now quite commonly used as a partial substitute for engine oil. So far, it has only been generally applied to crank pins and driving and truck journals. For these purposes it has been eminently satisfactory, and has reduced the cost of lubrication. In rod cups one filling will run for 500 miles or more. Consolidations have been operated using only one-eighth pound of grease for 100 miles, a service which formerly required a pint of oil. As for equal weights the costs of grease and engine oil are generally the same, the apparent saving is great. In driving boxes it has been found that 2½ ounces per 1,000 miles per box have been sufficient, and 1½ ounces for truck boxes, the cost being about one-tenth that of oil, and with less trouble from heating.

If we take the prices for oil given previously, we can work up the estimated cost per engine mile, either by assuming that the journal lubrication is entirely of engine oil or so much grease that it cuts the cost of journal lubrication in half, and obtain the following totals for the classes of engines just given.

Estimated cost for cylinder and engine oil per 1,000 miles, taking cylinder oil at 48 cents and engine oil at 28 cents per gallon, and allowing four gallons of the latter to one of the former in passenger service, and three to one in freight, also allowing for use of grease at half rate of engine oil.

Engine.	Service.	Cylinder diam.	Grease. Without.	With.
Simple	Passenger	12 or 18 inch.	$1.31	$0.87
"	Freight	17 " 18 "	1.65	1.12
"	Passenger	19 " 20 "	1.67	1.08
"	Freight	19 " 20 "	2.07	1.41
"	Passenger	21 " 22 "	2.23	1.45
"	Freight	21 " 22 "	2.68	1.84
Compound	Passenger	16 and 26 "	1.82	1.18
"	Freight	16 " 26 "	2.19	1.49
"	Passenger	17 " 28 "	2.23	1.45
"	Freight	17 " 28 "	2.68	1.84

These figures may be taken as a guide, but not as absolutely correct, as conditions may vary them considerably. Thus it was found that the fast mail on one of our principal roads used three times as much oil as the average of the passenger trains over the division, the engineer being particularly anxious that no delay should occur due to hot bearings. It is likely, however, that he used amounts greatly in excess of his actual needs. This would indicate that high-speed trains are likely to use more oil than slow-speed trains for the same amount of power developed. The effects of grade apparently are very slight upon oil consumption, as it requires about as much when running down hill as up grade.

The temperature has, no doubt, considerable influence upon the conditions of lubrication, and it is usual to use summer and winter grades of lubricating oil—the latter is much thinner, and if applied in warm weather will give trouble by running off, and also not providing sufficient viscosity for the separation of bearing and journal. These results, however, are too indefinite to embody them in estimates of cost.

(To be continued.)

Standard Length of Brake Beams.

At the last convention of the Air Brake Association a recommendation was adopted "That the length of brake beams for standard gage cars be not less than 59¾ in. and not more than 60 in. from center to center of brake heads." This recommendation was considered by the committee on Standards and Recommended Practice of the Master Car Builders' Association and embodied in its report to the Association at the Manhattan Beach convention last month with the recommendation that the present standard of 60½ in. be changed accordingly. Along with other sections of the report it was referred to letter ballot for adoption by the M. C. B. Association. That there is some question about the advisability of making the proposed change is evidenced by the fact that the Chicago Railway Equipment Company is now sending out to the railroads a circular letter and a drawing showing the relative positions of the brake shoes on the wheel treads with heads mounted 59¾, 60, 60¼ and 60½-in. centers. The following is an extract from the letter accompanying the drawing which is also reproduced herewith:

"It will be noticed that 60½ in. is the most desirable position, if maintained. One of the real difficulties is that many brake beams are over 60½-in. centers: again the method of hanging—whether

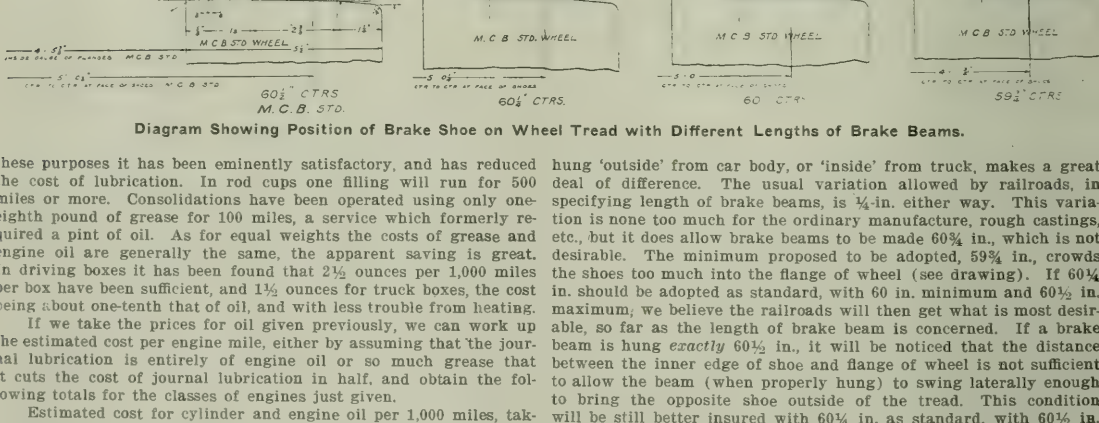


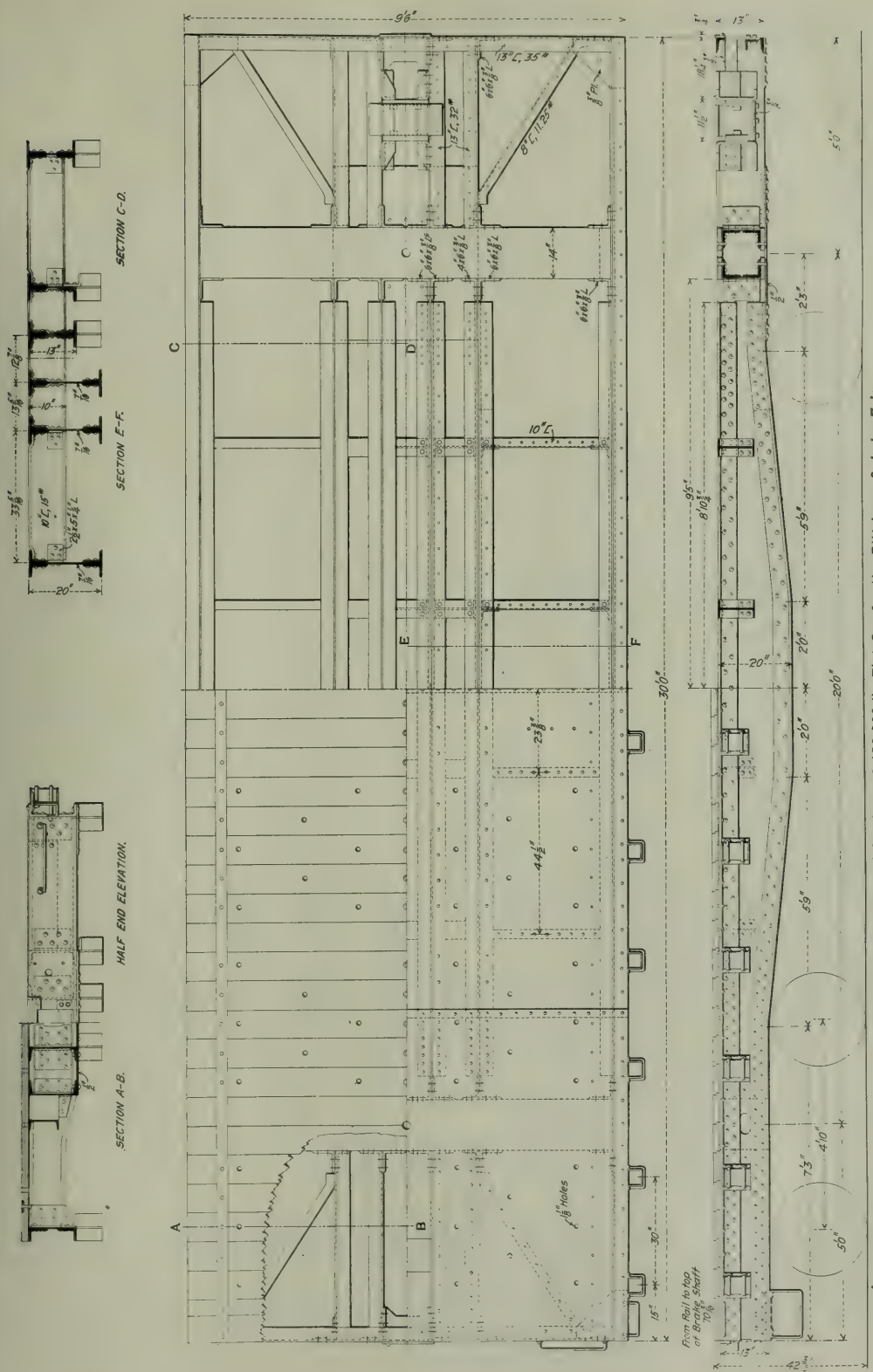
Diagram Showing Position of Brake Shoe on Wheel Tread with Different Lengths of Brake Beams.

hung 'outside' from car body, or 'inside' from truck, makes a great deal of difference. The usual variation allowed by railroads, in specifying length of brake beams, is ¼-in. either way. This variation is none too much for the ordinary manufacture, rough castings, etc., but it does allow brake beams to be made 60¾ in., which is not desirable. The minimum proposed to be adopted, 59¾ in., crowds the shoes too much into the flange of wheel (see drawing). If 60¼ in. should be adopted as standard, with 60 in. minimum and 60½ in. maximum, we believe the railroads will then get what is most desirable, so far as the length of brake beam is concerned. If a brake beam is hung *exactly* 60½ in., it will be noticed that the distance between the inner edge of shoe and flange of wheel is not sufficient to allow the beam (when properly hung) to swing laterally enough to bring the opposite shoe outside of the tread. This condition will be still better insured with 60¼ in. as standard, with 60½ in. the maximum and 60 in. the minimum."

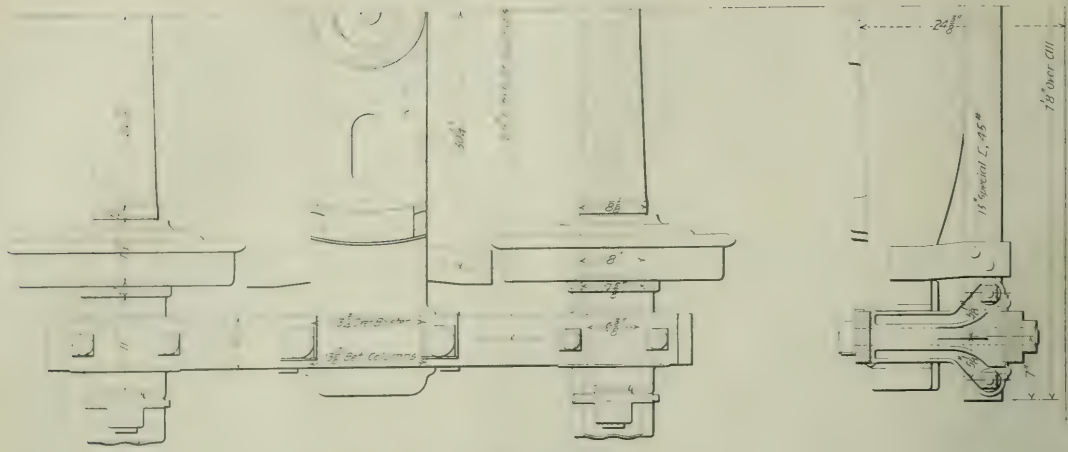
150,000-lb. Flat Cars for the Pittsburg & Lake Erie.

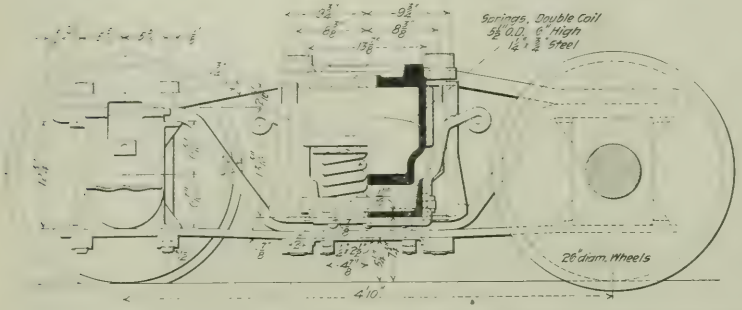
The Pittsburg & Lake Erie has recently built at its McKees Rocks shops two steel underframe flat cars which have a capacity of 150,000 lbs. They are intended for carrying heavy irregular castings, large ingots, etc., in and around the mill districts of Pittsburg. As will be seen from the accompanying drawings there have been embodied in their design a number of radical departures from usual practice in steel car building. No attempt has been made to simply re-inforce a 100,000-lb. underframe to give additional strength, but the cars have been built uniformly heavy and strong in every part. The weight is in consequence quite high for so short a car, being 48,200 lbs. as against 47,500 lbs. for the 60-ton flat car 40 ft. long built about two years ago for the General Electric Company by the American Car & Foundry Company.

The underframe consists of continuous fish-bellied side sills, heavy box section bolsters, 13-in. channel end sills, four center sills between the bolsters, and four draft sills at each end between the bolsters and the ends, the whole being covered with a ¼-in. floor

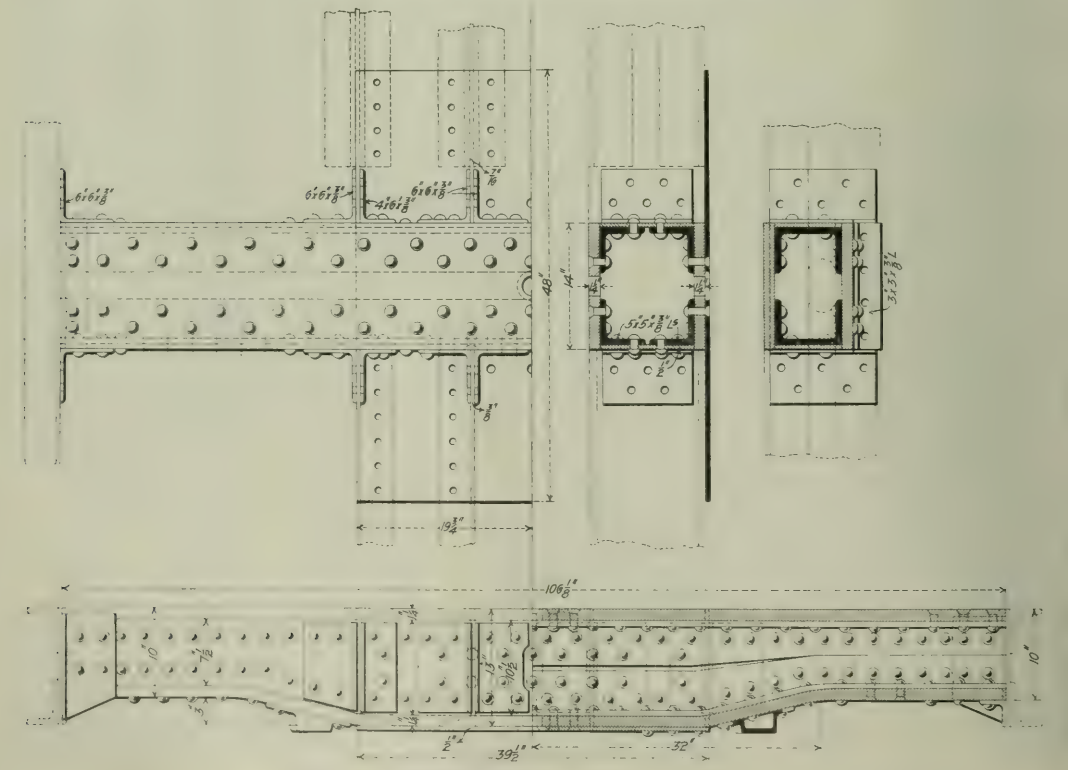


Plan, Elevations and Sections of 150,000-lb. Flat Car for the Pittsburg & Lake Erie.





Arch Bar Truck for Pittsburg & Lake Erie Flat Car.



Bolster for 150,000-lb. Flat Car, Pittsburg & Lake Erie.

plate on which the plank floor is laid. The side sills are 20 in. deep at the center and 13 in. deep at the ends, and are built up from a 7/16-in. web plate and four 5-in. x 3½-in. x 5/8-in. angles. The ends of the web plates are turned in and riveted to the back of the end sill channel webs and floor gusset plates have also been used to keep the corners square.

The bolsters are particularly heavy, as will be seen from the detail drawing. They are built of solid box section with 1¼-in. top and bottom plates, ½-in. side plates and 5-in. x 5-in. x 5/8-in. angles in each corner. At the center they are 13 in. deep tapering to 10 in. at the ends, where they are secured to the side sills with two heavy corner angles and a shelf angle underneath. The four sills between the bolsters and end sills, two of which are draft sills, are 13-in., 32-lb. channels riveted in with the usual angle connections consisting of short lengths of 6-in. x 6-in. x 3/8-in. angles. An 8-in. channel diagonal brace ends in from near the extremities of the end sills to the center longitudinal sills just in front of the bolster.

The four center sills are grouped close together and are not continuous over the bolsters. They are built up with the same I section as the side sills, but the angle flanges end 6¼ in. short of the back face of the bolsters. The web plates are brought up tight and riveted between two 6-in. x 6-in. x 3/8-in. angles. At this point the principal stress is vertical shear and the webs being 7/16 in. thick by 13 in. deep have ample strength to resist. A ½-in. plate 48 in. long by 39½ in. wide is riveted under the bottom of the bolster and the longitudinal sills to tie the whole structure together at this vital point. For the cross-bearers, of which there are four between the bolsters, 10-in. channels are used between the side sills and outside center sills and I-beam sections as fillers between the four center sills. The 2¼-in. deck planking is secured to the steel floor by three ½-in. x 3-in. strips of wrought iron running the length of the car bedded flush with the top surface and fastened with ¾-in. countersunk head bolts. At a large number of places in the floor 1⅛-in. holes have been drilled to allow for securing the load on the car and stake pockets are also provided.

The trucks used under these cars are of extra heavy design. They are of the diamond arch-bar type with special cast-steel bolsters. The top arch-bars are 1¾ in. x 6 in., the inverted arch-bars 1⅝ in. x 6 in. with gibbed ends, and the bottom tie bars are ⅞ in. x 6 in. The column bolts are 2 in. in diameter and the box bolts are 1½ in. in diameter. Four double-coil springs 5½ in. outside diameter and 6 in. of 1¼-in. and ¾-in. rods are used under each end of the bolster. The journals are 6⅝ in. x 11 in. and the wheels are 26-in., steel-tired.

We are indebted to Mr. L. H. Turner, Superintendent of Motive Power of the Pittsburg & Lake Erie, for the drawings and information. The cars were designed under his direction by Mr. W. P. Richardson, Mechanical Engineer of the road.

Reinforced Concrete.*

The justification of the use of reinforced concrete is usually based on some one or all of three conditions. First, under some circumstances it is actually more economical than any other rational method of construction. Secondly, there are cases where it is almost the only practicable method of construction. Thirdly, there are cases where it is simply preferable. It is not very easy to demonstrate the economy of this method except by comparative cost in individual cases, but an approach to a systematic comparison may be made as follows: A cubic foot of steel weighs 490 pounds. Assume as an average price that it can be bought and placed for 4.5 cents per pound. The steel will therefore cost $22.05 per cubic foot. On the basis that concrete may be placed for $6.00 per cubic yard, the concrete will cost 22 cents per cubic foot, which is 1 per cent. of the cost of the steel. Therefore, on this basis, if it is necessary to use as reinforcement an amount of steel whose volume is in excess of 1 per cent. of the additional concrete which would do the same work, there is no economy in the reinforcement, even though the reinforcement is justified on account of the other considerations. Assuming 500 pounds per square inch as the working compressive strength of concrete, and 16,000 pounds as the permissible stress in steel, it requires 3.125 per cent. of steel to furnish the same compressive strength as concrete. On the above basis of cost, the compression is evidently obtained much more cheaply in concrete than in steel—in fact, at less than one-third of the cost. On the other hand, even if we allow 50 pounds per square inch tension in the concrete and 16,000 pounds in the steel, it only requires 0.31 per cent. of steel to furnish the same strength as the concrete, which shows that, no matter what may be the variation in the comparative price of concrete and steel, steel always furnishes tension at a far cheaper price than concrete, on the above basis, at less than one-third of the cost. The practical meaning of this is, on the one hand, that a beam composed wholly of concrete is usually inadvisable, since its low tensile strength makes it uneconomical, if not actually impracticable, for it may be readily shown that, beyond a comparatively short span, a concrete beam will not support its own weight. On the other hand, on account of the cheaper compressive stress furnished by concrete, an all-steel beam is not so economical as a beam in which the concrete furnishes the compressive stress and the steel furnishes the tensile stress. This statement has been very frequently verified when comparing the cost of the construction of floors designed by using steel I-beams supporting a fireproof concrete floor, and that of a concrete floor having a similar floor slab but making the beams as T-beams of reinforced concrete.

Another instance of the actual economy of this method of construction is furnished by a recent design for a retaining wall. The wall was to be 14 feet in height and the design was for a skeleton reinforced concrete construction. It has a base plate of the requisite width, so that the center of pressure of the base will be properly located. Buttresses which run back into the embankment at proper intervals are connected with the base plate, while the face of the wall between the buttresses has only such thickness as is required to withstand the bursting pressure developed between each pair of buttresses. The whole structure is reinforced with steel so as to take up all the tensile stress which may be developed in any part of the wall. The cross-section of this wall has an average value of 25.44 square feet, which is the equivalent of 25.44 cubic feet per linear foot of wall. A wall of rubble masonry was designed by well-known railroad engineers for this same location. This wall had a cross-section of 80.45 square feet. On the basis of 25 cents per cubic foot, or $6.75 per cubic yard, each linear foot of the rubble wall would cost $20.12. Of course, the unit price of the concrete wall is considerably higher, but its volume is but little over 30 per cent. of the volume of the stone wall. In this particular case an estimate for this wall at the rate of 40 cents per cubic foot as measured in place was obtained from a reliable contractor, the estimate including the steel and all other items of construction except mere excavation, which was not included in the first estimate. The concrete wall would therefore cost $10.16 per linear foot, which is practically *one-half* of that of the stone wall. Many other illustrations could be given where reinforced concrete construction is the cheapest that gives a permanent structure.

As an instance of the second class of structures, viz., those in which reinforced concrete is almost the only practicable method of construction, the following case is given. It was required to construct a retaining wall with a height of 36 feet above the rails of a sunken track where the right-of-way was absolutely limited to a width that gave 10 feet from the right-of-way line to the clearance line for the tracks. The wall was designed to have its base 42 feet below the top. Of course, 10 feet is too small a base for a 42-foot retaining wall. The only possible solution appeared to be some provision by which the toe of the wall could extend underneath the track. Of course, such a construction in stone masonry or even in plain concrete would be an utter impossibility, since it would inevitably break at the angle at the base. A structure of concrete and steel in which the transverse stress at the lower angle of the wall is resisted by the horizontal steel bars in the base, with the very considerable pressure of the earth on the base plate behind the face wall, accomplished all that is desired. The resultant line of pressure is within the middle third of the base, while the maximum intensity of pressure on the subsoil was computed to be about 6,400 pounds per square foot. As the subsoil is a very firm gravel this pressure is a perfectly safe one, but if it had been found that the soil was less reliable it would have been a comparatively simple matter to enlarge the foundation as much as necessary. Of course, the conditions of this problem were very peculiar and unusual, and it illustrates what can be done under such circumstances.

The *Engineering News* recently published an interesting account of a wall constructed by the Great Northern Railway Company at Seattle, Washington. The wall is over 40 feet from base to top at the highest point, varying from this maximum to nearly zero. The economy of the design in comparison with a wall in plain concrete was computed. There was shown to be a saving of 20.4 per cent. for a wall 10 feet high and of 45 per cent. for a wall 40 feet high. But in this case there was no question of limitation of the base of the footing behind the face of the wall, and therefore no necessity of extending the toe of the wall under the tracks.

The third class of structures, viz., those in which reinforced concrete is simply preferable, may be illustrated by the very simple case of fireproof floors. One of the compensations of the Baltimore fire was its demonstration of the fact that a concrete floor when properly made approaches the ideal by being more nearly absolutely fireproof than any other flooring material. It has been frequently stated that since concrete is formed by the crystallization of a compound containing water, it only requires heat to drive off the water and render the whole structure worthless from a structural standpoint. In one sense this is true, provided the heat is sufficient; but the Baltimore fire proved that even with the very excessive degree of heat which was developed during that fire, the effect of such heat on a concrete floor was merely to calcine the

*Extract from a paper by Walter Loring Webb, read before the Engineers' Club of Philadelphia, March 18, 1905.

lower layer of concrete to a depth varying from ½ inch to 1 inch. After such calcination occurred, this layer of heat-resisting material proved to be such a thorough protection that the concrete above it was uninjured, and considering that the concrete that lies above the axis of the reinforcement is the only portion which is considered in calculating the strength, and also considering that an inch or two of concrete is always placed below the steel reinforcement, even the destruction of an inch of concrete on the lower side of a concrete slab will not impair its structural strength. After such a fire, the injured material may be scraped off, so far as it is loose, and another protecting layer, which is only put on for protection and not for structural strength, can be added.

Another very satisfactory use of reinforced concrete is in the construction of roof slabs for fireproof buildings. The author has recently constructed a factory and boiler house entirely of concrete. Even the side walls were built of hollow concrete blocks. The floors are of concrete, the roof slab of concrete, and even the stairs are made of concrete. The boiler house has a roof with a clear span of 30 feet formed by placing a 4-inch slab on concrete beams stretching across the span of 30 feet. The beams have a depth of 13½ inches under the slab and a width of 7⅜ inches. They are spaced 6 feet 2½ inches apart. The slab is reinforced by ½-inch bars spaced 16 inches apart. Only a few weeks after the roof was in place and before the concrete had attained anything like its full strength a very unexpected and unintentional test of the roof occurred. A steel stack was being erected, the stack being put into place by means of a derrick. The derrick broke, a large gin-pole was broken in three pieces, the stack crumpled up, and the whole mass of wreckage fell on this roof. No injury whatsoever was done to the roof.

A great number of long sidings have been built within the past year along the Siberian Railroad, and it is said that military trains are no longer held excessive periods to await trains in the other direction.

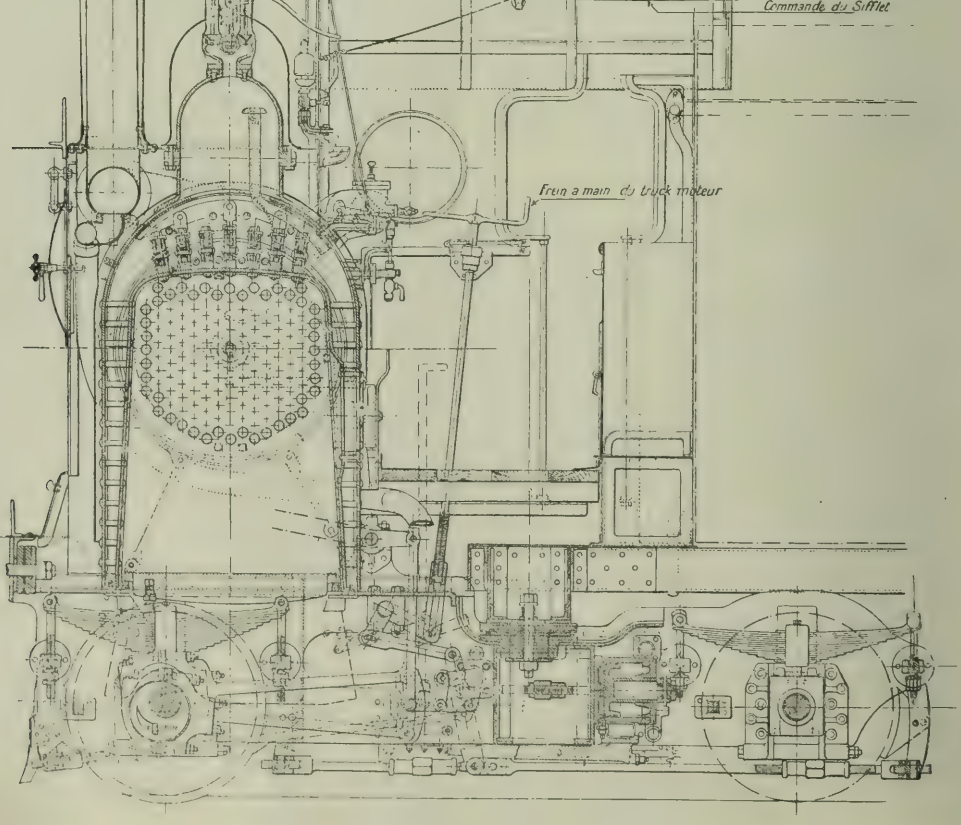
English Motor Cars.

The *Revue Générale des Chemins de Fer* recently publish brief review of the motor cars that have been introduced upo English railways. All of them are driven by steam with th ception of three, one of which belongs to the Great Northern two to the North Eastern. The Great Northern car has a lene motor capable of developing 72 horsepower. It is not y regular service though it has been on trial for a number of mo

The North Eastern cars also use gasolene in an engine drives a generator supplying current to tramway motors mo on the trucks. They are in regular service but the consum of fuel is excessive and as this fuel is expensive the cost per for oil alone is 9.66 cents. Since a locomotive on the light ways rarely burns more than 35 lbs. of coal per mile, costing per ton, or at a rate of 6.33 cents per mile, the cost of fuel o motor car is excessive.

Of the steam motors, that of the Taff Vale Railway is o the most interesting. One end of the car is carried on an ord bogie truck. The longitudinal section of the latter shows method of attaching the body. The car has no body bolste the end sill rests directly on the truck bolster to which an a ment is made in the ordinary manner with a king pin. The su is thus carried so far out on the end of the car that the latter i disturbed by the vibrations of the engines. The body is di into three compartments: a small van whose width is just to that of the door in the side by which it is entered, and is at the end over the motor truck; a third class compart seating 40 passengers, with a center aisle and cross seats, a first class compartment with side seats as in the ordinary tra

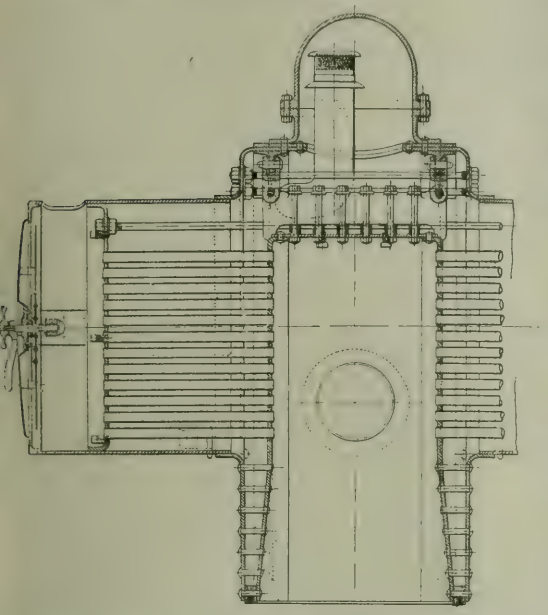
The general construction of the motor truck is clearly s by the longitudinal section, the most interesting feature of is the boiler. It is a locomotive boiler whose fire-box is a center of the tubes extending on either side. These are 3 number and 1¾ in. in diameter. The boiler stands acros



Longitudinal Section of Taff-Vale Motor Car Truck.

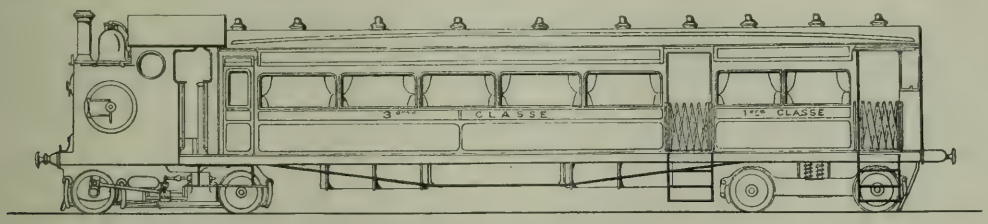
car and the stack is at the center, flues leading to it from the smokeboxes on either side as indicated by the dotted lines in the engravings. The cleaning of the tubes is made very easy by the presence of doors in the two smokeboxes.

Outside cylinders are used, whose connecting rods are coupled



Longitudinal Section of Transverse Boiler for Taff-Vale Motor Car.

to the wheels at the end of the car, no coupling rods being used so that the other pair are trailers. In operation, in order to avoid turning the car at each terminal, the conductor stands on the back platform, when the car is run with the compartment end to the front, where he is in electric communication with the driver, and also has control of the throttle and whistle as well as the hand brakes on the bogie truck.



Side Elevation of Taff-Vale Motor Car.

The following are some of the principal dimensions:

Cylinder, diameter	9 in.
Cylinder, piston stroke	14 "
Heating surface, firebox	39.25 sq. ft.
" " tubes	301.28 "
" " total	340.53 "
Grate area	8.0 "
Wheel base, motor truck	8 ft. 6 in.
Wheels, diameter	34 in.
Boiler pressure	165 lbs.
Tractive effort	2,200 lbs.
Length of car over all	66 ft. 6 in.
Distance between truck centers	40 " 8 "
Total weight	73,100 lbs.

Boston's View of the Differential Question.

The Boston Chamber of Commerce Committee on Differential Freight Rates has submitted its report, in which it maintains that the decisions which the Interstate Commerce Commission gave, in its capacity as an arbitration board, discriminate severely against Boston in favor of Baltimore and Philadelphia. It will be recalled that the adjustment of the export differentials, as between Boston, New York, Philadelphia and Baltimore, was voluntarily given to the Commission last spring, and that the Commission made no change in the status of Boston as compared with New York. It was decided that the rate on export traffic, except iron and grain, should, as heretofore, be from 7c. first class, to 2c. sixth class, per 100 lbs., higher than the New York rate, while iron and grain should take the same rate to Boston as to New York, when shipped for export. The Philadelphia and Baltimore differentials from New York were not greatly altered. (For a table showing the changes, see the *Railroad Gazette*, May 26, p. 573). It transpired at an early stage of the preliminaries that the interests of Boston and New York in this proceeding were from certain points of view at least not antagonistic, and the representatives of these two cities co-operated harmoniously throughout.

The following is an abstract of the argument now presented by Boston:

Taking the average for the years 1897-1901, inclusive, as against 1903, we find that in the export of:

Grain—Philadelphia decreased 45 per cent.; Boston decreased 46 per cent.

Provisions—Philadelphia increased 25 per cent.; Boston decreased 24 per cent.

Flour—Philadelphia increased 65 per cent.; Boston decreased 32 per cent.

Cotton—Philadelphia increased 390 per cent.; Boston decreased 36 per cent.

Petroleum—Philadelphia increased 17 per cent.; Boston decreased 21 per cent.

Miscellaneous Cargo—Philadelphia increased 30 per cent.; Boston decreased 21 per cent.

During the same term, except in the case of flour, which increased 6 per cent., Baltimore showed a considerable decrease, but except in the cases of grain and provisions the decreases were much smaller than in the case of Boston.

In 1904 there was a very heavy decrease in exports from all Atlantic ports, but contrasting the five-year period 1897-1901 with 1904 we find that in exports of:

Grain—Boston decreased 75 per cent.; Baltimore decreased 68 per cent.; Philadelphia decreased 68 per cent.

Provisions—Boston decreased 24 per cent.; Baltimore decreased 20 per cent.; Philadelphia increased 28 per cent.

Flour—Boston decreased 55 per cent.; Baltimore increased 2½ per cent.; Philadelphia increased 22 per cent.

Cotton—Boston decreased 42 per cent.; Baltimore decreased 22 per cent.; Philadelphia increased 499 per cent.

Petroleum—Boston increased 2½ per cent.; Baltimore decreased 14 per cent. (on very nominal amounts); Philadelphia increased 32 per cent.

Miscellaneous Cargo—Boston decreased $^9/_{10}$ per cent.; Baltimore decreased $^4/_{10}$ per cent.; Philadelphia increased 42 per cent.

So that the discriminating effect of the differentials in favor of Philadelphia and Baltimore as against Boston was proven by figures which were submitted in the statement of the Philadelphia case. The large annual clearance of steamers in ballast to load at southern ports with cargo for Europe was also demonstrated by one of the Boston exhibits.

Boston contended that conditions both on land and water have radically changed since these differentials were first adopted; that the existing differentials represent a greatly increased percentage of the inland freight rate to Baltimore and Philadelphia, and it was demonstrated that ocean freight rates from Baltimore and Philadelphia can be, and often are, as low as from Boston, and at times much lower, with ample profit to the Baltimore and Philadelphia steamship lines; that when ocean rates are higher at the southern ports it is simply because of concentration of freight at those ports brought about by the inland differentials, thus enabling the southern steamship lines to secure, by higher ocean rates, a part, and in some cases all, of the inland differential as a gratuity or subsidy.

Boston insisted that the great bulk of export traffic moves from point of origin to foreign destination via the cheapest route; that this is especially true of flour, grain and other staple commodities, the quality of which is not affected by moderate difference in the time of transit; that through rates on export traffic must therefore be uniform via all Atlantic ports or the route charging a higher rate, however slight, will be effectually shut out of participation.

These propositions were sustained by positive written state-

ments by a number of the largest flour millers and grain exporters in the United States that they would not pay any premium, however small, for the privilege of shipping via a port of their own selection over and above the lowest through rate which they could obtain via any one of the ports of Newport News, Baltimore, Philadelphia, New York or Boston.

Boston contended that if the Commission should now overrule the principle of equal rates on export traffic via all Atlantic ports and decide that the southern ports are entitled to differentials as against New York because of special advantages inherent to that port, then Boston is likewise fairly entitled to a similar differential in order to bring about an equalization of competitive advantages at all Atlantic ports other than New York. On this proposition the Commission made this significant admission: "It is possible that in the future it may become evident that Boston cannot fairly compete for the traffic upon the present basis."

Thus for the first time a flaw appears in the sole right and title to differentials so long monopolized by Baltimore and Philadelphia, and which they have regarded as an almost sacred inheritance. Philadelphia in defending its privileges relied in part upon the assertion that its ocean freight rates are higher, but this was clearly disproved by the Boston exhibit of weekly comparative ocean rates from the various ports.

Philadelphia relied in part upon its claim of shorter distance from the interior, but this factor is entitled to small consideration, as it does not represent a correspondingly lower cost of performing service. Philadelphia, however, so far as can be determined, based its claim to preferential treatment principally upon the time-honored Pennsylvania doctrine of Protection. Its mercantile "infant industries" still need nursing. Their cry is "Save us or we perish!" It is the same old and long successful attempt to secure by legislation those advantages which should result from native energy and local enterprise.

Boston asks no such favors. She is willing to take her chance in fair competition with any of the other ports, New York included, upon the basis of equal inland, or uniform through, rates on export traffic, relying upon the enterprise of her terminal railroad and the energy of her merchants to secure her just proportion of the trade.

Baltimore demanded preferential treatment because of shorter distance from the interior, higher ocean freights, and, like Philadelphia, the need of protection, because of her relative inferiority and inefficiency as a trading port. The claim of higher ocean freight rates was exploded by the Boston exhibits.

Baltimore ignored the fact that the distance principle has not for years been an important factor in the fixing of competitive rates. Longer haul has been used by the railroads as an excuse for lower rates but never as a reason for higher ones. A shorter haul uphill may be more costly than a much longer one on the level or down grade.

The insistent plea of Baltimore was, however, that the New York (and consequently the Boston) railroads be forced to charge higher rates than they were willing to accept because, to quote the Baltimore argument, "In carrying freight to New York they have done a better job" than the roads carrying similar freight to Baltimore or Philadelphia.

It would be hard to conceive a more audacious, unjust and arbitrary violation of public policy than to force the railroads to keep their rates up when they, themselves, desire to give the public the benefit of a reduction.

Philadelphia and Baltimore claimed that rates of marine insurance are higher from those ports than from Boston and New York, and that this is an additional reason for granting them a differential. This claim was completely refuted by the submission on behalf of Boston of letters from agents of several of the leading marine insurance companies, both American and foreign, in which they stated that the rates were precisely alike on vessels of the same classification, whether they sailed from Baltimore, Philadelphia, New York or Boston, and that they had placed insurance now in force on these terms.

The report and opinion of the Commission defies analysis. It openly confesses a vain search for some fundamental principle upon which to settle the dispute. Failing in this it flounders around in an abortive attempt to justify the indefensible. It undertakes to "rob Peter to pay Paul" and to accomplish the impossible feat of pleasing everybody without offending any one. It enunciates as facts statements contradicted by the evidence submitted. It strives to create an artificial division of the export traffic between the different ports by strangling competition through a so-called "equalization of advantages."

Here it asks, "What can be more just than to give each port the inland rate to which its location entitles it and to let it secure such portion of this export traffic as its ocean facilities can win for it?" while there it says, "The port of export is but a single station on the through line," and "Nothing can be more certain than that these inland rates upon through traffic should be treated as a part of the entire through rate."

It asks, "what will equalize the advantages of transportation through these various ports?" Yet expresses the opinion that the ideal condition would be the establishment of rates that would r ward by increased business port enterprise in the line of improve service or facilities, and thus insure that healthy struggle of loc ity against locality which is the best security for proper commerci development.

Notwithstanding these premises it suggests as a reason for ta ing traffic via New York the fact that that port "has quicker ar more reliable service, more frequent sailings, ability to reach greater number of ports, superior banking facilities, better storag facilities, etc." In one place it lays stress upon distance as a mo important factor, and in another, where the distance from Buffalo Baltimore, Philadelphia and New York is equal, or in fact slight less to New York than to Baltimore, it ignores its former vie and conceives it to be of no consequence.

Admitting, so far as lake-and-rail grain is concerned, the co tention of Boston and New York that the effect of the differentia may be to force traffic into unnatural and more expensive route it attempts to refute the argument as relating to all-rail grain, b altogether ignores the main contention, viz., that the refusal permit the railroads running to New York and Boston to redu their rates to the Baltimore basis imposes a tax to the extent the exact amount of the difference on all differential traffic destin for foreign ports with which the southern ports have no dire connection.

In regard to the lower grade freight such as flour, grain, et it expresses the opinions:

First—That "The through rate should be substantially the sam by all lines" (i.e., routes).

Second—That it is impossible to decide what inland differenti would produce this equality of through rates.

Third—That equal through rates would give New York an u equal share of the export business. And

Fourth—That Philadelphia and Baltimore are entitled to a low rate; which, it adds, they have had in effect for the last seven yea

Was ever confusion worse confounded?

It declares that "flour moves to the seaboard under substa tially the same condition and at practically the same cost as grain yet the ex-lake differential on flour is fixed at 2c. per 100 lbs. Baltimore and 1c. to Philadelphia, while on wheat it is but ½c. p 100 lbs. to either port.

In this remarkable decision the Commission, after stating th the purpose of the original differential agreement of 1877 was create equal through rates, finally decides that, subject to slig modification, the differentials provided for in that agreement shou now substantially be retained for the astonishing purpose of crea ing unequal through rates.

Lastly, the Commission has, to the extent of its ability, co pelled the New York and Boston railroad lines to charge high rates than they are ready and willing to accept.

Boston would prefer to rely upon her own pluck, industry a foresight to secure her just proportion of the export traffic, but the advantages of a port are to be capitalized; if lack of facilit is to command a premium and their development is to constitute handicap; if legislation is to compel what civic pride, local energ and liberal investment should command, then Boston wants its fa share in the distribution of favors.

We believe, however, with Commissioner Clements, that thes export freight differentials are in themselves illegal, inasmuch they are an interference with free competition, and are therefo in restraint of trade. We believe that the original cause for the establishment, as stated in the agreement of 1877, and in the repo of the Thurman Commission as conceded by the Interstate Co merce Commission in 1898, no longer exists, and we therefore sha not cease to demand their abolition.

Locomotive Exports.

The following table compares locomotive exports in the yea ending June 30, 1903, 1904 and 1905:

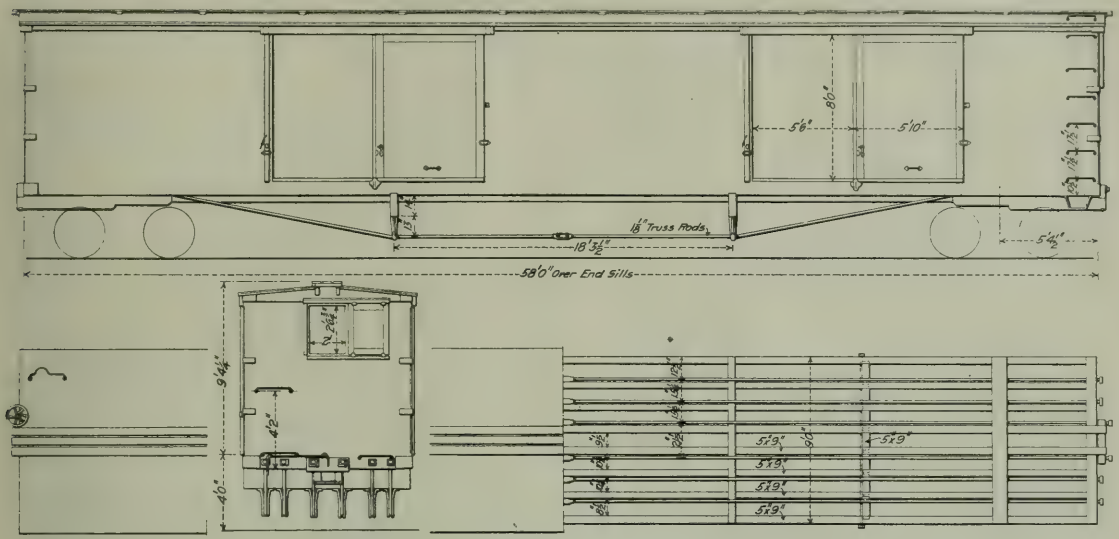
	1905.		1904.		1903.	
	No.	Value.	No.	Value.	No.	Value.
Europe	..	.....	1	$2,693	2	$25,6
British North America	133	$883,563	172	1,767,592	105	1,134,1
Central America	10	60,810	4	37,150	1	6,0
Mexico	46	368,126	135	1,034,521	102	1,238,7
Cuba	55	229,691	21	145,436	11	67,9
West Indies	2	8,325	..	.....	..	.....
Argentina	15	207,448	19	137,506	1	8,3
Brazil	8	117,086	13	129,791	8	119,5
Colombia	2	19,330	5	47,251	..	.....
Other South Am	15	98,416	22	249,207	6	56,2
Chinese Empire	25	280,825	6	39,750	4	25,4
Japan	151	1,276,045	74	624,873	32	275,0
British Australia	1	3,300	1	5,500	..	.....
Philippine Islands	1	2,550	..	.....	1	2,3
Other Asia & Oceanica	3	27,405	8	119,220	..	.....
British Africa	3	16,180	2	9,110	16	260,3
All other Africa	2	21,000	1	11,822	..	.....
Totals	453	$3,617,010	504	$5,261,422	289	$3,219,7

This gives an average value of $11,141 in 1903, $10,439 in 190 and $7,984 in 1905. It will be seen that Canada and Mexico, hithe to by far our best customers for locomotive equipment, have bot been exceeded this year by Japan.

Transfer Cars of the Great Northern.

Hamline Transfer of the Great Northern Railroad is a large freight transfer station between St. Paul and Minneapolis designed to relieve congested local conditions in the two cities. Freight destined for these two points is received at Hamline, loaded into transfer cars and sent to the city freight depots. Out-bound freight is handled in reverse order.

For this service the road recently designed and had built a lot of special transfer cars, the general plan of which is shown herewith. The most notable characteristic of these cars is their unusual length, which is 58 ft. over end sills. The underframe has four intermediate sills, or nine sills in all, and is trussed with six 1⅛-in. rods. The needle beams are 14 in. deep and the queen posts 13 in. high, giving a truss depth of 27 in. Each side of the car has two doors 10 ft. 3 in. either side of the middle. The cars are mounted on arch-bar trucks with Haskell & Barker iron truck and body bolsters, and are equipped with continuous draft rigging. They are, of course, confined to the service for which they were designed, never being permitted to get into road service.



Plan and Elevations of 58-ft. Transfer Box Car for the Great Northern.

Development of the Lake Superior Region.

At the semi-centennial celebration of the completion of the first canal at Sault Ste. Marie held July 26 and 27, the Hon. Peter White, President of the Semi-Centennial Commission, presented an interesting historical address on the "Development of the Lake Superior Region," in which he outlined the steps in the growth of the northern peninsula of Michigan from a wilderness to what is perhaps the greatest mineral producing region in the world. He said in part:

As early as 1636, Lagarde, in a little book published in Paris, made known the existence of copper in this far-off country. The Jesuits, too, from 1632 to 1672, frequently spoke of the existence of copper. Claud Allouez visited the Lake Superior region in 1866 and makes mention of a large mass of native copper which was plainly visible there near the shore of the lake. The first attempt at development was made as a result of the account of the mineral deposits related by Captain Jonathan Carver, who visited Lake Superior in 1765. Alexander Henry, an Englishman, organized a company to exploit the resources of the region, and built a barge at Point Aux Pins and laid the keel of a sloop of 40 tons. They also erected an air furnace at Point Aux Pins. They found specimens of silver, lead and copper, but not in quantities.

Nothing further was done towards the development of this region for nearly three-quarters of a century. It is to Dr. Douglas Houghton that the credit belongs of discovering the presence of copper in the upper peninsula though he discovered no mines in the commercial sense. The first copper mine, the famous Cliff at Eagle River, was discovered by John Hays, of Pittsburg, later of Cleveland, on Nov. 18, 1844, and in a period of 10 years from 1846 to 1856 it yielded $3,858,000 upon an original investment of $108,000.

Iron was first discovered by William A. Burt, United States deputy surveyor, and party, who were engaged in surveying the upper peninsula. While running the east line of township 47 north, range 27 west, they observed, on Sept. 19, 1844, by means of the solar compass, the most remarkable variations in the direction of the needle. Mr. Burt was the inventor of the solar compass, and when the fluctuations indicated a variation of 87 deg. he was tremenduously excited. He directed the members of his party to look around for the presence of minerals. A mere rip of the sod revealed the ore. The surveying party duly recorded their discovery in their reports, but they appear not to have mentioned it to anyone who could profit by the discovery.

In the spring of 1845, P. M. Everett, of Jackson, Mich., concluded that he would investigate the reports concerning copper in the Lake Superior region, and undertook the journey, accompanied by four men. They found the deposits known later as Jackson mountain and the Cleveland mountain. The following spring another expedition was fitted out by Mr. Everett to visit the Jackson location. They returned to the mouth of the Carp river with 300 lbs. of ore upon their backs. Some of the ore was then taken to Mr. Olds, of Cucush Prairie, who succeeded in making a fine bar of iron of it in a blacksmith's furnace, the first iron ever made from Lake Superior ore. In the spring of 1847 the Jackson company constructed a forge on the Carp river, about three miles from the mine, and on Feb. 10, 1848, the first iron ever made in the Lake Superior region was made in this furnace by Ariel N. Barney. The daily product was about six tons, requiring two teams of six horses each to convey the blooms to Marquette, which lay 10 miles away.

The Marquette Iron Co. established its forge in 1849, the second to be established in the region. It was during the winter of 1850 that ore was first hauled from the Cleveland mine. During the winter of 1850 about 25 double teams were employed in hauling the ore to the forge at the lake, where it was crushed and then made into bloom iron ready for shipment. This venture of making blooms was most disastrous. The cost of getting the ore to the lake, the cost of the charcoal, the unloading at Sault Ste. Marie, the portage over the falls, the loading again upon small vessels, made the actual cost of the blooms so excessive that it was impossible to win a profit from their manufacture. By the time the blooms were laid down at Pittsburg they had cost altogether about $200 per ton, while the market price for iron at that time was about $70 a ton.

The Cleveland and Jackson companies began the construction of a plank road to the mines, but in 1853, after the successful test of a few tons of ore in a blast furnace at Sharon, Pa., they determined to convert the plank road into a strap railroad, and rails for that purpose were sent up from Sharon. Meanwhile Congress had authorized Michigan to give 750,000 acres of land to any company that would undertake to construct a canal around the rapids of Sault Ste. Marie. Work was begun upon the canal in 1853 and was finished in 1855, water being let into it on April 19, the sidewheel steamer "Illinois" passing upward on June 18 following, and the sidewheel steamer "Baltimore" passing downward immediately thereafter on the same day. The first shipment of ore through the

canal was opened to Escanaba on Aug. 17, 1865, and was forwarded by the Cleveland Iron Mining Co. and also consigned to the Cleveland Iron Mining Co. at Cleveland. In all 1,449 tons were shipped through the canal that year, constituting the total shipments of the peninsula. All this ore was shipped by the Cleveland Iron Mining Co., as the Jackson and Lake Superior companies were not prepared to ship any at all.

The steam railroad to the mines was finished three or four months after the canal was in operation. The motive power was mules, and the cars held about four tons each. The cars were flat bottom and a team could not make more than one trip a day—sometimes not that—and for the entire motive power to move 35 tons a day from the mines to the lake was regarded as a big day's work. The grades were steep and the cars frequently ran away.

Herman B. Ely had begun the construction of a steam railroad to the mines, and when Congress passed the land grant in 1856 to stimulate the construction of railroads, overtures were made for consolidation with Ely's steam railroad. Ely's steam railroad to the mines was finished in September, 1857. The first locomotive used upon it was the "Sebastopol," which was carried up the lakes on the brig "Columbia." The second locomotive was named "C. Donkersley," which was brought up on the schooner "E. C. Roberts." Both these locomotives were built by the New Jersey Machine & Locomotive Works, Paterson, N. J.

With this motive power it was possible to move 1,200 tons per day. The little dock at Marquette was a flat structure without trestle work, and the ore was put aboard steamers by means of the gangplank and wheel-barrow. All ore was practically carried in sailing vessels as the steamers of those days were passenger boats and had practically no means of carrying ore without making a deadful litter upon the deck. It was not for some years thereafter that anyone thought of building steamers exclusively for the ore trade. The common opinion was that iron, being a low priced material, would always be carried principally in sailing vessels, which it was supposed would always remain the cheapest mode of transit.

It was in 1865 that the Peninsula Railroad, projected mainly through the efforts of Mr. Charles T. Harvey, who built the first canal at the Sault, was extended from Escanaba on Green Bay to the iron mines at Ishpeming and Negaunee, a distance of 62 miles, thus forming another outlet for the ore of the Marquette range. The growth of the ore trade, however, was slow, and for many years lumber continued to be the important trade of the lakes. It was in 1869 that the first steamer designed for ore carrying purposes exclusively was built. This was the steamer "R. J. Hackett," which was built to carry the ore of the Jackson mine. The following year the "Forest City" was built as her consort. Prior to that time ore had been carried principally in sailing vessels and towing had become a profitable business in the rivers. First of all sailing vessels were lashed alongside of the little propellers and towed through the rivers, as is the common practice in the coast ports to-day. Later, however, astern towing was found more convenient and it was common to see seven or eight sailing vessels towing behind one steamer. The propeller and its consort, however, proved handier, and in the 70's displaced altogether the system of towing through the rivers. Gradually the sailing vessels which had been living an independent existence became consorts to steamers themselves.

In 1877 the Menominee range was opened and by 1879 had become an important contributor to the stream of ore going down the lakes. The problem of loading the ore had been solved by means of pockets and chutes in the ore docks, but the problem of unloading it was a severe matter. The first ore was unloaded in tubs by means of a horse, block and tackle. The horse by walking forward hoisted the tubs out of the hold, where it was dumped into barrels and wheeled ashore. In order to get the tub into the hold again it was necessary for the horse to back up. It took two days to unload a cargo of 400 tons by this means. In 1867 Robert Wallace installed on the docks at Cleveland a little portable engine to take the place of the horse, and in this manner secured increased despatch.

In 1884 the Gogebic range made its first shipment and shortly thereafter in the same year the Duluth & Iron Range Railway was completed to the Minnesota mine on the Vermilion range, bringing this great ore body into the market. Six years later the Mesabi, the world's unrivaled ore deposit, was discovered, and in 1892 began shipments. Though only 12 years old, Mesabi's shipments now exceed those of any range, having passed the total shipments of the Marquette range last year. Sudden as has the expansion of the ore trade been—more than one-third of the total movement being the work of the past five years and more than three-fourths of the total movement the work of the past 10 years—vessel tonnage and dock equipment have both expanded to care for it with ease. This is a remarkable achievement in a trade subject to such violent disturbances as is the iron trade, where the movement of ore may fluctuate between wide latitudes, increasing from 1,000,000 tons one month to 5,000,000 the next. A system that will accommodate itself with ease to such a trade as this is remarkable, but such a system exists on the lakes. The vessels of the great lakes have grown until they now rival in dimensions the ocean liners. Arched girders have taken the place of stringers and stanchions, so that the hold is entirely uninterrupted and no part of the vessel's structure interferes with the operation of the unloading machine.

The fact which militated against high unloading speed was that the tubs had still to be filled by hand. This problem has now been solved by the invention of an automatic bucket which fills itself in any grade of ore. These buckets lift 10 tons of ore at one time and by their use vessels carrying over 10,000 tons of ore have been unloaded in a little over four hours' time.

Freight rates on the lakes were a sort of a jumping jack in the early days, but they are now becoming as stable as rail rates. In the fall of 1866, $6.50 was paid to freight ore down the lakes, and in November, 1871, it went to $7. Now the contract rate is 75 cents from the head of the lakes, with a wild rate that scarcely varies from that figure.

In the early days they started to make pig iron in the peninsula. Everyone thought that that was the proper thing to do until they discovered that it wasn't. We could make about six tons a day in our little forges and lose a great many dollars on every ton. The first pig iron produced in the Lake Superior region was made in 1858 by Stephen R. Gay, who leased the forge of the Collins Iron Co., which was the third forge to be established in the peninsula, and converted it into an experimental miniature blast furnace. The first blast furnace in the Lake Superior country was built in 1858 by the Lake Superior Iron Co. of Negaunee. It was called the Pioneer furnace. About 25 furnaces were started in the next 10 years, 13 of which were in operation at the end of the decade, but only one of them now survives, the "Pioneer," which was transferred a few years ago to Gladstone. The time was not ripe then for iron making in the peninsula. There was no consuming population within its natural market. This condition is now being gradually changed, however, as the northwest is becoming populated. Lake Superior ores, however, are fully three-quarters of all the ores mined in the United States, and this year fully 80 per cent. of the pig iron metal that is made in this country will be made out of Lake Superior ore. The iron trade of the United States practically had its birth with the discovery of the Marquette range. It has been reinforced steadily by the discovery of other ranges until it now rests upon the firm basis of Mesabi, the most abundant and the easiest mined high grade ore in the world. In 1855, the year in which it became commercially possible to ship Lake Superior ore, the United States produced 700,159 tons of pig iron, as against 3,218,154 tons by Great Britain. By 1869, by which time Lake Superior ore was moving freely, the United States produced 1,711,287 gross tons of ore as against 5,445,757 tons in Great Britain and 1,409,429 in Germany. The encroachment upon the British lead by reason of the profusion, quality and ease of transit of Lake Superior ore by the United States has been steady until in 1890 we find the United States passing Great Britain by making 9,202,703 tons of pig iron against 7,904,214 tons in Great Britain, and 4,641,217 tons in Germany. In 1903 the pig iron production in America reached its high water mark, making 18,009,252 tons against 8,935,063 tons in Great Britain, or more than once again as much as Britain. Germany during 1903 made 10,085,634 tons of pig iron. The present year of 1905 is, however, expected to be the record-breaking year of all, when more than 30,000,000 tons of Lake Superior ore will come down the lakes, and when the furnaces of the United States will, according to the monthly rate of the present year, safely make more pig iron than Great Britain, Germany and France combined. One single company alone, the United States Steel Corporation, produced last year more steel than was made in the whole of Great Britain. The steel output of the Steel Corporation last year was 8,406,378 tons, against 5,134,102 tons, exclusive of castings produced in Great Britain.

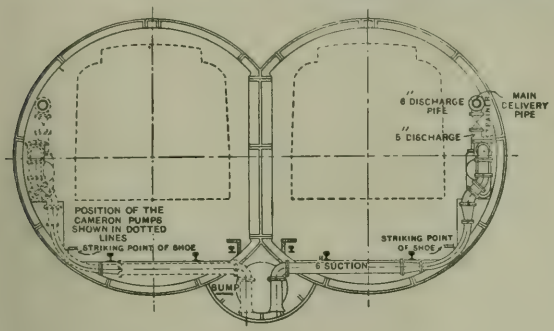
Draining the Interborough Rapid Transit Tunnel under the Harlem River.

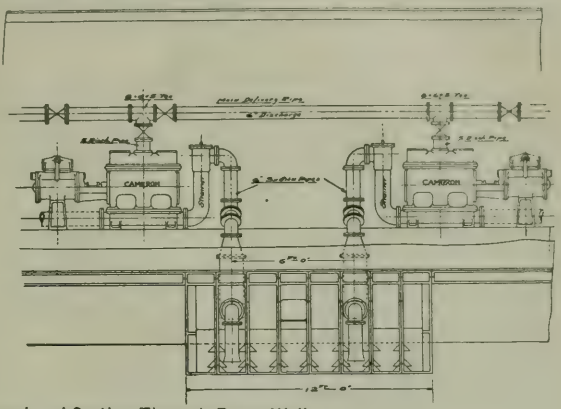
One of the most difficult engineering problems connected with the building of the Interborough Rapid Transit Company's subway in New York City was the construction of the twin tunnels under the Harlem river on the Bronx division. These tunnels were built by an original and novel method, which was quite fully described in the *Railroad Gazette*, Sept. 4, 1903. They are twin tubes 641 ft. long and 16 ft. in diameter inside, the top of the tunnel being 20 ft. below low water. They are built of segmental cast-iron rings lined with concrete and the work was carried out in an open cofferdam; half the length of each tunnel being built at a time, while the remainder of the channel of the river was left open for navigation. On account of the fact that the tubes are in water-bearing ground, it was necessary to provide a complete drainage and pumping system to take care of the water which percolates through the walls and also to provide for emergencies in case of the breaking of a water-main in the tunnel or other similar accident. The accompanying drawing shows a cross-section through the two tunnels, the location of the discharge pumps and the suction wells. On account of the very narrow clearances, a special design of pump

was installed. These pumps were designed and built by the A. S. Cameron Steam Pump Works, New York; have 12-in. x 12-in. x 18-in. cylinders, and are of the simplex, single-cylinder pattern, having the regular Cameron pattern steam end; although the pumps will be worked with compressed air. Four pumps were installed; two in each tunnel, at the junction of the subway proper and the tunnel under the river. The illustration from a photograph shows the pumps in position on concrete foundations built in the wall of the tunnel, and also the piping and connections for the suction and discharge mains. The 6-in. suction pipes leading to each pump draw their supply from a single sump at the lower end of a large central drain running under both tunnels.

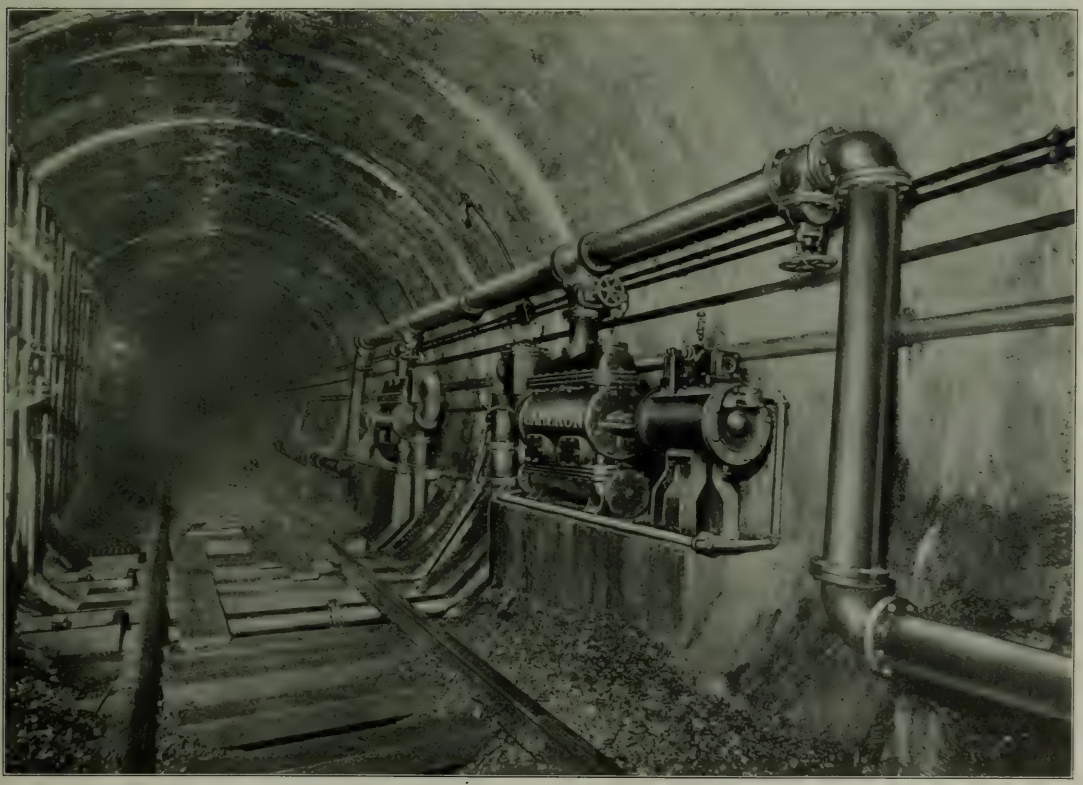
Each pump has a separate air line to the compressor plant, which is located about three-quarters of a mile away, above ground. The pumps are controlled automatically by separate floats located in the tunnel. It will be seen from the illustration that the water cylinders are very compact, their extreme width being only 19 in. Nevertheless, they have ample water valve area. The water valves are set in movable valve decks, allowing them to be quickly and easily removed. The suction valves are under the water cylinder and the discharge valves are placed above the water cylinder. Each of the pumps is capable of delivering 600 gallons of water per minute when running at normal speed under a lift of 70 ft. and with an air pressure at the throttle of about 70 lbs. per sq. in. In cases of emergency this capacity can be increased to 1,000 gallons per minute.

The valve chambers are constructed so as to permit of easy access for inspection and repairs. The water piston and rods are of composition metal, and as the water is very dirty and gritty the water cylinders are made with removable composition metal bushings. Cameron strainers of the goose-neck pattern are supplied on the suction pipes to keep out dirt and rubbish and to insure the





Cross-Section of Harlem River Tunnel and Section Through Pump Well.



Cameron Pumps in Harlem River Tunnel of the Interborough Rapid Transit Subway.

priming of the pumps by keeping the suction chambers filled with water. There are no outside rods or valve gear to become broken or to get out of alinement and the working parts are substantial and few in number. In case the tunnels were flooded completely, floating timbers and debris could do little or no harm to the pumps.

These pumps have already been severely tested when some time ago water was discovered entering the tunnel. Temporary piping and connections were hurriedly made and the pumps were pressed into service on short notice. They were kept in operation day and night and the inflow of water was easily taken care of, so that there was but slight interruption to the completion of the work.

The Lackawanna Terminal Fire.

The buildings of the Hoboken terminal of the Delaware, Lackawanna & Western Railroad were destroyed by fire on Monday night, August 7. Reports indicate that the fire started on board the ferry-boat "Hopatcong," which was tied up in her slip for the night. The flames spread to the ferry-house and to the adjoining station and train-sheds, which were all old buildings and of light construction. The lower portion of the ferry-house, excepting one slip, was totally destroyed as well as the station and train-shed. The new emigrant station south of the depot, which cost $75,000 and which was only opened last week, escaped serious damage. The ferry-boat "Hopatcong" was totally destroyed and the upper works of the ferry-boats "Montclair" and "Binghamton" were badly burned. A number of passenger cars were in the train-shed. Many of these caught fire, but were got out by the yardmen before they were badly damaged. Adjoining the train-shed of the D., L. & W. was the terminal of the North Hudson Railroad Company and the train-shed of the Public Service Corporation, in which about 50 trolley cars were stored. These, as well as the old Duke House, which was across the street, were destroyed. The total loss is estimated at about $250,000. The officials of the D., L. & W. state that the railroad's loss alone will be upwards of $200,000. So far as is known no lives were lost. Fortunately, the D., L. & W. had already prepared plans for a new terminal which was to be built in the course of the next two years. The emigrant station was part of this new structure. Although the entire passenger terminal was destroyed, the railroad officials made heroic efforts to continue the regular train service and a temporary station was installed at the United States Express Company's building, which is situated about 100 ft. west of the passenger station. Here Vice-President E. E. Loomis and General Superintendent T. E. Clarke established their headquarters, from which they endeavored to get the system into running order again. A large force of men was immediately put to work to repair the ferry slips, two of which were ready for use in time for the afternoon rush hours. The D., L. & W. has a large local traffic and the question of caring for it was a serious one. Great credit is due to the management for the manner in which they handled the situation. By 4 o'clock of the day following the fire the train schedule of the road was practically restored. The main line trains were run to and from the company's Hoboken terminal with little interruption at any time; suburban trains from points west of Newark stopped at Newark the morning after the fire and passengers to New York came from there by trolley and over the Pennsylvania Railroad, the Erie and the Central Railroad of New Jersey, Lackawanna tickets being honored on all the steam lines. There was no delay in the moving of freight. Ferry-boats were run on 15 instead of 7½ minute headway. All the boats starting from Twenty-third street, Manhattan, went to the Fourteenth street slip, Hoboken. Every other boat leaving the Barclay and Christopher street ferries went to the regular ferry-house at Newark street, while every other one landed passengers at Fourteenth street, and all teams bound for Hoboken had to go to Fourteenth street. The fire will undoubtedly hasten the construction of the new terminal, as the principal difficulty of erecting this station lay in getting rid of the old structures without interfering with traffic. Now that this difficulty has been removed by the fire, work will at once be started on the new terminal.

A Train Load of Sugar Pine.

The train shown in the accompanying photograph was made up of 26 cars, each of which carried one sugar pine log, 16 ft. long. The smallest log in this lot was 53 in. in diameter, and the largest, 79 in. The road is the property of the West Side Lumber Co., California. The total scale of the logs on this train amounted to 86,010 ft.

Train Containing 26 Logs—86,010 ft. of Lumber.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XXXIX, No. 7. FRIDAY, AUGUST 18, 1905.

The killing of 12 persons in a butting collision near Vermillion, Ohio, last Sunday, conveys a startling lesson concerning the risks connected with our American method of running trains on single track, and the need of doing away with those risks; but so many equally startling lessons have been given in the past that one hesitates to use the term, and is tempted to doubt whether its dictionary definition still has meaning in connection with train accidents. Ohio was at one time called the "railroad-accident State," and the nearness of Vermillion to Mentor will tempt the reporters to now revive the name. The first significant thing brought to mind by the Vermillion collision is the statement, which has been uttered so many times by railroad managers, that the block system is being introduced "as fast as business demands it"; or "on the lines of heaviest traffic." The New York, Chicago & St. Louis has undoubtedly been left without the block system because it is not one of those lines (of its owners) which have the heaviest traffic. And yet it has traffic enough to kill people by the dozen. What is a line of "heavy traffic," from the humanitarian point of view? Or from the point of view of civic decency?

Near Bayonne, N. J., on August 4, there occurred a serious accident from the breach of a simple but comprehensive rule, which is often broken, and broken by men classed as careful, and yet which seems not to receive from superintendents the attention that it deserves. An eastbound express train of the Central of New Jersey was derailed at a point where track-changes were being made, and the engine fell into the water, killing the engineman. It was on the two-mile trestle bridge across Newark Bay, just east of the drawbridge. A new facing point switch, not yet connected to the signal tower, and dependent for safety on being kept spiked, was left set the wrong way. There being no signal protection, the safety of trains depended, of course, on the unerring carefulness of the men doing the work and the vigilance and caution of enginemen, who, presumably, were, by a posted rule, ordered to run under control over such a place in the track. A similar accident occurred at West Philadelphia a few months ago. A man repairing interlocked switches spiked a facing point crossover the wrong way, and an eastbound local passenger train ran into the side of a westbound fast express. This was in the night, when it was difficult for the engineman to see the rails, but the Bayonne accident happened in the daytime. At both places the man who made the mistake was standing near-by when the train ran off the track. The rule (or principle) to which we refer is that when we deprive ourselves of the benefit of signals it is essential to reduce the speed of trains correspondingly. "Correspondingly" means in proportion to the added difficulty of seeing obstruction or danger from the engine. Perhaps the added danger of such a place as a trestle bridge ought to be taken into account also, though it might well be that a crossover at such a busy place as West Philadelphia would present more chances of danger to life and limb than a switch on a less busy line nearer deep water. This question of reducing speed at all points where the track or its regular safety adjuncts may have to be disturbed, is classed as a difficult one, because we grudge every minute lost by fast trains. There would seem to be no way to settle it by rule, except in adopting and enforcing, a very radical rule—the rule that wherever switches are being changed, or the interlocking or the signals are being repaired, renewed or taken out, the speed of trains be reduced sufficiently to enable the engineman to see the rails of the track far enough ahead to stop if necessary. At night this would demand powerful headlights as well as very low speed. In many situations this will, of course, seem to be excessive caution; and yet with any provision less cautious than this we are trusting to the unaided vigilance of probably one man, the man in responsible charge of the track work. We may go on thus trusting to one man, with a high percentage of safety, for these men make very few mistakes of this kind; but the trouble is that where the result of a derailment is liable to be disastrous, no percentage less than 100 can be looked upon as tolerable.*

The terrible collision at Hall Road, England, on the Lancashire & Yorkshire, July 27† calls attention to the same rule as the Bayonne accident, though it emphasizes a different aspect of it. The essential trouble at Hall Road was one which afflicts many a signalman, and which is difficult to eradicate—the lack of sufficient mental poise to act deliberately when in a hurry. When one is calmly studying a rule book it is clear enough that, if a signal lever is found unexpectedly immovable, a thorough examination should be made of every

*The Lake Shore & Michigan Southern rules are given on another page.
†Reported in the *Railroad Gazette* of August 4; for additional particulars, see General News Section in this issue.

related part before doing what is the matter; but when one fears that he is going to delay an important train, and sees that the question ought to be decided in half a minute, it is extremely easy to get "rattled." Only persistent training will cure this defect, in most minds; and this Hall Road signalman had been doing signal work only 18 months. This is a very unusual record for an English signalman. Records of 18 years are much more common. The use of a screw-unlocking device which requires a full minute to manipulate is favored, on some American roads, as a suitable means of compelling a signalman who is in an unreasonable hurry, to stop and reflect; but the device is not without its drawbacks, and it has never been used, so far as we know, to lock up hand flags. Even with a mechanical restraint the speed-reduction rule still remains an important element, and, as was intimated in the preceding paragraph, the only practicable way to prescribe speed limits satisfactorily is to lean to the side of conservatism—to make the rate of speed too low rather than too high. A facing point is a horrible danger to a fast train, except when it is in perfect order and perfectly protected by signals; and the slightest imperfection should be taken as a warning of the need of the *utmost* caution. It is only by drilling, of course, that such a high degree of caution (which may be needed only at rare intervals) can be infused into a signalman's mental habit. Unfortunately, no such drilling has been systematically attempted. We leave it to the slow educating processes of experience, and, in this matter, 18 months is a brief term. The very high reputation of English signalmen as a body is due to the fact that such a large proportion of them have had many years' experience, working through all the grades from booking boy up.

THE BALTIMORE AND OHIO RAILROAD.

As a result of the action of the directors last month the common stock of the Baltimore & Ohio was placed upon a 5 per cent. dividend basis, instead of 4 per cent., as during the past few years. Earnings have been very great, both gross and net, and the road seems to be entering upon a period of prosperity which comes as a most interesting sequel to the troubled years in the past. At the time of the reorganization in 1896, considerable attention was paid to the company in these columns. Prior to that, occasion was taken every year or so to criticise the extraordinarily bad annual reports—bad both in form and in substance—which were prevalent for many years, excepting only the brief period when Samuel Spencer took control and started reforms which were not carried out by his immediate successor.

The history of the Baltimore & Ohio naturally divides itself into periods that are pretty clearly marked. The road started its career in a burst of glory. Within eleven days after the subscription books were opened, March 20, 1827, 22,000 persons had subscribed $4,178,000 of stock. The rails were then pushed westward, little by little. It is worth while to recount again the well-known historical fact that horses were the first motive power, and it was not until 1830 that the road was worked by steam. The history of the first five presidents—Philip E. Thomas, Louis McLane, Thomas Swan, William C. Harrison and Chauncey Brooks—is chiefly concerned with this period of preliminary extension. The road was opened to Harper's Ferry in 1834, to Winchester, Va., in 1836, to Cumberland in 1842, and to Wheeling in 1853. But though this Wheeling connection was nominally made during 1852, ready for use at the opening of the new year, the railroad remained embarrassed and practically ineffective until 1856. The man who made the Baltimore & Ohio a real railroad, connected up at both ends, and gave it an active place among the great transportation systems of the country, was John W. Garrett. Mr. Garrett's father, the original Robert Garrett, was a wealthy Baltimore merchant and banker. His son became associated with him as a young man, and was made a director of the Baltimore & Ohio in 1857 at the urgent request of influential citizens of the town that had so active an owning interest in the road. When Chauncey Brooks resigned as president, in November, 1858, John W. Garrett was elected to fill his place. Mr. Garrett was then 38 years old. In his first year of service the road increased greatly its earnings, both gross and net. Mr. Garrett harmonized the hitherto conflicting interests, and when the war broke out the Baltimore & Ohio was at its first flood tide of prosperity. The railroad ran right through the heart of the war country. It was fought across by both armies. There was much destruction of property and much blocking of traffic by the use of portions of the line as a military railroad; but the property continued to be strong, useful and well-managed. It was more than domineered by its president—it was ruled by him, and Mr. Garrett's help was much appreciated by Secretary Stanton and by President Lincoln. Under this forceful management the road made constant gains, and when peace was declared it was in a situation of even greater prosperity than when the war began.

But in the era of railroad consolidation which began about that time, the Western railroads began to link up connections of their own that took traffic away from the Baltimore & Ohio, and threatened the very existence of Baltimore as a port. So Mr. Garrett aranged a system of roads of his own in the West, while in the East he made arrangements to ship freight through to Philadelphia and New York. It is suggestive of the differential quarrels of the present day that, by that very act, he was accused of discrimination against Baltimore, in 1860, because he gave the Western roads rates to New York and Philadelphia no higher than the rate to Baltimore for the sake of drawing traffic through his route instead of having it diverted to some other railroad.

John W. Garrett brought the quotations on the company's stock up from $46 in 1858 to $174 in 1884. He served the railroad as president for 26 years. A man of most forceful personality, he was a good deal of an autocrat. He always wanted his own way, and it was hard for him to make concessions to other managers. Throughout the latter years of his presidency the Baltimore & Ohio was often a disturbing element in trunk line business. It was at a disadvantage as compared with New York, and was sometimes prone to be a rate-cutter. In the latter years of Mr. Garrett's rule he was fond of referring to his company's immense surplus of undivided profits, a surplus which made an impressive showing on paper; but, as a matter of fact, his methods of finance, especially during the latter part of the '70s and the early '80s, were far from being above criticism. His great surplus did not earn much for him, and quite a share of the undivided profits to which he referred so fondly were invested in properties which yielded no income. There came to be a well-defined suspicion—not to express this more concisely—that many of his latter investments in subsidiary companies were made chiefly as an excuse for raising money; some of which was needed for obligations already assumed, and some of which presumably helped to pay dividends. In spite of the undivided surplus the company was often sorely in need of money.

John W. Garrett died in 1884, and was succeeded by his son, Robert Garrett, who had been closely associated with his father in the management of the road for several years. With the death of the elder Garrett the second distinct period in the history of the road came to a close.

Robert Garrett was president from 1884 until 1887. He found a property full of loose ends, with a complicated and uncertain debt, and a system of making annual reports which quite effectively prevented outsiders or insiders from learning anything about the road, except that it was not increasing its earnings in anything like proportion to the constant increases in its indebtedness. The share capital was small. In 1887 it only amounted to about one-eighth that of the total capital issue, and, say, one-eleventh of the total capital which had been expended. The younger Garrett was of less forceful personality than his father. He tried to make the property still greater and more cumbersome, without any attempts at cleaning up the waste. We said in the *Railroad Gazette* at the time, that many of the company's troubles under the younger Garrett were due to enterprises begun by his father, but it is certain that Robert Garrett had no clear perception of the procedure that was necessary to restore the property to a really solvent basis, and it is probable that he failed to realize that such restoration was even advisable. When new money was needed, new enterprises continued to be taken up, while the capital indebtedness was swelled unceasingly. In 1886 the capital account was $45,000,000 greater than in 1873, while profits were only $835,000 greater. In 1886, with 1,690 miles of line, gross earnings were 18½ millions, and net earnings 6⅛ millions. Five years before, with 200 miles less line, both gross earnings and net earnings were greater, and ten years before, with 238 miles less line than in 1886, gross earnings amounted to over 15 millions and net earnings to nearly 5½ millions.

A thoroughly characteristic enterprise of the years of Robert Garrett's presidency was the building of the Philadelphia division. The road needed badly enough to get into New York on its own tracks, but the undertaking cost twice the estimate and nearly swamped the company. The 1886 report, characteristic of this period, was so blind in its references that it brought out a sharp reproach in financial circles. What it did show, with sufficient clearness, was a deficit of over one million dollars from branch line working during the year, and it was evident that all of the complex

system of branch line property was in pretty bad shape. The younger Garrett, coming as he did from a prominent and distinguished Baltimore family, was much given to society life, and these two men, father and son, suggest quite an interesting parallel between the Hydes, father and son, in the up-building and subsequent management of the Equitable. In both cases the father was a man of great force and personality, who accomplished great results, but did not always scruple to make use of questionable financial methods. In both cases the son adhered to his inheritance of questionable finance rather than to his inheritance of strength. During the younger Garrett's presidency two attempts were made to get the road out of its difficulties by syndicate purchases of the property, but both attempts were unsuccessful. The failure of the last one, which was long-pending, created a depression which almost wrecked the road. Robert Garrett died in July, 1896. It was evident even before his resignation that he was losing his mind, and the last years of his life were spent in retirement.

When Mr. Garrett resigned from the presidency of the Baltimore & Ohio, in 1887, he was succeeded by Samuel Spencer, now president of the Southern Railway, who had had a long and valuable training with the Baltimore & Ohio. Mr. Spencer's methods were radical. Placed in a position of great difficulty, he at once analyzed the finances of the road, and in 1887 presented a report which was frank and honest, although it made a thoroughly bad showing, and revealed the innate rottenness of the property. In one year Mr. Spencer reduced the floating debt, which had been one of the great causes of uneasiness, from $8,769,000 to $3,478,000. He showed that the old surpluses were nothing more than forced profit and loss balances. Had Mr. Spencer remained president there is every reason to suppose that the subsequent history of the road would have been quite different from what it was, and that he would have created a new period in its development; but he served only for about a year, after which he accepted a position with Drexel, Morgan & Co. His presidency, therefore, instead of marking a distinct period in the history of the road, was really only incidental in the twelve bad years which received their definite beginning with the accession of the younger Garrett in 1884, and extended through the presidency of Charles F. Mayer, which terminated in 1896.

Mr. Mayer, before going to the Baltimore & Ohio, was for several years president of the Cumberland & Pennsylvania. The only thing that really stands out in his administration as constructive work was the increase of the western and southwestern extensions and improvements at tide-water; but these changes were made at great cost. Gross earnings in 1889 (Mayer) were $21.303,002, and they continued about the same until the road went into the hands of receivers in 1896, except for the especially good returns in 1893 occasioned by the World's Fair at Chicago; but between 1889 and 1895, 25 million dollars was added to the debt. After the financial straightening out accomplished by Mr. Spencer in 1888, dividends on the common stock were suspended for several years; but a stock dividend of 20 per cent., not earned, was declared in 1891, and the next year cash dividends were resumed on the increased capital, and 3¾ per cent. was paid. Five per cent. was paid in 1893, 4½ per cent. in 1894, and none was paid on the common stock in 1895, although dividends were paid on the first and second preferred.

Following the resignation of Mr. Mayer and the close of this depressing period in the road's history, John W. Cowen was made president January 24, 1896, and the inevitable receivership followed a month later. Mr. Cowen had been General Counsel of the road for twenty years, and was a thoroughly sound, conservative and progressive lawyer. He was made joint receiver with Oscar G. Murray, now president. This was the only receivership the road ever went through, and its fundamental causes may be well understood from what has been said. The immediate cause of the insolvency was the inability of the directors to raise about $400,000 to meet interest payments due March 1, 1895. The directors failed in their efforts to make a collateral trust loan, but the cause of the downfall, as we pointed out at the time, was plainly attributable to the large and constant increase in capital and fixed charges with no improvement in the earning ability; although unearned dividends were persistently paid on the small outstanding capital stock, which received large sums annually and sold at prices that reflected little more than the determination of the directors thus to favor it. It must be recollected that the B. & O. had no monopoly of bad financial management at this time, but, with the exception of the Wisconsin Central, it was the last to be reorganized of the big lines forced into insolvency in the hard years following 1893.

An excellent report on the finances of the property, open to criticism only on the ground of being over severe in its attitude towards the apportionment of charges between capital and income, was made by Mr. Stephen Little in 1896. This report started with Mr. Spencer's year, since his work brought the finances in an understandable state up to 1888, and continued the record up to 1896. Mr. Little grouped under six heads the great errors in accounting, thus:

Over-statement of net income.
Mischarge of wornout equipment to profit and loss, instead of to income.
Capitalization of charges to income.
Capitalization of so-called improvements and betterments of subsidiary roads.
Payment of unearned dividends.
Under-statement of liabilities.

Taking the first four, the discrepancy as presented by Mr. Little and in the statements of the company, was no less than $11,204,859. From 1888 to 1896 dividend payments were $6,269,008, including a stock dividend of 20 per cent. Mr. Little estimated that only $971,447 of this was earned, although, as we have said, he charged certain items to income with even greater strictness than is required by the present best practice. But even including Mr. Little's full system of charges to income, he showed that the company during this period could have claimed an average surplus of $136,550 each year, after paying the regular $300,000 dividends on the preferred had it properly applied its funds.

Mr. Cowen's entire service as president and receiver covers about five years, and marks out a distinct period of development. The receivership ended June 30, 1899, when the new company took formal possession, and foreclosure was not gone through with. A reorganization plan on which two committees worked from 1896 to 1898 had been put into effect, and most of the exchange of securities had been effected. In carrying out this plan the old common stock was assessed $20 a share, and the old preferred stock $2 a share. The old company had some 90 millions of bonds and 30 millions of stock; the new company had 133 millions of bonds and 75 millions of stock. The host of divisional and subsidiary bonds were retired, and the bonded debt was unified under two general mortgages which covered between them the entire property and equipment, and were large enough to provide for future needs. There was no scaling of principal, but the interest rate was reduced. The fixed charges of the company, amounting to approximately $6,250,000, occasioned a saving of some $1,520,000 as compared with the fixed charges of the last fiscal year before the reorganization.

Mr. Cowen was an active and progressive president. Between 1894 and 1899 the average ton-mile rate was cut nearly in half, falling from 6.48 mills to 3.90 mills. Between 1896, the year of the receivership, and 1900, the last year when the annual statement did not include the returns from the Baltimore & Ohio Southwestern, freight ton-miles per mile of road increased from 1,357,701 to 2,587,123. Gross earnings increased from $23,944.781 to $34.890,226, and net earnings increased from $6,361,361 to $12,359,443. The addition of the Baltimore & Ohio Southwestern's returns made the showing even better, and the common stock, which during the first part of Mr. Cowen's presidency had been quoted around 30, rose to par in 1901.

The Pennsylvania, in recent years, had acquired considerable holdings of Baltimore & Ohio stock, and this influence led to the next well defined period in the history of the road, when L. F. Loree became president, in May, 1901, and the Pennsylvania took a strong representation in the directorate. Mr. Loree's work is fresh in every one's mind. It is sufficient to say that he carried on aggressively the large scheme of rebuilding and betterment work inaugurated by his predecessor. This work has been described fully in the *Railroad Gazette*. We pointed out that the traffic summit and the topographical summit of the line about coincide, in an area east and south of Pittsburg. Mr. Loree aimed to reduce the mountain grades and the severe curves, and make the line fully able to compete for tide-water tonnage with the lower grade lines to the northward. Besides this, he changed, to a considerable degree, the theories on which the working staff had been recruited, organized and maintained; a class of work which was rather outside the immediate scope of Mr. Cowen's interests and training in spite of his marked success as an administrator. Mr. Loree remained president of the Baltimore & Ohio only two years and a half, but left the property well advanced from the position in which he found it. In the general standards of honesty, courage and good administration, Cowen, Loree and Murray stand together as contributors to the current epoch of the road's history—an epoch of sound finances, earned dividends and notable increases in earnings. During a portion of Mr. Loree's administration, in 1902, the traffic on the road was too heavy for the best efficiency, and the Baltimore & Ohio suffered, like all the trunk lines, from congestion of freight; but this difficulty was not of long duration. After the accession of Mr. Loree, a majority of the Reading stock was divided between the Lake Shore and the Baltimore & Ohio, carrying a New York entrance over the Central Railroad of

New Jersey, and something like half the unmined anthracite in Pennsylvania.

On December 29, 1903, Mr. Loree was elected president of the Rock Island System, and was succeeded by Oscar G. Murray, who had served as first vice-president of the Baltimore & Ohio since 1896, and was joint receiver with Mr. Cowen for three years. With the exception of the receivership period, Mr. Murray's training had all been in the traffic department, but he came to the presidency with a full knowledge of the property and full sympathy with the best traditions of its latter years. A man of simple and direct nature, always approachable by his subordinates, he has done much to weld a spirit of loyalty and *esprit de corps* throughout the service. No landmarks in the history of the property are attributable as yet to his administration, but the road is at last enjoying the fruits of honesty and good management. When Mr. Murray's report is issued this fall it will be the seventy-ninth consecutive document of this character; a record of continuous history which no other company in the country can equal.

New Haven's Electric Finances.

In the form of a round number and in "net" shape the New York, New Haven & Hartford has given out the receipts for the fiscal year ending June 30, of the great electric system owned or controlled by the Consolidated Railway Company as a holding corporation. The "net" returned over and above all operating expenses and fixed charges is $426,000, or about 4¼ per cent., on the Consolidated Railway Company's stock capital, which is all owned by the parent steam corporation. From this, however, is to be deducted approximately $350,000 of interest on the issue of about $10,000,000 of debentures of the steam corporation—a direct obligation used for the purchase of the Fair Haven & Westville system. Subtracting that amount it leaves $76,000 as the net profit of the first year's operation of the Consolidated Railway system—though it is likely that, in the case of some of the street railway lines acquired during the year, figures are included which do not fall into the period during which the holding corporation has been operating those lines.

Stated in somewhat different words, during the first year of its great electric ventures the New Haven Company seems not merely to have made good its investment but earned $76,000 besides—and to the $76,000 should be added some $80,000 a year which was being, in past years, lost annually on the Worcester & Connecticut Eastern system and which now is "digested" in the general financial returns of the Consolidated Railway Company. Such a showing is certainly remarkable and goes far, as a precedent on a very large and varied scale, to justify the theory of the purchase of electrics by steam companies. It is to be recalled that while the Consolidated Railway system does not include the old steam lines electrified of the New Haven Steam Company it does include a vast and diversified assortment of street railways. There are lines in considerable cities like New Haven and Hartford and lines in small cities like Meriden, Stamford and Middletown. There are suburban lines and "cross-country" lines; lines with high pressure of traffic and lines with scant traffic and unprofitable; and, finally, perhaps one-third of the total street railway mileage of about 560 miles competes directly or indirectly with the steam road. As to the absolute size of the system it may be stated further that it represents now some 25 lines of street railway originally independent and with capitalization in all forms of liability of some $32,000,000—though a considerable part of this was originally water both in stock and bonds. When it is remembered also that the New Haven Company has had to buy up such street railway systems as those of New Haven, Hartford and Springfield at a very high price the result of the first year's return becomes the more emphatic—saying nothing of the radical conversion of President Mellen himself to the electric theory which he disapproved so strongly during the first ventures of President C. P. Clark.

While no details are given of the earnings of the separate railways of the system it is probable that the earnings show the largest increase both relative and absolute in the cities. In one city—New Haven—it is very likely due to the strenuous efforts lately made to check pilfering of fares by employees of the street lines. But, in general, reduced cost of operation under consolidation and increased business are probably the main elements in the showing. If that increase keeps up we may yet see realized a prophecy of President Mellen that his street railways will ere many years earn 1 per cent. on his steam company's capital of $80,000,000. But whether that expectation is realized or not there must be set to the credit already of his great electric venture the advantages of control of his former electric competitors and of the operation of steam and electric lines in harmony instead of rivalry. On the negative side is to be set, as his chief peril, the results to his electric system of a period of financial depression.

While we have been hearing so much of the New Haven Company's expansion in the purchase of electric railways we have been hearing much less of its plans for electrifying of steam roads in New England. But we fancy this is merely a pause and not the surrender of a policy which President Mellen has proclaimed. It will be noticed that no change has been made either in the steam roads already electrified or in electric plans relating to suburban New York. For the moment and the moment only President Mellen's active purchase of trolley roads has probably belated larger schemes of electrification. Meantime as one token of fresh schemes of electric expansion may be remarked the official claim a few days ago of the New Haven Company that under the remarkable "omnibus" charter of the Consolidated Railway Company, granted by the last Connecticut legislature, that corporation can buy up and utilize any realty that it pleases without considering public interest or any appeal to the rights or privileges of eminent domain.

Real or searching criticism of railroad annual reports was, fifteen years ago, "in its infancy," says the *Wall Street Journal*, in a retrospect which we reprint in another column. Only by slow stages did "those who study railroad reports" learn to look intelligently into expenses, train loads and other light-giving items. This retrospect is an interesting paragraph and therefore we copy it; but we cannot refrain from completing it by remarking that the reason why the "financial district" and the other students here referred to did not learn railroad affairs faster was that they did not read the *Railroad Gazette*, which fifteen years ago had been making illuminating studies of railroad reports for 15 years and more. President Hill, of the Great Northern, says our Wall Street reviewer, first taught financial men the economy of large train loads, and "very largely" taught the railroad world the same lesson. It will probably be difficult to find any considerable number of citizens of the railroad world who will admit having sat at the feet of the St. Paul prophet to receive this lesson. It seems to us that the men who designed the powerful locomotives and the 50-ton cars were the ones who taught us to run big train loads—or, rather, that the dullest of us knew enough to practise this economy as soon as we had the instruments to do it with. Mr. Hill and other financial leaders performed an important function in seeing that roadway and bridges and other fixtures were improved as fast as was necessary to accommodate the heavier engines. Our friends of the financial district will do well to keep a sharp eye on "C. T." expenses, and keep them in the center of the stage, as is suggested; but we fear that one of the actors at the extreme left of the stage may baffle them now and then; that is the general manager who, for reasons of his own, determines not to tell the financial district just how he is spending all of his money this year!

NEW PUBLICATIONS.

Earth and Rock Excavation: A Practical Treatise. By Charles Prelini, C. E. New York: D. Van Nostrand Company. 1905. Octavo, vi + 357 pages, 167 figures. Cloth. $3.00.

This volume is an attempt to give a concise and comprehensive treatment of earth and rock excavation together with the method of planning and computation of such work, and description of the machines by which it is accomplished. It begins with a description of the ways of graphically representing earthwork and a discussion of the different ways of measuring the same. In Fig. 8, on page 16, B should be A, A should be B; and on the same page the formula, cut $= \frac{B_1^2}{A_1 B_1} \cdot \frac{d}{2}$ should be cut $= \frac{B_1^2}{A_1 + B_1} \cdot \frac{d}{2}$; and at the top of page 17 the expressions for cut and fill are interchanged. In chpater III, rules for locating a grade line on a profile are given and discussed somewhat in detail. The author cites cases in which it would be more advantageous to waste and borrow than to balance the cuts and fills when over-haul would be necessary. In connection with this the author makes the statement, "In the United States no attention is paid to the distribution of volumes along the line, either in public or in private works." "As a consequence the mean distance of haul is not known, and earthwork is never calculated on scientific principles in the United States." The tabular method used by Italian engineers for obtaining the distribution of masses and the mean distance of haul is then given, as well as the graphical methods of the German and French engineers. In the description of hand-drilling, the drills shown in the figure do not correspond to the description in the text, and both the drills and hammer are different from those generally used. Very good illustrations of two types of machine drills are given; 21 pages are devoted to the history, composition, transportation and storage, and relative value for blasting purposes of gunpowder, dynamite and nitroglycerine. These are described quite thoroughly in a theoretical way, but there is little to indicate which one should be used in a certain rock. The preceding comprises the first 87 pages of the book. The balance of the book is devoted to a discussion and description of earth excavation and excavating machinery. The subject is handled in a general way until the subject of earth excavation is reached. This is treated in some detail, and the most val-

uable part of the book is the discussion of the relative distance most economical to haul excavated material by barrows, carts, wagons and tramways. Tables are given showing the number of round-trips, the amount of material moved, and the cost per cubic yard of hauling for distances between the proper limits for each.

W. L. W.

Universal Directory of Railway Officials 1905.—Prepared under the direction of S. Richardson Blundstone, Editor of *The Railway Engineer*. The Directory Publishing Co., Ltd., 3 Ludgate Circus Buildings, London E. C.; R. A. Bagnall, 132 Nassau street., New York, sole representative for the United States. 598 pages, 5x8-in. Subscription price, 7*s.* 6*d.*; after publication 10*s.*

The field covered by this most useful directory is well known. It only needs to be said that it contains a careful list of the principal officers of every railroad in the world, together with a brief statement of the mileage of the road; of its gage, and of its equipment. In Great Britain the tramway lines are also included, although this is not true in other countries. The book is excellently indexed, containing in the back an alphabetical list of all the officers included in the book, with a paragraph reference to their companies. The companies themselves are likewise indexed alphabetically in the front of the book. This directory is a thoroughly careful and reliable publication, of very great value to persons who wish the principal physical characteristics and the personnel of the world's railroads gathered together in compact form for instant reference.

TRADE CATALOGUES.

In 1894, the Master Car Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. The advantages of conforming to these sizes have been recognized, not only by railroad men, but outside of railroad circles, and many engineers make a practice of immediately consigning to the waste basket all catalogues that do not come within a very narrow margin of these standard sizes. They are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

Standards.

Postal-card circulars	3¾ in. by 6⅛ in.
Pamphlets and trade catalogues	3½ " by 6 "
	6 " by 9 "
	9 " by 12 "
Specifications and letter paper	8¼ " by 10¾ "

Oil Storage Systems.—Catalogue 4 of S. F. Bowser & Co., Ft. Wayne, Ind., is entitled "Bowser Oil Storage Systems." It illustrates and describes oil storage systems and oil house equipments, including adjustable measure oil cabinets, self-measuring oil outfits, navy oil tanks, underground storage tanks, etc. The storage systems are illustrated by half-tone engravings from drawings showing buildings with complete installations applied, the walls, flooring, etc., being broken away to show all details. A variety of measuring outfits, navy oil tanks, storage tanks, etc., are also illustrated and described in detail.

Twist Drills, Reamers, etc.—The Cleveland Twist Drill Co., Cleveland, Ohio, has issued a new catalogue and price list of its tools for turret lathes and screw machines, including oil tube twist drills, fluted chucking reamers, shell reamers, turret tool holders and floating tool holders. This latter tool holder is of special benefit in holding and driving finishing reamers. It is self-compensating to counteract any inaccuracy in the alinement between the turret holes and the spindle or work, and will allow the reamer to cut a straight hole its own diameter.

Valves.—The Crane Co., Chicago, is distributing its special jubilee number of *The Valve World*. The cover bears a picture of R. T. Crane, the founder and president of the company. The Crane Co. was started in 1855, and this issue of *The Valve World* is devoted chiefly to a history of the company and its progress during the past 50 years. Descriptions and illustrations of its home office and of its branch offices throughout the world are given.

Wheel-Truing Brake Shoes.—The Wheel Truing Brake Shoe Co., Detroit, Mich., sends a folder in colors depicting summer scenes and entitled "In the Good Old Summer Time." The text states that while operating expenses of railroads are less in summer, flat or worn wheels are expensive at any time. The cheapest and most effective remedy is the use of this company's shoes on such wheels.

Continuous Gas Producer.—The Morgan Construction Co., New York, is distributing a neat catalogue of the Morgan continuous gas producer. It contains upwards of 50 pages and 16 illustrations showing various views and cross sections of the machine. A full detailed description of the construction of the producer is given as well as the method of operating it. The advantages to be derived from its use are also clearly set forth.

Electric Railroads.—The Railway Electric Power Company, 114 Liberty street, New York, which is the sole lessee in America of the patents of Ganz & Co., Budapest, Hungary, on a three-phase alternating current electric traction system, is distributing a large pamphlet containing a complete description of the Valtellina Railroad in Switzerland, reprinted from the "Organ for Progress in Railway Matters." This description was printed in liberal abstract in the *Railroad Gazette* and covers the entire installation, its operation and economy. The pamphlet contains a large amount of interesting and valuable data on heavy electric traction problems.

Rock Drills.—The Ingersoll-Sergeant Drill Co., New York, has just issued its new rock drill leaflet. The various types of drills made by this company, the different mountings and the special advantages of the principle types are briefly stated. Illustrations throughout show the drills as used in various classes of work.

Frogs and Switches.—Catalogue A of the Weir Frog Co., Cincinnati, Ohio, illustrates a large number of frogs and special work made of light rails for electric railroads, coal mines, plantations, factories, etc. The frogs shown are made of rail from 12 to 40 lbs. per yard.

Air Lift Pumping.—This is the title of a small pamphlet issued by the Ingersoll-Sergeant Drill Co., New York, in which a few of the possibilities of air lift pumping are briefly stated. Catalogue 73 of this company gives complete information on the subject.

Electric Trucks.—Record of Recent Construction No. 50, published by the Baldwin Locomotive Works, Philadelphia, Pa., contains illustrations and general specifications of 13 of the latest types of trucks for heavy electric traction.

Pipe Dies and Valves.—The Crane Co., Chicago, sends advance circulars of its sectional and solid easy cutting pipe dies. Also of its combination back-pressure and exhaust relief valves and butterfly hot water radiator valves.

Cutting and Punching Machinery.—The Krips-Mason Machine Co., Philadelphia, Pa., send an illustrated folder descriptive of its punching machine, which is especially adapted for making washers and discs for armatures.

Disastrous Collision at Kishmans, Ohio.

In a butting collision on the New York, Chicago & St. Louis at Kishmans, near Vermillion, Ohio, about four miles west of Cleveland, on the morning of August 13, at one o'clock, 12 persons were killed and many others were injured. An eastbound passenger train ran at full speed into a westbound freight. Most of the killed were Italian laborers riding in the smoking car of the passenger train, which was crushed for half its length by the car behind it. Of the 39 passengers on this car nine were killed instantly. The freight train should have taken the side track at Kishmans, but it ran 2,000 or 3,000 ft. beyond. No explanation has yet been given as to how the freight came to thus encroach on the time of the passenger.

Rules for Signal Repairmen.

In connection with the recent derailment at Bayonne, N. J., and the collision at Hall Road, England, which are briefly discussed on the editorial page of this issue, the reader will be interested in the following extracts from the rules for securing the safety of trains, when signal fixtures are being changed, or parts are out of order, which have recently been adopted by the Lake Shore & Michigan Southern. A notice of this new book of the Lake Shore was given in the *Railroad Gazette* of July 28, page 80. Following the Lake Shore rules we give an extract from the English clearing-house rules on the same subject.

RULES FOR REPAIRMEN, L. S. & M. S. RY.

542. They must not make any alterations or additions to the work under their charge without instructions from the supervisor of signals.

543. When it is necessary to do any work requiring the disarrangement of locking devices, the repairmen in charge shall first obtain authority from the supervisor of signals, including instructions as to the time that the work shall be done. Before starting the work he shall wire the division superintendent and obtain his o-k for authority. He shall then personally notify the signalman and shall note on the block report of the tower the words, "locking disarranged," giving the numbers of the levers affected, the time at which the work is started, and his signature. Before disarranging the locking, he shall first disconnect all switches and signals affected by the work, and shall spike the switches in their normal position, thus insuring the proper protection of all movements involved in the disarrangement of the locking. When the work is complete and the locking restored, he shall personally notify the signalman and shall note on the block report the words, "locking restored," giving the time at which the work is completed and his signature.

He shall then wire the division superintendent and the supervisor of signals that the work is complete.

544. During the time that the locking is disarranged trains shall be forwarded on caution cards or clearance cards the same as for any failure of the apparatus. (See rule 363 below.)

545. No movements shall be disconnected or circuit cut out except in case of actual necessity, but when such necessity exists, the repairman shall first notify the signalman and shall note on the block report the words "——— No. ——— disconnected," inserting the name of the movement in the first blank space and the number of the lever in the second, together with the time and his signature. When the movement is again connected up and regular working restored, he shall enter under his previous note the words, "Regular working restored," again giving the time and his signature.

546. Repairmen, in addition to recording on train sheets or towers any disarrangement of locking or disconnecting of operating devices, will, in addition, secure the acknowledgment of the signalman for all such repairs upon the form provided, and send same to the office of the supervisor of signals on completion of the work.

547. If necessary to disconnect any switch, facing point lock, detector bar or drawbridge lock, electric circuit, or any similar device affecting the safety of the track, the repairman must first confer with the section foreman and arrange for the proper protection of the track by flagman under the section foreman's direction.

548. The repairman must fasten at danger all signals protecting the movements to be disconnected, and must personally see that the flagmen are properly protecting the tracks concerned in accordance with transportation department rule No. 99, before any movement is disconnected. Whenever a switch or movable point frog is disconnected it must be spiked in position before any train is permitted to pass over it.

549. Repairmen shall adjust switches and movable point frogs with a standard switch gauge, and if the gauge of the track is incorrect, or the stock rail is improperly bent ahead of the points so that they do not face up properly, he shall notify the section foreman in writing, and if the necessary change is not promptly made, he shall notify the supervisor of signals. In the meantime the points must be adjusted to fit the stock rails as they are, so that there may be no possible chance of a wheel taking the wrong side of a point. If by any chance the gauge should be so defective as to render such adjustment impossible, the repairman shall disconnect the switch and spike it in the normal position, also disconnecting the signal for any diverging movement over that switch. He shall also make record of the occurrence on the block report in accordance with rule 545, and shall notify the division superintendent and supervisor of signals by wire. He shall also follow up the case and see that regular working is restored as promptly as possible.

550. In connecting new work, switch points must be kept spiked until the signals governing movements over them are connected up. Also arrange to have sectionmen stationed at the tower as long as the switch is disconnected, and to throw the disconnected switch by hand, under the direction of the signalman.

551. No apparatus shall be cut out of service without the authority of the supervisor of signals, and then only after notice by wire has been sent by the repairman to the division superintendent for his information.

363. When, from any cause, the home signals of an interlocking plant cannot be cleared, trains will not be forwarded on hand signals, but on caution card, except that when signalman has ascertained that the block is clear between the interlocking and the next block signal in advance, he may forward trains on clearance card instead of on caution card.

364. When any signal governing a switching movement cannot be cleared, hand signals may be used, but they must be authorized by the signalman and given from the ground, upon the track for which they are intended, and only after the train or engine which is to make the movement has been brought to a stop, and the situation fully explained and understood.

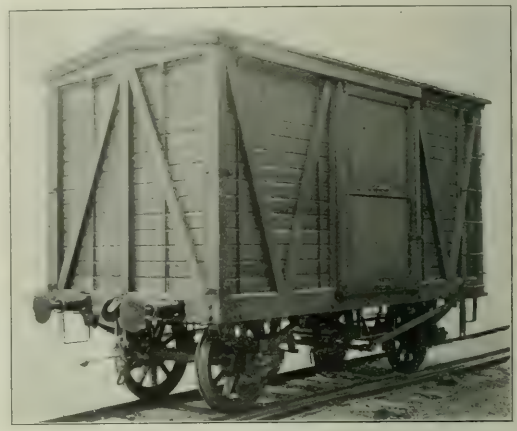
365. Whenever it is necessary to discontinue the use of any fixed signal, the division superintendent and the supervisor of signals must be notified by telegraph.

ENGLISH RULES.

In the clearing house rules governing the disconnection of facing switches, it is laid down that before any detector or detector bar, or any facing switch connection is interfered with, a memorandum must be given to the towerman by the signal fitter as to what is going to be done and this memorandum must be signed by the fitter and its receipt acknowledged in writing by the towerman. The distant signal applicable to the line affected must be fastened at danger by being disconnected from the lever in the machine, and a flagman must be stationed at the disconnected switches. The stop signal must be kept at danger by the towerman and not lowered until he has been assured by the flagman that the switches are lying in their proper position. When the work is completed the signal fitter and towerman exchange certificates and of course the towerman is to assure himself that all is in order before he puts his signature to such a document.

Covered Goods Wagons for Japanese Railways.

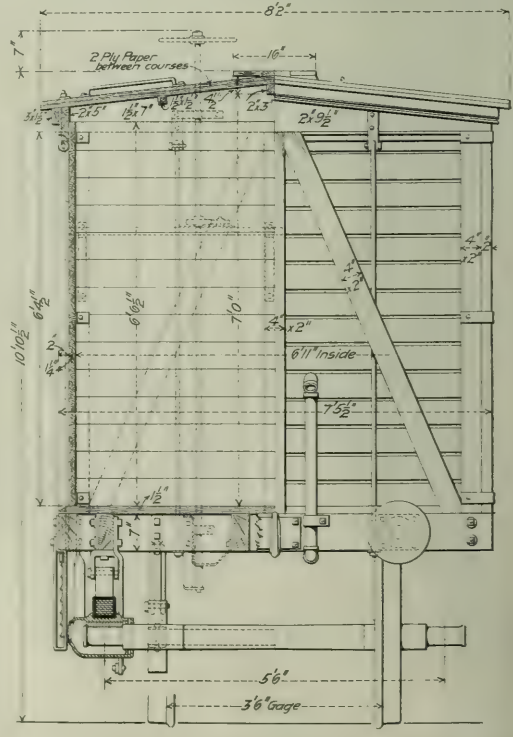
The Western Steel Car & Foundry Company, Chicago, is building for the Japanese Imperial Government Railways a lot of 900 narrow-gage (3 ft. 6 in.) covered goods wagons, illustrations of which are shown herewith. This is part of an order for 2,400 of these cars placed in this country, the remainder being built by the American Car & Foundry and the Middletown Car Works respectively. Their capacity is seven long tons (about 16,000 lbs.), and their weight 12,300 lbs. each. The car is a combination of American and European practice, the superstructure following the



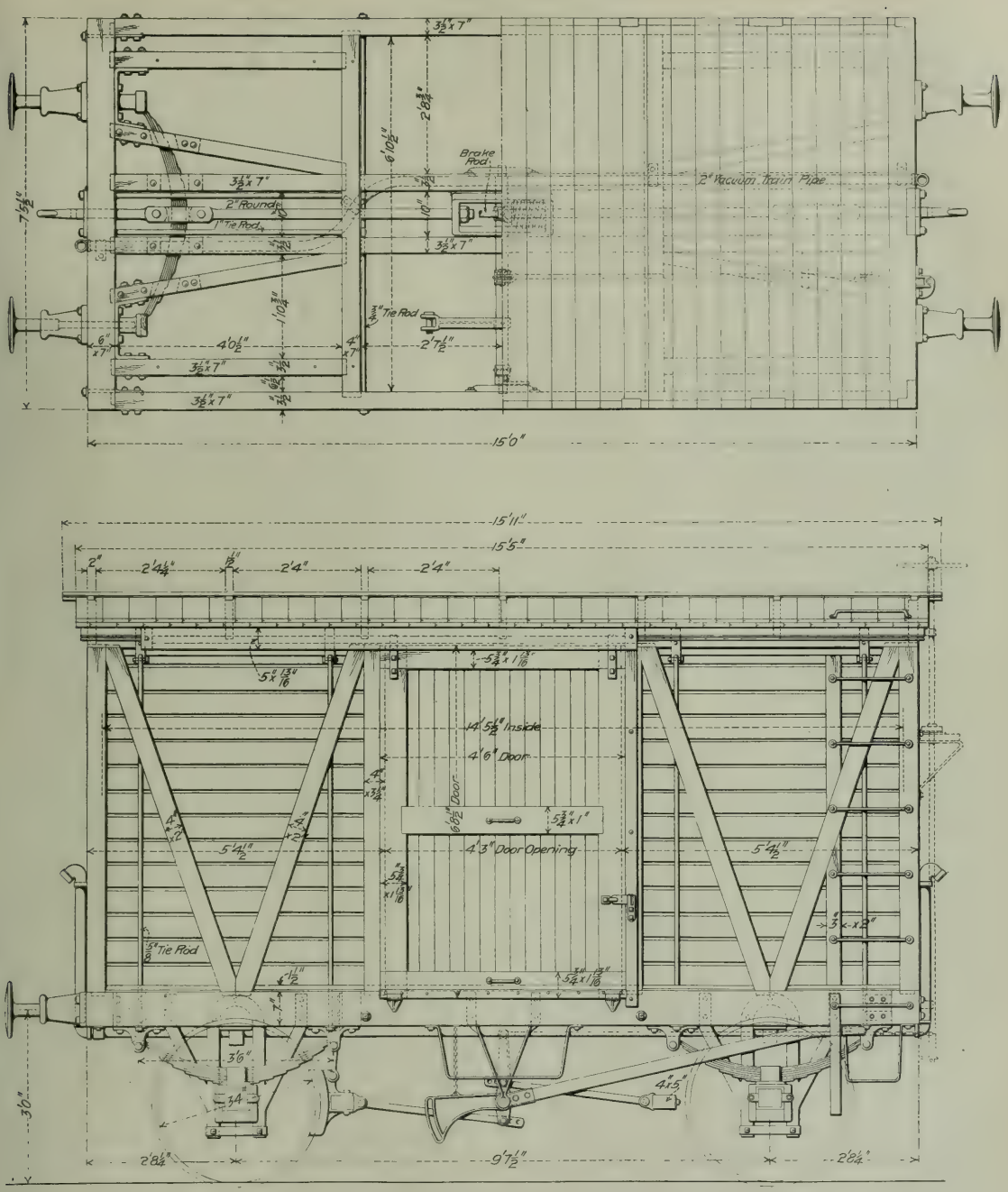
Covered Goods Wagon for Japanese Imperial Government Railways.

former, while the general characteristics are similar to the latter. Its length over end sills is 15 ft., width over side sills 7 ft. 5½ in., and height top of rail to top of running board is 10 ft. 10¾ in. The corresponding inside dimensions are 14 ft. 5½ in., 6 ft. 11 in. and 7 ft. respectively.

A special body construction is employed to enable the cars to



Part End Elevation and Cross-Section of Covered Goods Wagon



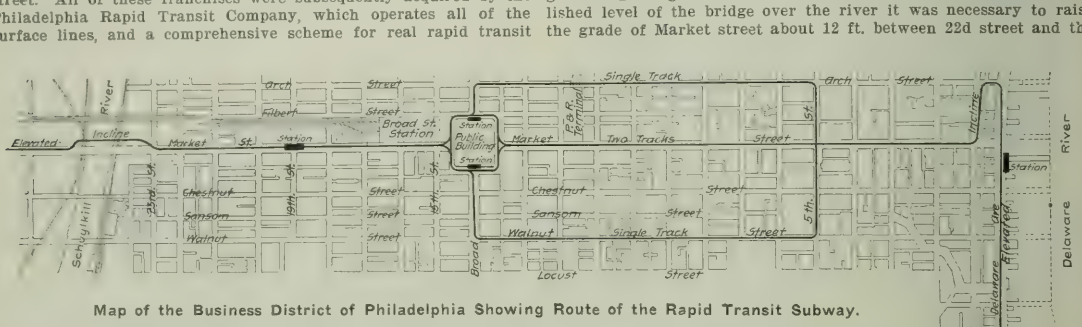
Plan and Side Elevation of 16,000-lb Covered Goods Wagon for Japanese Imperial Government Railways.

be shipped conveniently, knocked down. The body can be separated into eight parts, not including the doors, composed of the roof, floor, ends, and two parts in each side. The whole is held together by the vertical rods seen in the half-tone view. By removing the nuts on the bottom ends of these rods under the side sills they may be loosened and the pins securing them to the eyes attached to the roof may be removed. The sides are further held together by straps at the corners. With the removal of these straps, all of the parts may be separated readily.

The cars are all equipped with a foot-power brake, the details of which may be seen from the drawings and the photograph. A long lever at the side of the car extends from one end to connection with a transverse shaft hung below the middle of the car. Extending respectively above and below this shaft, in the same plane, are two short arms to which the brake rods are attached. The outer end of the operating lever passes through a guide secured to the side sill and extending downwardly therefrom. The inner side of this guide is a rack, enabling the lever to be retained in any desired position within the guide. The cars are also fitted for the application of the vacuum brake and are piped for connection with vacuum-braked cars. In addition, every tenth car is fitted with staff, wheel, etc., for hand braking. They will have draw-hook and screw couplings, wrought iron buffers, gray iron journal boxes, elliptic bearing springs and steel tired wheels.

Philadelphia's Rapid Transit Railroad.

Philadelphia is characteristically a city of homes and covers an enormous area for its population. The Delaware river on the east prevents expansion in that direction and the city's growth has taken place largely to the west, north, northeast. With the newer outlying residential districts being rapidly built up, some form of rapid transit to and from the business center has become an absolute necessity. The introduction of electric traction in 1892 helped somewhat, but it was not long before the capacity of the surface lines laid on the narrow streets in the business district was taxed to the utmost, and some other measure of relief had to be looked to. Practically every street in the business district bounded by Delaware avenue, Arch, Tenth and Walnut streets is already occupied by surface lines, most of them single track loops carrying cars in one direction only on account of the narrowness of the streets and the congested vehicular traffic. Up to 1901 there was no law in the State of Pennsylvania under which an elevated or subway rapid transit railroad could obtain a valid charter and this undoubtedly hindered the development of any plans for relief of the congestion in Philadelphia. In the spring of that year, the so-called Focht-Emery bills were passed and almost immediately franchises were granted by Philadelphia Councils for five different rapid transit projects. These were the Ridge Avenue Elevated, the Frankford Avenue Elevated, the Passyunk Avenue Elevated, the Germantown Avenue Elevated, the Broad Street Subway and the Market Street Elevated. In April another franchise was granted for a subway under Market street. All of these franchises were subsequently acquired by the Philadelphia Rapid Transit Company, which operates all of the surface lines, and a comprehensive scheme for real rapid transit was outlined. It was decided to begin with the construction of the Market street elevated and subway line and to subsequently build and connect up the other lines for which franchises had been granted. West Philadelphia stood in the most urgent need of the better facilities which this line will give, and in the business district the congestion of traffic on Market street, the principal thoroughfare, will be greatly relieved.



Map of the Business District of Philadelphia Showing Route of the Rapid Transit Subway.

The plan proposed for the Market street line which is now building was an adaptation of Boston's rapid transit scheme and provided for elevated trains and surface cars. The Market street franchises gave the right to build both an elevated structure and a subway. Accordingly the line was laid out for a double track elevated road on Market street from a point 700 ft. west of the county line near 63d street in West Philadelphia to the west bank of the Schuylkill river, the surface car tracks to be maintained underneath. A four-track bridge over the river carries the elevated and surface lines up to the portal of the subway section at 23d street. From this point to 15th street a four-track subway was planned, the two outside tracks carrying the surface cars and the inside tracks carrying the elevated trains. At 15th street the subway is to be divided, passing around the City Hall. The elevated train tracks will continue on around and join at Market street again to form a two-track subway to extend down to the river front, where the tracks will emerge on an incline to an elevated structure on Delaware avenue from Arch to South streets. The surface car track will leave the elevated train track at Broad street and the City Hall and continue south on Broad street in a single track subway to Walnut street, then east to Fifth street, north to Arch street, west to Broad street and south to City Hall, where it completes the loop and joins the westbound elevated train track to continue on out under Market street. These lines will reach the heart of the business and wholesale district, the Pennsylvania's Broad street station, the Philadelphia & Reading terminal at 12th and Market streets, and the Camden ferries at the foot of Market street.

MARKET STREET SUBWAY.

Work was begun first on the subway section between the Schuylkill river and 15th street. For the purpose of letting the contract this section was divided into two parts, section three including the work from the west house line of 15th street to the west house line of 22d street, and section four beginning at the west house line of 22d street and including the east abutment of the bridge over the river. Contracts for both sections were let to the E. E. Smith Contracting Company, Philadelphia, on April 1, 1903, and the first ground was broken on April 6.

Before actual work could be begun on the subway it was necessary to arrange to change the location of the sewers under Market street between 15th street and the river and to build a new outfall into the river. The drainage through this part of the city is to the north and a new intercepting sewer was therefore built outside of the line of the south wall of the subway to take the sewage from the cross streets and the houses on the south side of Market street. To take care of the house drainage on the north side of Market street a small sewer was built in the north wall of the subway as the work progressed. The water and gas mains were moved outside the subway walls, pipe lines under cross streets being carried over the roof of the tunnel. The most difficult work of this kind was a 48-in. water main under 22d street which was carried over the roof, a special construction being employed here. Between 22d and 23d streets the subway passes close to large gas holders of the United Gas Improvement Company, and a complicated network of gas pipes was relocated here. The conduits of the Bell Telephone Company were taken up and relaid in Arch street one block north. Part of the conduits of the Keystone Telephone Company were laid in the upper part of the south wall of the subway and the remainder were relaid in the back filling along the north wall substantially in their former position.

When the rapid transit system was laid out a maximum grade of 5 per cent. was adopted. In order to preserve this maximum grade and bring the tracks up from the subway level to the established level of the bridge over the river it was necessary to raise the grade of Market street about 12 ft. between 22d street and the river. This work, including the changes of grade in adjacent streets, was authorized by a city ordinance passed Dec. 24, 1902. The contract was let by the city to C. P. Weaver, and afterwards sublet to the E. E. Smith Contracting Company, contractors for the subway work. The old grade of Market street was only 9 ft. above the established level of the base of rail in the subway and the approach to the Market street bridge was quite steep. Concrete retaining walls were built on both sides of Market street next to the property line and the excavated material from the subway was used for filling in. The south half of the street was filled in first and the street car tracks and roadway shifted to that side, while the north half was being filled in and the subway and portal built.

The total length of the tunnel in sections 3 and 4 is about 3,700 ft. It is four-track throughout and is a tangent for the entire distance except for the reverse curve beginning 77 ft. west of the center line of 22d street, which deflects the tracks out 100 ft. to the north to the center line of the bridge over the Schuylkill. The portal is 150 ft. west of the center line of 23d street. A typical cross-section of the subway is shown in one of the drawings. Market street is practically level between 15th and 23d streets and the floor of the tunnel corresponds nearly to the street grade. The minimum cover above the top of the roof is 4 ft. and the maximum about 9 ft.

The side walls are concrete of a 1:3:6 mixture, reinforced with horizontal and vertical rods bedded 3½ in. from the inside face of the wall. The horizontal rods are deformed rounds ⅝ in. in diameter and spaced 18 in. apart beginning from below the base of rail and extending up just under the bed plates for the roof beams. In the early part of the work 1⅛-in. Thacher rods, 17 ft. 6 in. long and spaced 15 in. center to center, were used for the vertical reinforcement in both walls, when it was intended to build ducts in both walls, but later this detail was changed so as to use 1-in. Thacher rods spaced 15 in. center to center in the north wall, where the ducts were omitted, and 12 in. center to center in the south wall, where the ducts were retained. The walls are the same thickness, 42½ in., from top to bottom, being given no batter.

The floor is concrete of a 1:3:6 mixture with a minimum thickness under the ballast of 11 in. on an earth foundation and 6 in. on a rock foundation. It is formed with suitable benches for supporting the roof columns. These columns, which are made up in an I-

section of four 4-in. x 3-in. x ⅜-in. angles and a 6-in. x ¼-in. web plate, are spaced 5 ft. center to center. They rest on base plates 16 in. x 14¼ in., and support the roof beams with 9-in. x 14-in. cap plates. At cross-overs and on the reverse curve west of 22d street, concrete bulkheads or fenders will be built in the rows of columns as shown in the drawing, a passageway being left between every other column, which also serves as a refuge bay for workmen. These bulkheads will be 4 ft. 5½ in. high, and will be reinforced with $^{5}/_{16}$-in. round rods. Where the bulkheads are not used, a reinforced concrete strut is placed longitudinally about the middle of the column.

The roof is the same arch construction as was extensively used in the New York subway. The roof beams are 20-in. I-beams, 65 lbs. per ft. bedded on 12-in. x 12½-in. x ¾-in. bearing plates in the side walls and supported by the central columns. They are completely encased by the concrete arches except the bottoms of the lower flanges and are thus effectually protected from corrosion. The arches are made of a 1:3:6 mixture of concrete and have a minimum thickness under the waterproofing at the crown of 1 ft. 3 in. They are reinforced over the I-beams by a strip of wire mesh 20-in. wide and by ¾-in. tie rods between the beams.

The roof loads assumed in the design of the roof and column members are in accordance with the results of long experience in Philadelphia and allow for the heaviest loads likely to be transported through the streets. The heaviest pavement liable to be placed—granite blocks on a 6-in. concrete base—was assumed, which gives a weight for 15 in. of depth, including a 3-in. sand cushion, of 175 lbs. per sq. ft. The weight of earth filling below the pavement was taken at 110 lbs. per cu. ft., giving a maximum dead load for a 10-ft. covering of 1,140 lbs. per sq. ft. The concentrated live load consists of 10 tons on each of four wheels, 20 ft. between axles on a 6 ft. gage. This is considered as evenly distributed over the roof by the pavement and the top filling. By assuming these wheel loads as replaced by rectangles spaced 20 ft. apart, the equivalent distributed load was found. This varies from 1,180 lbs. per sq. ft. for a 4-ft. cover to 200 lbs. for a 16-ft. cover though not in direct proportion to the depth. In addition to the foregoing concentrated loads, a general load of 200 lbs. per sq. ft. is applied exterior to a space 30 ft. long and 11 ft. wide, placed symmetrically to the concentrated load, the greater length parallel with the longitudinal axis of the latter.

In some places where the standard roof construction could not be employed special methods were used. At cross-overs, for example where the span of the roof beams is 24 ft., 30-in. plate girders are used instead of the 20-in. I-beams.

The waterproofing and means for keeping the subway dry have been given particular attention as part of the tunnel walls are below the level of water bearing gravel. In the side walls a layer of waterproofing is applied as follows: First, a layer of Cerion waterproofing compound over the concrete, then a layer of burlap, another layer of paint, another of burlap, and a third layer of paint. Eight inches of concrete is then put on outside of this coating before the back filling is put in. This layer of waterproof covering extends down to the level of the base of the rail and is made a continuous part of the roof waterproofing, which consists of rock asphalt mastic 1 in. thick applied in two layers. The specifications for this mastic are as follows:

The asphaltic rock forming the basis of the mastic shall be Seyssel, Limmer, Sicilian or Neuchatel, of the best quality and imported in the crude state. Such rock shall be prepared and manufactured with asphalt as a flux, to be composed of Bermudez or Alcatraz asphalt or a mixture of them, made into blocks, properly marked and branded. These blocks shall be broken up and melted on or in the immediate vicinity of the work and prepared for use by the admixture of materials, as stated in the following: The mixture shall consist of 70 parts by weight of the aforesaid asphaltic mastic as received in cakes or blocks, ten parts by weight of refined Bermudez or Alcatraz asphalt or a mixture of them, and 20 parts by weight of sharp grit and sand that will pass a sieve of eight meshes to the lineal inch, free from dust and dirt. As the mastic is melted, the grit and the asphalt, having been previously heated to the same temperature as the mastic, shall be added, and the whole mass heated to a temperature of 260 to 280 deg. F. and thoroughly mixed. After a sufficient time of boiling, the mastic is to be carried to the work in wooden pails or barrels and there carefully spread over the floor and roof with wooden spatulas to such a depth that after having received its ultimate compression it will have a thickness of not less than ½ in. The mastic so applied shall be thoroughly worked until it is entirely free from voids and thoroughly compacted. Care shall be exercised so that the grit used shall be free from particles exceeding the size herein specified, and the surfaces well broomed and free from pebbles or any particles which will be rolled about in smoothing and compacting the mastic, and thereby produce defective spots in the covering.

All surfaces upon or against which waterproofing is to be placed must be dry and approved before waterproofing is applied. In particular situations apparatus for local application of heat shall be used if necessary to expedite drying of the surfaces.

The roof is given a slope each way from the center of 1 in. in 6 ft. and on top of the waterproofing an additional 3 in. of concrete is placed to protect the waterproofing from being punctured by the top filling.

Under the floor of each of the outside tracks a 12-in. terra cotta drain has been placed which dips to a common sump at 22d street. At intervals of 50 ft. branch drains 4 in. in diameter extend out under the floor beyond the side walls to collect the water in the soil back of the wall which would otherwise back up and leak through. A quarter-turn bend is placed at the end of these cross drains with the open end turned down and surrounded by broken stone to prevent the drains from choking up. A gutter in the floor of the subway leads any water which may collect inside the tunnel to gratings over the main drains, where it is run off. At 22d street two small centrifugal pumps, motor driven, with automatic float regulators, keep the water in the sump down to the prescribed level. This arrangement has proved very satisfactory, not only after the work was finished but in keeping the advance headings dry during construction. The drain is led ahead of the excavating and carries off most of the surface water. The waterproofing has been very effective for although the tunnel runs most of the distance in water bearing ground, the walls of the completed section are quite dry and in only one or two places can leakage be observed, and then only a small amount of water drips down.

There is only one station in the completed portion of the subway, at 19th street, although one will be built at 15th street when the work progresses that far down. The station at 19th street is for the surface cars only, running on the outside tracks. It has short platforms capable of accommodating about two cars at a time, or if desired three cars. On the south side there are two levels, the upper one having the ticket office and the lower one being at the level of the tracks for boarding and alighting from the cars. This double level was made necessary by the large sewer built along the south wall, which did not allow room for a ticket office and platform on the same level. The north platform is wider and allows the ticket office to be put on the lower level. Each platform has a separate exit and entrance and toilet rooms for men and women.

In building the subway the contractors made an effort to disturb traffic on Market street as little as possible. Work was begun on the west end after the necessary changes had been made in the street grades and sub-surface structures. The first step was to open the street on the south side and excavate a trench of sufficient width and depth to build the main sewer, subway wall and the foundations for the first row of columns. This was done in sections about two blocks long and one side of the street only was closed to traffic, the street car tracks not being disturbed. When the sewer and wall were built for the length of the section the first row of columns was put up and the roof beams, concrete arches and floor of the south track completed entirely. Then the trench was back filled and the top filling and pavement put down and restored to its original condition. Temporary shores were put in to relieve the wall from the earth pressure back of it until the remainder of the roof could be completed and the central core was bulkheaded at the same time. When this was completed the trench for the north wall was begun and carried up to the end of the south wall. After the wall had been built stringers were then placed under the street car rails, which rested on the central core, and a plank floor was laid on them. The pavement between the tracks was relaid on the plank floor and the whole was supported on temporary wooden posts until sufficient earth had been removed from under the floor to insert the roof beams on top of the standing columns. The floor was then lowered on blocking to the roof beams and the excavation of the central core begun. To facilitate the removal of the excavated material the roof next to the north wall was left off until the entire core was removed, when the roof arches over the remaining three tracks were placed and filled in on top. The street pavement was then restored to its original condition on a solid earth fill. The accompanying illustrations from photographs taken during progress of the work show these steps and also the comparatively unobstructed condition of the street.

The soil penetrated was firm clay and gravel with only an occasional outcrop of rock requiring very little blasting. No difficulty from caving was experienced and the work has progressed rapidly since it was fairly begun. The concrete used was all machine mixed and placed very wet. The surface next to the forms was well spaded and the result is a smooth uniform surface on the walls. The concrete work is an excellent example of good work placed under difficulties of accessibility. Gravel obtained from the excavation was used in much of the concrete in place of sand.

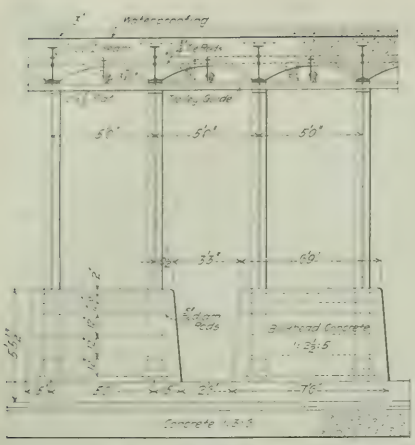
The conduits in the south wall are divided into two groups of 57 ducts and 21 ducts respectively. The top bank will contain the wires and cables of the Keystone Telephone Company and entrance to the manholes serving this group will be from the street surface. The lower bank of 57 ducts will carry the telephone, power and light wires of the Philadelphia Rapid Transit Company. The manholes for this bank open into the tunnel and also into the street. The ducts are 4 in. inside diameter, made of salt glazed vitrified clay and were laid in sections 18 in. and 24 in.

Market Street During the Construction of the Subway.

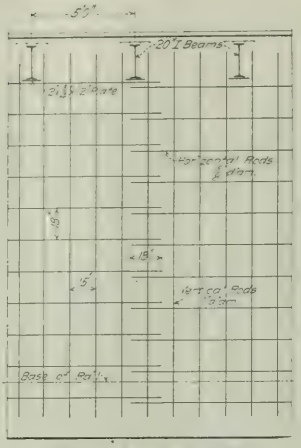
Roof Construction in the Subway.

Placing Concrete Roof Arches at 23d Street.

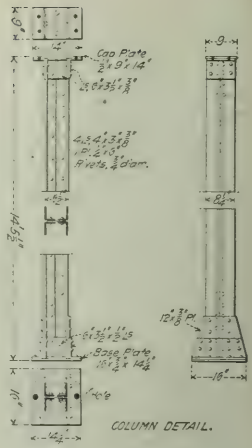
Completed Portion of the Subway Near the West Portal.



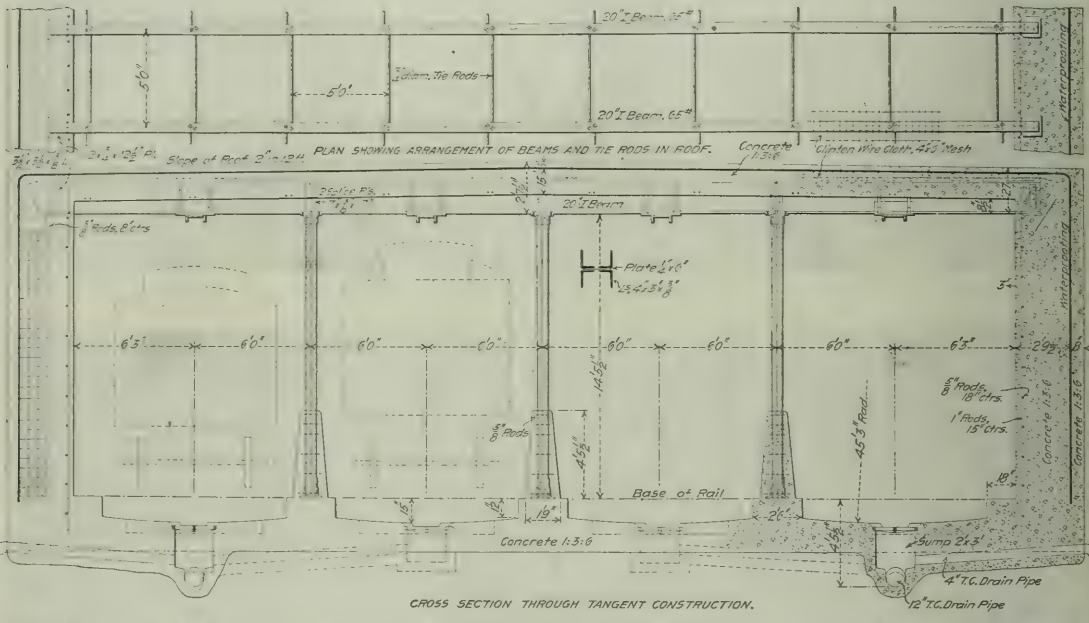
LONGITUDINAL SECTION SHOWING BULKHEADS.



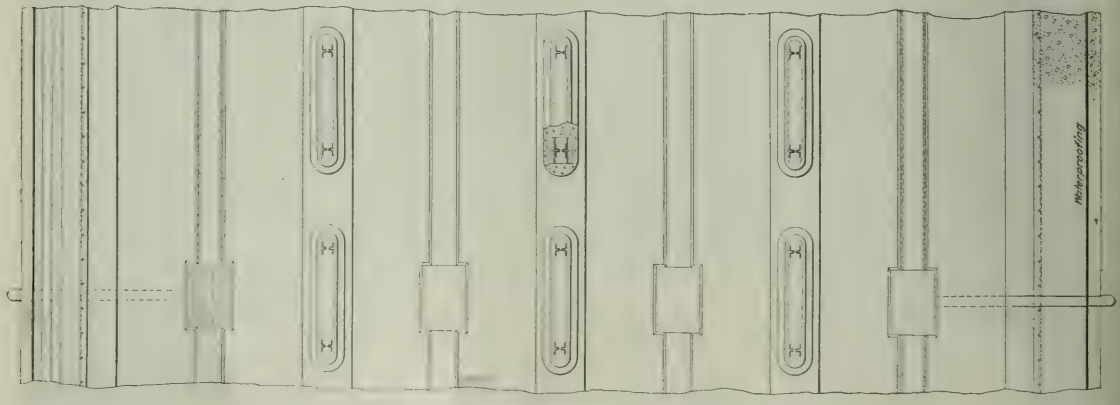
ELEVATION OF RODS IN SIDE WALLS.



COLUMN DETAIL.



CROSS SECTION THROUGH TANGENT CONSTRUCTION.



SECTIONAL PLAN SHOWING BULKHEADS AND FLOOR.

Details of Typical Construction in the Philadelphia Subway.

long. Particular care was taken to have them exactly coincide at the joints and to clean them of all projecting fins and mortar which might damage the cable covering. The joints are wrapped with two strips of thick muslin 6 in. wide and saturated with neat cement mortar to keep out water and dirt.

The track in the subway will be laid with 90-lb. T-rail. For the two middle tracks a third-rail will be installed, but trolley wire brackets have been fixed in the roof over all tracks, so that in case of emergency or for any reason it should be desired to run surface cars on the middle tracks means will be provided for delivering current through an overhead trolley. No attempt will be made to light the tunnel brilliantly and as yet it has not been finally decided whether the walls will be washed with a light colored water-paint or left in the natural color. The columns will be painted a dark color to relieve the eyes as much as possible. Whether a complete signal installation such as has been installed in the New York Subway will be put in has not yet been finally decided.

To assist ventilation four openings will be built near 15th street and two have been built at the 19th street station. These will provide room for fans driven by motors. At 22d street the foundations have been put in for an ornamental masonry ventilating stack 60 ft. which by natural draught will draw out foul air from the tunnel and discharge it above the house tops.

The present progress of the work is about as follows: The subway is completed from the portal west of 23d street east to a point about under 17th street. The south wall is completed to the end of the section at 15th street, and most of the remaining section of the north wall is done. The roof and excavation for the central core remains yet to be finished and there is much finishing work to be done on the 19th street station. No track has yet been laid but in the completed portion of the tunnel the floor has been cleaned to receive the track and part of the rails have been delivered along the track ready to be laid.

SCHUYLKILL RIVER BRIDGE.

The four tracks emerge from the tunnel portal west of 23d street on a 4½ per cent. grade and with a spiraled reverse curve running on a solid fill close to the north retaining wall of Market street up to the east abutment of the bridge about 350 ft. west of the portal. A station for local cars is built between the first pier and the abutment having covered platforms about 90 ft. long. This span of the bridge carries the tracks over the tracks of the Baltimore & Ohio which run along the river's edge and is made up of four deck plate girders, with separate girders outside to carry the platforms. The four tracks on this span rise on a 4.63 per cent. grade to the first through span. The ties rest on stringers under each rail and these are supported on heavy floor beams. The abutment is built with a cross tunnel inside of the face. Stairways lead down from each platform to the level of the tunnel to furnish a connection from the station to the Baltimore & Ohio passenger station, one block away.

One of the illustrations from a photograph shows the bridge over the river. The superstructure consists of a plate girder approach span at the east end on which the station is built, a 98-ft. through Pratt truss, a 214-ft. truss with curved top chords, a 90-ft. Pratt truss and plate girder approach spans 82 ft. long on the west end. The design of the bridge involved considerable difficulty in placing the floor members and lateral bracing because the inside tracks for elevated trains are carried up on a 4.3 per cent. grade from the east shore pier so that at the west end they are on a level with the elevated structure which begins there, while the outside tracks are on a descending grade of 2.34 per cent. from the east river pier to the ground surface at the west end of the bridge. The design was further complicated by the fact that the west approach is also on a reverse curve having the point of tangency about over the west shore pier.

The east Pratt truss is a through truss with heavy floor-beams and stringers arranged in the usual manner. It is 22 ft. high from center of bottom chord to center of top chord. The 214-ft. span also has through trusses, but at the west end the inside tracks are raised so high that the portal is moved back to the second panel point. The west Pratt truss is practically a double deck structure,

Photo courtesy Philadelphia *Evening Bulletin.*

The Schuylkill River Bridge of the Philadelphia Rapid Transit Railroad.

The elevated tracks emerging almost at the level of the top chord. The piers and abutments are all stone and with the exception of the west abutment rest on solid rock foundations put down with pneumatic caissons. The west abutment rests on a pile foundation. The total length of the bridge from the east abutment to the west abutment is 563 ft., and the under clearance at mean high water is 28.6 ft. The American Bridge Company built and erected the superstructure.

We are indebted to Mr. W. S. Twining, Chief Engineer of the Philadelphia Rapid Transit Company; Mr. Charles M. Mills, Principal Assistant Engineer in charge of subway and elevated improvements, and Mr. Frank Fisher, Assistant Engineer in the field, for information and the illustrations. In a subsequent article the elevated structure on West Market street will be illustrated and described.

(To be continued.)

The Swiss legislative bodies have been discussing the report and accounts of the state railroads for the year 1904, when there was an increase of working expenses much larger than the increase in earnings, due chiefly to an increase in payments to employees and some additional train service. The responsible officers report that the full effect of the increase in the number and wages of employees will not be felt till 1906; and that a conservative course must be pursued as to popular demands for additional trains, new structures, etc.; but that there is no cause for alarm, if such a

course is followed. They urge very strongly that the sinking fund policy, which will pay off the cost of the railroads in 60 years, be adhered to. Many suggestions were made in the legislature, but the prevailing feeling seemed to be one of satisfaction.

Criteria in Railroading.

The time is close at hand for the annual harvest of railroad reports. In the next three months we shall have the usual statements covering the operations for the year ended June 30 last. Every year brings some improvement in the method of railroad reporting. Occasionally some company takes a step backward in the matter of furnishing information, but usually this is offset by improvement in other quarters.

Twelve or fifteen years ago the principal interest in railroad reports centered in the companies balance sheets. The all important point was that of "floating debt." At that time very little attention was given even by the more expert observers to anything beyond the condition of a road's finances. If a road's cash assets exceeded its current liabilities, and the official "income account" showed a surplus after all payments every one was satisfied. What might be called the "higher criticism" of railroad figures was then in its infancy. Later, as times improved, there came the study of "concealed equities" representing betterments charged directly in operating expenses diminishing the final surplus and superficially concealing the true earning capacity of the property. Expenses for maintenance of road and equipment began to receive close attention and the principal aim of those who study railroad reports was to develop the extent to which there was an equity in these expenditures. This was the principal criterion in the middle and later nineties.

Then came the question of operating efficiency as measured by the revenue train load. The principal impetus to this line of study was furnished by the advent of Mr. James J. Hill in Northern Pacific affairs in 1896. That Mr. Hill educated the financial district upon this point admits of no question. That he very largely educated the railroad world on the point is reasonably certain. At all events attention was focussed upon the matter to such good purpose that in a few years fully 100 tons was added to the average revenue train load of all the trains of the United States, although for many years previously little or nothing had been done in that direction. Study of the "train-load" question then directed people's minds to the importance of the "conducting transportation" expense-item which depends so largely and so directly upon train loads. In the last two or three years this has been the item in a railroad report which has received the most critical observation and according to which railroads have been judged. Of course the other criteria have not been neglected by any means, but, as is natural, each item in turn has had, so to speak, the center of the stage. The "conducting transportation" matter is, moreover, likely to hold the forefront for some little time to come as results for the past two years have been on the whole unsatisfactory from this point of view. The railroads, partly as a result of inefficient facilities, partly as a result of bad weather and partly as a result of careless operation owing to considerable prosperity, have fallen off in the matter of operating efficiency and the ground lost will have to be made up as a preliminary to further improvement.

Probably no single item in the railroad reports for the fiscal year recently ended will be of greater importance than this one. Probably the reports will show results not satisfactory. That there is at the present time a great margin for improvement so far as most of the large systems are concerned is quite certain. Because railroads are prosperous they need not necessarily be extravagant. —*Wall Street Journal.*

Investigation of Private Car Lines.

The Interstate Commerce Commission, on its own initiative, acting from complaints against private car lines, has begun a much needed investigation of the subject. Prior to any action that may be taken by Congress, next winter, it is desired to test the existing laws, and see if they provide workable remedies for the evils that undoubtedly exist.

The complaint set forth by the Commission is directed against the Armour Car Line, the American Refrigerator Transit Company, the Santa Fé Refrigerator Despatch, and the following railroads: St. Louis & San Francisco; Atchison, Topeka & Santa Fé; St. Louis, Iron Mountain & Southern; Central of Georgia; Southern; Atlantic Coast Line; Seaboard Air Line; Pennsylvania; Southern Pacific, and Kansas City Southern. The railroads and refrigerator lines are made respondent in proceedings which require that specific answer to all allegations be made to the Interstate Commerce Commission by Sptember 5.

It is charged that by way of rebates or other devices the refrigerator lines are acting for the railroads as authorized agents and the railroads, acting through the refrigerator lines, are collecting and receiving for the refrigeration of fruit and vegetables lower rates from some shippers than they are contemporaneously receiving for similar service rendered to other shippers. This is held to be in violation of sections two and three of the act to regulate interstate commerce.

Another charge is that failure and neglect to publish at shipping stations and file with the Interstate Commerce Commission the rates and charges imposed for refrigeration of fruits and vegetables, constitutes a violation of section six of the Interstate Commerce act.

The Commission alleges further that the charges published jointly by the refrigerator lines and the railroads for the refrigeration of fruits in certain specified territories are unreasonable and unjust, and in violation of section one. The territories described are Missouri, Arkansas, Indian Territory, Texas, California to eastern points, Louisville and Kansas, and Georgia, South Carolina, and North Carolina, to New York.

The Frisco System of Handling Time Freight.

The present time freight system of the Frisco, which went into effect March 1, 1905, is based on a telegraphic record of cars containing important or perishable commodities. Such commodities are divided into two classes. Perishable freight, carloads of package freight or merchandise, oils, etc., are designated as Red Ball freight. The second classification of goods, which take precedence over ordinary freight but not over the Red Ball group, is larger and includes new agricultural implements, ammunition, architectural iron, export cotton, canned goods, crockery, dried fruits and vegetables, machinery, furniture, etc. The commodities on this list are known as Green Ball freight. On June 1, 1902, a system was put into effect covering Red Ball shipments only. The forms that were used were practically the same as at present, except that movement of the cars was posted on a large board by symbols, and these symbols were moved along the board as fast as wire reports were received. This served very well for keeping track of the cars in transit, but did not give a permanent record which could be consulted easily later on; therefore, the board was done away with, and the movements of freight were recorded on loose record sheets. This system is still in effect and permits a permanent record to be maintained by which tracers can be answered days or weeks later. A Red Ball envelope was formerly used which carried the billing; but this caused inconvenience, extra work, and occasionally improper handling of cars through the bills being placed in the wrong envelope. The 1905 modification of the system has done away with the envelope at the same time that it introduced the Green Ball classification. Instead of the usual waybill, these shipments are covered by billing printed on red and green paper, and at large stations, such as St. Louis, Kansas City, etc., a red or green card waybill is used when the regular billing cannot be made out in time to accompany the car. One of these waybills is shown with this article. Merchandise billing is made out in the usual form, with a Red Ball card attached to the bundle or car when the bills are not ready at the time of forwarding. Freight from small points not designated Red and Green Ball billing stations is moved to the first division terminal in local trains, where it is assigned proper symbol letters and numbers and is placed in through trains.

The "consist" reports, as well as the passing and set-out reports, are explanatory, and are sent by wire promptly after passing each terminal. Examples of these reports are shown herewith. Only the original consist report gives the car number, waybill reference, etc. Thereafter the symbol is used exclusively. By this system the company is enabled to notify its traffic representatives promptly of shipments coming on or reaching various important terminals, such advice being sent either by mail or by wire as circumstances may require.

The Red Ball system is maintained in the office of the superintendent of car service and he is the only one authorized to trace carload shipments, an arrangement which has materially reduced wire work and duplicate tracing by different departments.

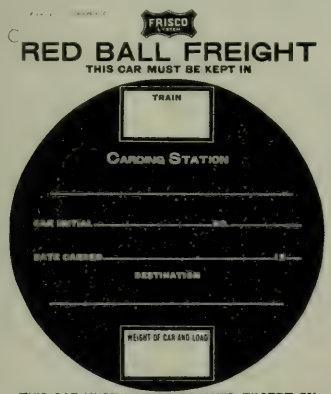
The pamphlet of instructions sent out at the time the present system was inaugurated last March specifies, among other things, that all tracing of carload freight shall be done through the superintendent of car service, and that tracing of less than carload freight shall be done through the freight claim agent. Less than carload shipments must not be traced by wire and tracers must not be started until sufficient time shall have elapsed for shipments to have reached destination and with positive information of non-arrival. Tracers received either by mail or wire must be answered promptly and not held awaiting arrival of shipment. All tracers from the superintendent of car service are covered by a file reference, and this file reference must always be quoted in answering tracers. Attention is called to the point that the principal object to be attained by the system is to eliminate all telegraphic tracing and also to relieve the freight claim agent's office of the burden of tracing by mail, and it is emphasized that success depends entirely on these tracers being handled without any delay whatever.

There are 66 stations at which Red and Green Ball freight can

be billed. Each of these stations has a symbol letter and is assigned numbers, extending from one to 30 in the case of the smallest stations, and from one to a thousand in the case of Kansas City and St. Louis. Other points range between these extremes. Each station uses its numbers consecutively, regardless of whether Red or Green Ball freight is covered, commencing with the lowest number and starting again with "one" when the highest number has been reached. Thus, Afton, symbol letter F N, numbers from one to 30; Memphis, symbol letter A U, numbers from one to 600.

Forms 142 and 142A are the Red and Green Ball cards to be attached one on each side of every car of freight thus designated by the agent at the billing station. The Green Ball form, not shown with this article, is precisely like the Red Ball form except that the legend on the bottom of the card reads "This car must not be delayed except on account of being in bad order or to give preference to Red Ball freight." It is marked on top "Green Ball Freight," and contains in its center a green disk 6¾ in. in diameter. From one to five trains are specified in each of the nine operating groups as Red Ball trains, and for convenience all of these trains in each group are designated and carded by a single train number, often given in an abbreviated form.

Form 1,171 or 1,172 must accompany each car of Red Ball freight. The accompanying waybill for Green Ball freight is not shown, being substantially the same. These forms can also be used as a through waybill when shipments are destined to points beyond the Frisco system and for which through rates are provided. The space provided for Red Ball symbol letters and numbers must be left blank by agents at non-Red Ball billing stations and filled in by the agent at the first Red Ball billing station en route. This waybill takes the place of the Red Ball freight envelope formerly used. It is specified in fine print in the lower right-hand corner of the waybill that conductors must refuse to handle the car beyond



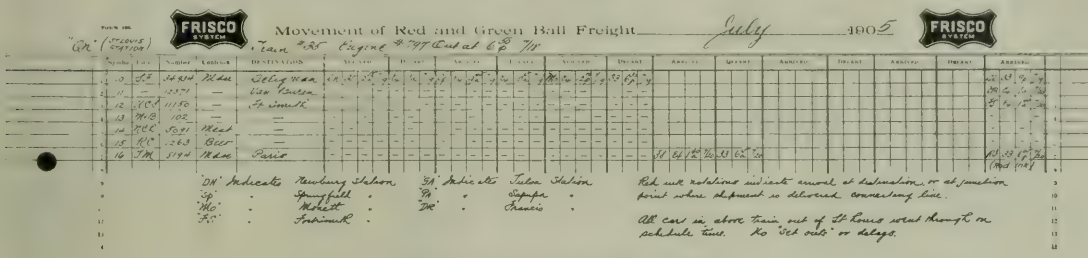
Red Ball Time Freight Card.

the first Red Ball billing station en route unless it bears the proper station symbol letters and numbers.

Form 1,173 Red Ball card waybill is used by agents at large billing points for purposes of forwarding Red Ball freight when the regular Red Ball freight waybill cannot be made out in time to accompany the car. This form and the accompanying one for Green Ball freight, No. 1,175, are also used at junctions with other lines for purposes of forwarding Red and Green Ball freight received from connections under through waybill. These card waybills can only be used at points authorized by the auditor of freight accounts. It is prescribed that these forms must be copied, The original accompanies the car and the tissue copy is mailed to the auditor of freight accounts at St. Louis.

The Red or Green Ball freight waybills (either regular or card) are not given symbol letters and numbers until all of the cars which are to be forwarded as Red or Green Ball freight are ready. The waybill covering the car for the nearest destination, either Red or Green Ball, should be given the opening symbol number, and the waybill for each succeeding destination should be given succeeding numbers consecutively in the same way.

Forms 106 and 106-A, differing only in size, are known as the consist report, and are used by the agents at Red and Green Ball


FRISCO SYSTEM
Movement of Red and Green Ball Freight July 1905
FRISCO SYSTEM
"DN" Indicates Hamburg Station
"SP" Springfield
"MO" Mobert
"FS" Fairmont
"SL" Indicates Tulsa Station
"PS" Sapulpa
"DE" Francis
Red and relative symbols indicate arrival at destination, or at junction point where shipment is delivered connecting line.
All cars in above train out of St Louis west through on schedule time. No "set outs" or delays.

Portion of Page from Monthly Record.

billing stations to report by wire to the superintendent of car service the forwarding of all cars belonging to either of these classes. The report is made up from information given on the face of the Red or Green Ball waybills.

Set-out cars are handled with form 102, which is attached to the back of the Red or Green Ball freight waybill or card waybill whenever it is necessary that such cars be set out. This blank is gummed at the top, so that it can be fastened to the back of waybills. It is of distinctive color and indicates to every one that the car has been set out and must not again be set out except on account of bad order. A duplicate of this report is left by the conductor with the telegraph operator at the point where the car is set out, and he at once wires the information given thereon to the superintendent of car service. If the car is set out at a blind siding, report will be left at the next telegraph station. Should the freight be transferred to another car the necessary information will be entered on the Red or Green Ball waybill in the proper place, but no change is permitted in the original symbol letters and numbers, which must identify the shipment to its destination.

Form 104, known as the delayed cars forward report, is used by all agents and yardmasters to report by wire to the superintendent of car service the forwarding of all cars of Red or Green

Form 103.

FRISCO SYSTEM

Report of Arrival. Destination.

Sending Operator.	Receiving Operator.	Time Filed.	Time Sent.
		....M	....M

25 REPORT.

Supt. Car Service, Springfield. From "A" .....

Date. "B" ..... 19 ....

Freight with Way-Bills carrying following Symbol Letters and Numbers arrived at this station at time and date given below:

Symbol Letters and Numbers.		Arrival this Station.		
Lowest No.	Highest No.	Train No.	Time.	Date.
"C"	"D"	"F"	"H"	"J"

..... Agent or Yardmaster.

Instructions: Agents or Yardmasters at destination of car will make out this report immediately on arrival of cars of "Red and Green Ball Freight" travelling under symbol letters and numbers, and telegraph it to Supt. Car Service. Agents at junction points where cars leave this Company's rail, or at junction points with any branch line who receive any cars being handled as Red and Green Ball, will make out this report showing arrival of all such cars at their station.

In making up this report use the lowest and highest symbol number with letters shown on the "Red and Green Ball Freight" Way-bills. Make separate entries when break occurs in consecutive order.

FRISCO SYSTEM

Leave this Space Blank for Binding Purposes

FORM 1171

This form to be used for billing RED BALL Freight ONLY

SEE CLASSIFICATION IN BOOK OF INSTRUCTIONS.

St. Louis and San Francisco Railroad Company

This space to be used at RED BALL billing stations only. Connecting Lines not interested.

RED BALL { SYMBOL LETTERS / SYMBOL NO.

FROM _____ TO _____ DATE _____ 190.....

ROUTE — VIA JUNCTION / WITH R'Y. — VIA JUNCTION / WITH R'Y. — VIA JUNCTION / WITH R'Y. — VIA JUNCTION / WITH R'Y. — VIA JUNCTION / WITH R'Y.

Gross, Tare, and Net Weight of Carload Freight to be entered in this Space, where the Car is Weighed.

WAY-BILL { SERIES / No.

CAR No. CAR INT.

TRANSFERRED INTO

INT No. AT

INT. No. AT

Weigh this Car at

Stop this Car at

Marked Capacity of Car lbs.

For

*WHEN A THROUGH RATE IS USED AND THE SHIPMENT IS TO BE RE-WAY-BILLED EN ROUTE, THE SUBDIVISIONS MUST BE SHOWN IN THE RATE COLUMN IN ROAD ORDER, NOTING OPPOSITE EACH PROPORTION THE INITIAL OF THE ROAD TO WHICH IT ACCRUES.

CONSIGNOR. Connecting Line Reference. Original Car and Way bill Number and Point Shipment.	MARKS, CONSIGNEE AND DESTINATION.	No. of Pkgs.	ARTICLES AND CLASSIFICATION Conditions (O. R., O. R., Rel., Gtd., Etc.	WEIGHT	Rate and Author	FREIGHT	ADVANCES	LOCAL PREPAID	TOTAL TO PAY	PREPAY CONNECT'G LINE

AGENTS AT JUNCTION STATIONS RECEIVING THIS WAY-BILL FROM CONNECTING LINE MUST STAMP IN THE SPACES BELOW, IN CONSECUTIVE ORDER, THE NAMES OF THEIR STATIONS AND DATE UPON WHICH WAY-BILL IS RECEIVED.

1	2	3	4	5
Stamp of Junction Forwarding Agent.	Stamp of Junction Forwarding Agent.	Stamp of Junction Forwarding Agent.	Stamp of Junction Forwarding Agent.	Stamp of Junction Forwarding Agent.

Conductors must enter in space provided on *back of this Blank* number of train, station taken from and left at, date and signature. Read the instructions on back.

Conductors will refuse to handle car covered by this Way-bill beyond first RED BALL billing station en route, unless it bears proper station symbol letters and numbers. This rule will be strictly enforced.

NOTE. AGENTS AT NON RED BALL BILLING STATIONS WILL LEAVE SPACE FOR STATION SYMBOL LETTERS AND NUMBERS BLANK, TO BE FILLED IN AT FIRST RED BALL STATION EN ROUTE.

Form 104.

FRISCO SYSTEM

DELAYED CARS FORWARDED

This report to be used when forwarding any cars loaded with Red and Green Ball freight which has been delayed from any cause.

Sending Operator.	Receiving Operator.	Time Filed M.	Time Sent M.

24 REPORT "B"

From "A" Date .....

SUPERINTENDENT CAR SERVICE, Springfield.

The following cars loaded with Red and Green Ball freight which have been delayed at this Station, went forward this date.

Train "C" Engine "D"

Time Forwarded "F" M.

Signature "G"

Position "H"

SYMBOL LETTER AND NO. From	To	SYMBOL LETTER AND NO. From	To
"J"	"K"	"J"	"K"

INSTRUCTIONS. This form will be used by Agents and Yardmasters to report the forwarding of cars loaded with Red and Green Ball freight which have been delayed at any station on any account. Operators must give this report best possible service, using symbols in transmitting.

Form 103.

FRISCO SYSTEM

PASSING REPORT—"52" REPORT

Sending Operator.	Receiving Operator.	Time Filed M.	Time Sent M.

SUPT. CAR SERVICE, From "A"

SPRINGFIELD. Date "B" 190

Freight with Way-Bills carrying following Symbol Letters and Numbers passed this Station as shown below:

Symbol Letter and Numbers.		Movement.			
Lowest No.	Highest No.	Arrived		Left	
		Train No	Time	Train No.	Time
"C"	"D"	"F"	"H"	"J"	"M"

Cause of Delays "K"

Agent or Yardmaster.

INSTRUCTIONS. This report to be made by Agents or Yardmasters at designated stations and telegraphed to Superintendent Car Service immediately after the cars have departed. In making up the report use the lowest and highest symbol numbers with letter shown on the "Red and Green Ball Freight" Way-Bills. Make separate entries when break occurs in consecutive order.

Form 101.

FRISCO SYSTEM

SET OUT REPORT

This report to be used at points where more than one car of Red and Green Ball Freight is set out for any reason.

Sending Operator.	Receiving Operator.	Time Filed M.	Time Sent M.

21 REPORT "B"

From "A" Date 190

SUPT. CAR SERVICE, Springfield.

The following cars loaded with RED AND GREEN BALL freight have been set out at this station:

Symbol Letter and No. as shown on Red Envelope		By Train	ON ACCOUNT OF (Give here exact cause for each car set out.)
From Lowest No.	To Highest No.	No.	
"C"	"D"	"F"	"K"

Signed Position.

This form will be used to report set out cars containing Red and Green Ball freight when more than one car is set out. When one car is set out use regular Set Out Card. Give Symbol Letter and Number only when referring to these cars on this report.

Train Symbol is shown on face of Red and Green Ball freight Way-Bills.

FORM 1171 (Back)

INSTRUCTIONS

AGENTS:—When this form of Way-bill is used in billing to points off this line, be particular to enter the proper serial letters and write the name of the station at which the freight will leave this road, also the name of the road on which the station billed to is located, on the blank lines provided on the face of Way-bill. In column headed "Authority" you will note the number of Special Rate, number of Special Order or Tariff, as the case may be. Agents are in NO CASE to make a Way-bill to cover more than ONE CAR. A Way-bill MUST be made for EACH AND EVERY CAR. When billing carloads from a station having no track scales, agents must enter on the face of Way-bill the name of station at which the car is to be weighed.

Immediately upon receipt of Way-bill the Receiving Agent must enter date received, using his station dating stamp. ☞

CONDUCTOR'S RECORD

No. of Train	STATION NUMBER Taken from	Left at	DATE	CONDUCTOR

CONDUCTORS must enter above the number of train, the station taken from and left at, the date, sign their names in the blank space provided, note particulars of transfer from one car to another, where, when and why transferred, also enter new car number and initials on both face and back of Way-bill, and any general information.

INSTRUCTIONS

IMPORTANT READ THIS

Agents will use this Form to cover all carload shipments forwarded from their station coming under the classification as RED BALL Freight, as show in Book of Instructions. The freight covered by this Way-bill must be given preference over all GREEN BALL Freight and all ordinary freight.

This Way-bill must bear the proper station symbol letters and number before car, which it covers, is forwarded from a RED BALL billing station. Conductors will refuse to handle the car which it covers until this information is shown in space provided.

The freight covered by this Way-bill must not be delayed except on account of bad order.

After it has been delayed once, great care must be taken to see that it is not again delayed en route.

Whenever it becomes necessary to set out this car on ANY ACCOUNT, conductor or yardmaster must securely attach hereto a "Set Out Car" Report, Form 102.

Form 1175.

FRISCO SYSTEM

GREEN BALL FREIGHT.

Card Way-Bill No.....

Initials.....Car No.....

Way-Bill Reference.....

Transferred.....Car No.....

At.....Date.....190....

From.....Date.....

To.....

Final Destination.....

Routing.....R. R

Contents.....

Consignee.....

Consignor.....Weigh at.....

Stop Car at.....For.....

Forwarding Green Ball Station Symbol Letters.....

Forwarding Green Ball Station Symbol Number.....

WEIGHT.	☞ Agent will enter on blank lines below any SPECIAL INSTRUCTIONS following Car.
Weighed at.....	
Gross.....	
Tare.....	
Net.....	

INSTRUCTIONS.

(IMPORTANT—READ THIS)

When authorized by Auditor Freight Accounts, agents will use this form as a Card Way-Bill for loaded cars when regular Way-Bill cannot be made in time.

Green Ball freight must be given preference over all ordinary freight.

Each Card Way-Bill of this form must bear the proper Green Ball symbol letters and number before car is forwarded. Conductors will refuse to handle the car which it covers until this information is shown in space provided.

The freight covered by this Card Way-Bill must not be delayed except on account of bad order, or when found necessary to move Red Ball freight, which must always be given preference.

Whenever it becomes necessary to set out this car on any account, conductors or yardmaster must securely attach hereto "Set Out Car" report, Form 102.

If car covered by this Card Way-Bill is track scaled in transit, gross, tare and net weight, and point where weighed, must be entered in proper space above.

Agent at destination or at junction, if regular Way-Bill is made to point beyond our rails, must transfer the weight to the regular Way-Bill.

FORM 1175 (Back).

RECORD OF MOVEMENT.

No. of TRAIN	STATION No. Taken from	Left at	DATE	CONDUCTOR

Conductors must enter, in space provided, number of train, station taken from and left at, date and signature.

INSTRUCTIONS.

When Green Ball freight is received from connecting lines at our various junction points, under foreign Way-Bills billed to points on our rails and beyond, agent at such junction will fill out one copy of this form and securely attach same to the through Way-Bill. All necessary information called for by this form must be filled out by forwarding agent, and a consist report, Form 106, made to cover.

In case Green Ball freight is received from connecting line at a point not a Green Ball billing station, the car will be moved under regular Way-Bill as received from connecting line and Green Ball billing applied at first Green Ball station en route.

Agent at destination or point where car leaves our rails, will file this Green Ball Card Way-Bill for future reference.

See Book of Instructions for other information.

Form 102.

FRISCO SYSTEM

SET OUT CAR.

21 REPORT. "B"

To From Station "A".....Date.....

SUPT. CAR SERVICE, SPRINGFIELD.

.....

Car bearing Symbol "C".....

Set out at "D".....

By Train No. "F".....

On account of "K".....

.....

.....

.....Position or title.

INSTRUCTIONS.

IMPORTANT READ THIS.

If for any cause a car loaded with Red or Green Ball freight is set out, one of these "Set Out Car" forms must be properly filled out by the Conductor when car is set out between terminals and attached securely to the face of the Way-bills for this car. This form must remain with proper Way-bill until it reaches destination.

Conductors must leave these "Set Out Car" forms with Telegraph Operator who will telegraph above information to Superintendent Car Service, Springfield, and then turn this form attached to regular Way-Bill or Card-Bill over to proper party.

This car must not again be delayed except account Bad Order. Yardmasters and Conductors must see that this rule is absolutely enforced.

Yardmasters who take cars of Red or Green Ball freight out of its regular train for ANY cause and hold them for another train, thereby forcing a delay, must attach one of these "Set Out Car" reports properly filled out to the Way-bill for each car so delayed and make proper report of it to Superintendent Car Service on form 100.

Operators will use Symbol Letters shown hereon in transmitting this report.

106-A.

FRISCO SYSTEM

1-1905-50 M—C

CONSIST 23 REPORT

Sending Opr. | Receiving Opr. | Time filed | Time sent

M .....M

"B"

From Station "A" ..... Date..... 19

RINTENDENT CAR SERVICE, SPRINGFIELD.

Following Cars RED AND GREEN BALL freight left this station on

No. "C" ..... Engine No. "F" ..... Departed at "G" ..... M.

	CAR Initials	CAR No.	CONTENTS	CONSIGNEE	DESTINATION	If final destination is to point beyond our line, give: Junction point where it leaves our line	Routing beyond
	"J"	"K"	"M"	"N"	"Q"	"R"	"S"

RUCTIONS.—This Consist Report to be made up from information shown on face of Red or Green Ball before each train handling Red or Green Ball freight leaves the station, and to show only such cars as d as Red or Green Ball. Operator must telegraph this report within one hour after train has left

Ball freight which have been delayed. This form is also used by yardmasters in reporting the forwarding of such cars, delayed by any cause, when not sent out in the proper train. The passing report, form 101, is used only by agents or yardmasters at a small number of important stations, and is a progress report for the information of the superintendent of car service. The final report, form 103, is used by all agents in reporting arrival of cars at destination.

It is provided that local merchandise traveling as Red Ball freight shall be red balled to the last district terminal reached before distribution begins, after which the car travels on local trains. These cars are handled on form 1,173. Less than carload shipments may be waybilled on Red Ball freight waybill form 1,171 or 1,172, but no symbol letters and numbers must be used on such waybill. It is specially provided that Red Ball freight must be handled only on trains designated or covered by special instructions, and that all Red Ball freight must be bunched as far as possible at district terminals for movement in such trains; these trains to be filled out with Green Ball freight. Cars containing freight other than the commodities given in the book of instructions must not be billed on the special classified waybills without permission from the office of the superintendent of car service. The diversion of all loaded cars in transit is handled through the office of the freight claim agent, and whenever a car is diverted the agent making the diversion shall notify the freight claim agent jointly with the superintendent of car service, by wire, giving new consignee, destination and routing. The general monthly report of the movement of this freight is shown on form 108, in abbreviated form.

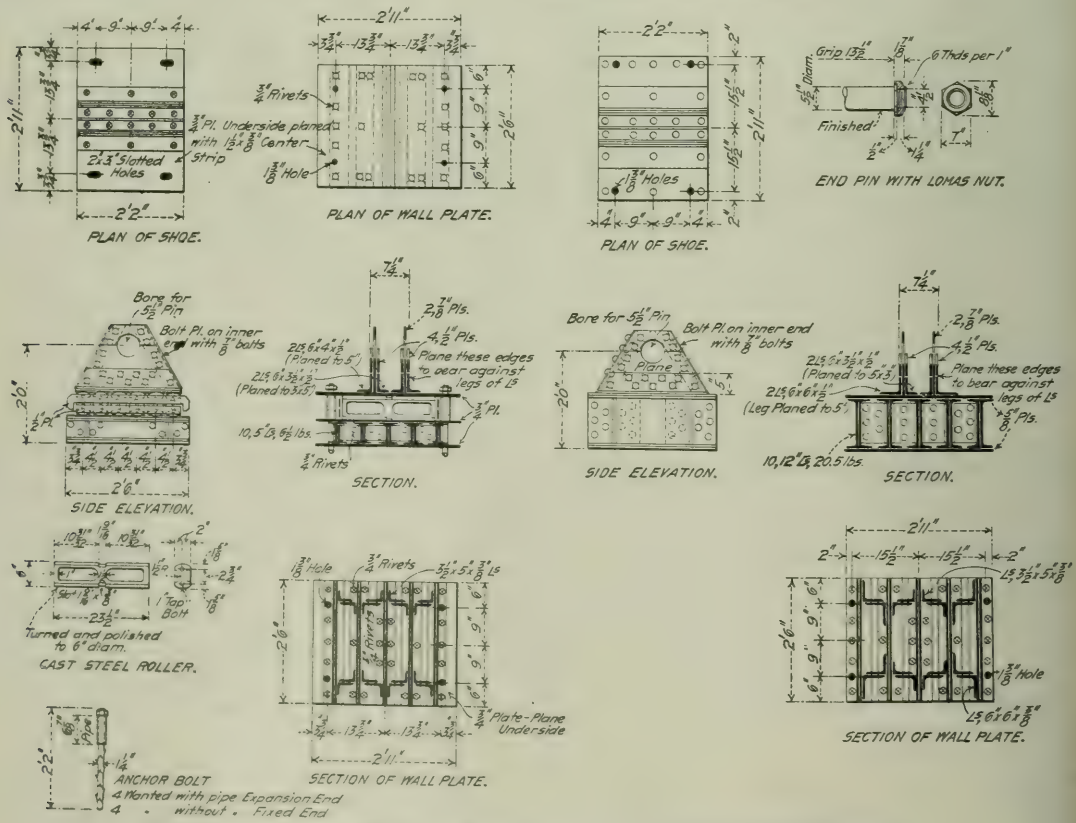
The Air-Brake Law.

The Interstate Commerce Commission, acting under the authority vested in it by the law of March 2, 1903, proposes to make a change in the requirement that there shall be a certain percentage of air-braked cars in all trains, increasing the minimum beyond the present 50 per cent., provided it shall prove reasonable and practicable to do so. As a preparatory measure, the Commission has called upon the railroads to report to it before October 1 the average percentage of air-braked cars used in [freight] trains during the past six months. The law empowers the commission, "to more fully carry into effect the objects" of the law, from time to time, after full hearing, to increase the minimum percentage of cars which must have power brakes in use. It is held that sufficient time has now elapsed to permit the railroads to make any necessary preparations. In the preamble of the present notice it is said that "it has been brought to the attention of the Commission that dangerous conditions frequently arise from the buckling of trains under emergency applications of air on trains insufficiently air-braked," and that it now seems practicable to increase the aforesaid minimum percentage without serious inconvenience to the carriers. After the required information has been received, a day for a hearing will be appointed. The roads are to report also the number of freight cars in use and the number equipped with air-brakes; and they must also send a statement of any instructions which have been issued respecting the use of air.

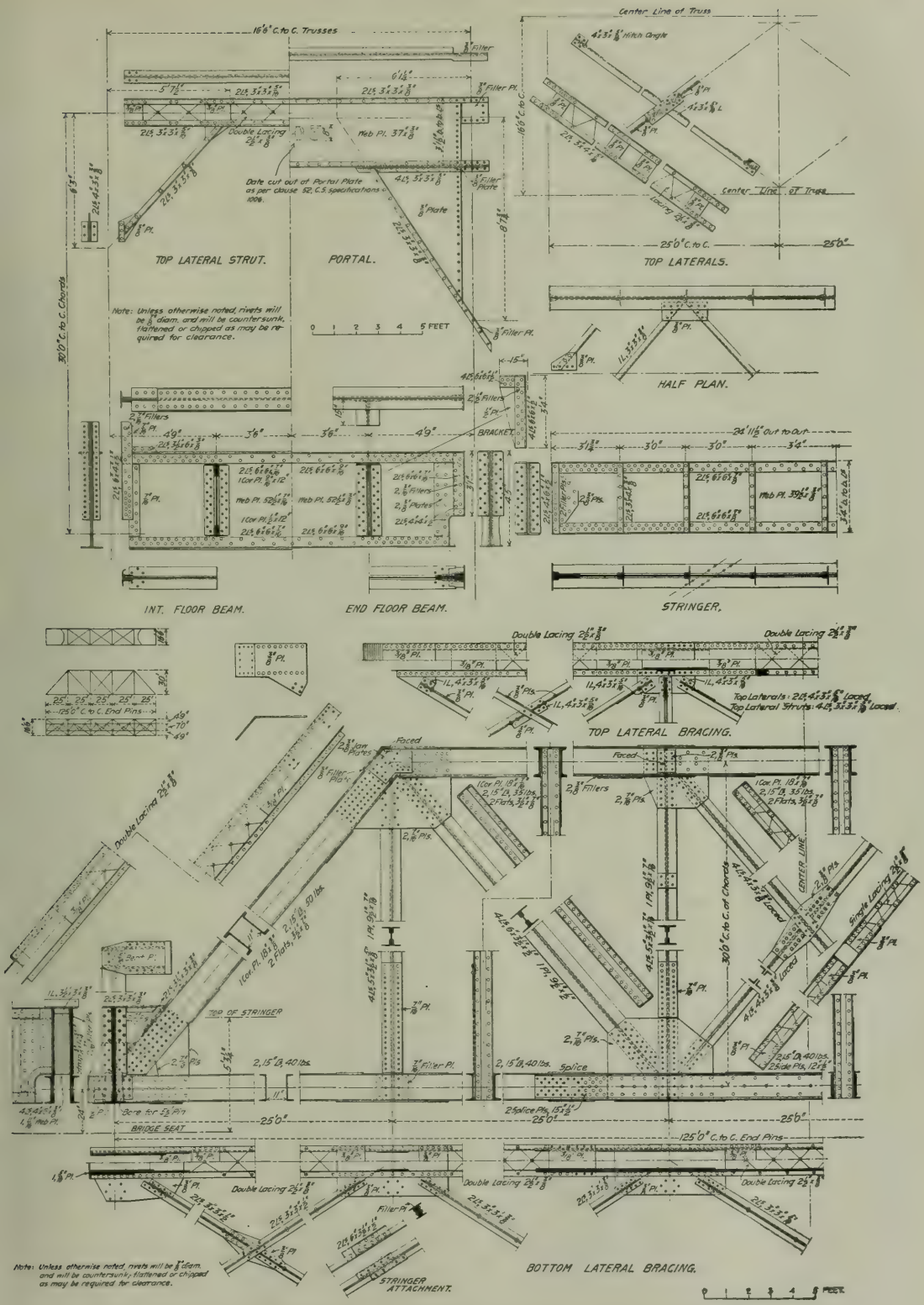
Standard Bridges on the Harriman Lines.*

The drawings herewith show the Harriman Lines' standard 125-ft. riveted through truss bridge. It differs in some essential details from the 100-ft. and 110-ft. spans previously shown, notably in the introduction of a fifth panel and in the design of the diagonals. In the intermediate panels of the 125-ft. span the diagonals are fabricated with an I-section from four 6-in. x 3½-in. x ½-in. angles and a 9½ x ½-in. web plate instead of two 12-in. channels with single lacing as in the shorter spans. Double diagonals are used in the middle panel, built up of four angles 4 in. x 3 in. x ⅜ in. laced to approximate an I-section. The top and bottom chords are exactly the same as for the shorter spans, as is also the lateral bracing both top and bottom. The end bearings are correspondingly heavier and stronger, but in the details of the design no changes have been made. The estimated weight of one span complete is 220,000 lbs.

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, and Aug. 11.



Details of End Bearings for 125-ft. Through Riveted Truss—Common Standard, Harriman Lines.



Details of Trusses and Floor System of 125-ft. Through Riveted Truss—Common Standard, Harriman Lines.

The New York, Westchester & Boston.

The New York, Westchester & Boston Railway Company, of which Mr. William L. Bull is the President, has let a contract for the construction of that portion of its line which lies within New York City, and the prospect that New York will have another railroad to the northeast, which has been in sight for many months but which has been subject to innumerable vicissitudes, appears now to be based on something more substantial than hopes and promises. In the several contests before city governments during the past year the Westchester company appears to have come out ahead of its competitor, the New York & Port Chester, in nearly, or quite, every case; and it has all along shown more evidence of adequate financial backing than has the Port Chester. The present contract, which is noted in our news columns, will amount to about $3,000,000, and it is said that the contractor will begin operations within a week. About 300 men have been at work on the line for two or three months past under two temporary contracts, and these forces will probably be retained.

The New York & Port Chester was organized in 1901 to build a line from the Harlem river northeastward to the Connecticut state line, 21 miles, and a description of the project was published in the *Railroad Gazette* of May 2, 1902. Through the upper part of New York City the proposed line is parallel to the New York & Harlem (used by the main line trains of the New Haven), but sufficiently far away to secure, in that thickly settled district, a considerable passenger traffic. Through Mount Vernon the line still continues some distance away from the New Haven, but the rest of the way it was laid out very close to it. The Westchester company, though holding a charter over 30 years old, came into the field after the Port Chester company had tried for a year or two to get started and had made little or no progress. The Westchester line in a general way follows the same course as that of the other company; but beyond Mount Vernon the company proposes to run two lines; one to Port Chester and another northward to White Plains.

Of the contract now announced about $1,200,000 is allowed for grading and masonry and the remainder apparently covers bridges and metal structures. This road, like the Port Chester, has promised the public a "four-track elevated electric road"; but, of course, will build its tracks on the surface or on earth embankments wherever right of way can be secured at reasonable cost. The line does not run longitudinally in the street at any point and the figures now given out indicate that practically the whole of the line is to be on embankments or on the surface, the term "elevated" meaning simply that grade crossings will be entirely avoided.

While the charter calls for a line beginning on the south at 129th street, the company proposes first to build a line from 177th street northward, as connection can be made with the lines of the Interborough Rapid Transit Company at 177th street.

The contests between the Westchester and the Port Chester companies before the city governments of New York, Mount Vernon, and other cities, have had to do wholly with the right to build bridges across streets. In New York the Westchester company has now secured this right. In Mount Vernon the Port Chester company secured it two or three years ago, but has made no use of the privilege. The petition of the Westchester company is still pending before the Council of that city.

A German Impression of British Railroads.

BY WILHELM CAUER.
Railroad Engineer and Professor at the University of Berlin.

In complying with your request to describe for your highly esteemed paper the impressions gathered on the English railroads, while traveling there for my instruction, I am given a chance to extend my thanks to the railroad companies of the United Kingdom for their hospitality. Yet, I give this description with some hesitation, because I feel the truth of the objection that even an extended journey is not sufficient to enable a correct judgment to be made of foreign organizations. I am perfectly willing, therefore, to take good advice wherever I may make a mistake.

English railroads are in nearly everything quite different, not only from German railroads but also from other Continental railroads, so far as I know them, and in my opinion this is chiefly due to the insular location of the United Kingdom and to the different national characteristics of the personnel. Compared with Germany, the difference results mostly from the fact that German railroads are under the control of the government while English railroads are operated by private companies. I myself am a thorough partisan of governmental ownership, at least so far as German conditions are concerned, but in England this system would not have many friends and I doubt whether it would be appropriate for the English state of affairs. I have to confess that English railroads give an excellent service, which is in many instances superior to the German. A considerable part of the benefit derived from German railroads lies in other spheres; in equalizing commercial fluctuations, promotion of industrial and agricultural activity, and, last but not least, in their production of a surplus for the national treasury. From this it will be easy to perceive that the effectiveness of the two railroad systems cannot be compared off-hand, and English railroad men agree with me in this.

The German traveler will note in the first place that the passenger traffic in England is much larger and that it is handled with great attention. London and other large cities have a dense network of railroads for suburban traffic, which had reached large dimensions there before other countries thought of establishing special services for this kind of business. I have found it especially remarkable that convenient communications exist as well between the various railroad stations in London as between these stations and those of the underground lines, which shows that the competition between the different companies has not prevented them from realizing that it is not only to the interest of the traveling public but also to their own interest, to facilitate the communication between stations in order to promote traffic and to guide travelers from one line to the other. Besides the urban and suburban traffic, numerous express trains are provided for greater distances and comfortable cars are used in most cases. The geographical situation greatly facilitates railroad traffic in general, as the bulk of it can be carried on a certain number of chief lines of limited extent, mostly not longer than a few hundred miles; for example, London-Plymouth; London-Cardiff; London-Manchester; London-Edinburgh; Hull-Manchester-Liverpool, etc. Those who wish to go to less important places or to towns out of the way of the main lines do not object to changing trains several times. We on the continent are in the midst of the network of all the European railroads. Lines of great importance cross each other in all directions, most of them coming from foreign countries and going to other foreign countries, and travelers prefer to be carried without being obliged to change cars, even when they change the railroad line, cross the frontier of a state, or go from a main to a side line. It is possible to go from Berlin to Vienna, from Vienna to Ostende, or from Budapest to Paris, without changing cars, and even when going from a main line to a side line as for instance from Berlin to Kissingen, Werningerode or Meran, no change of cars is necessary. For this reason many of our express trains are composed of through cars, which originate from or are given later to other trains, going in other directions. This, of course, necessitates another kind of train service.

It is sufficient, then, to say that excellent care can be taken of the passenger traffic in England, owing to her geographical situation and other favorable circumstances. However, it is not always easy for the traveler to select from the many trains at his disposal those which will be the most suitable for his purposes. This may be less true for an Englishman than for a foreigner. At all events the new arrangement by which the Bradshaw time-table compiles in a special edition the express trains running between the chief cities is a great convenience. As a whole I must avow that English time-tables did not seem to me easy to use. We are accustomed to see the figures indicating the minutes during the night time, i.e., between 6 p.m. and 6 a.m., underlined, in order to distinguish them from those of the day time. If one is accustomed to this system, one can see at a glance at what time a given train is running, but errors will easily occur if one has to look for the items a.m. and p.m. at the head of a column, especially with trains which start before noon and continue their run after noon, and *vice versa*. In several Continental countries, railroad hours are counted from 1 to 24,* and as soon as one has become familiar with this method, no error is possible.

Although the great advantages of terminal stations for the handling of passenger traffic are recognized on the Continent, these stations are only used in special cases. If terminal stations are used more frequently in England, I do not agree with my colleagues on the Continent that this is due to the predilection which English railroad engineers have for these stations, but I think that there are other reasons. Competition has induced many railroad companies to advance their stations as far as possible into the center of the cities, even at great cost for building tunnels, bridges and viaducts, and terminal stations have been the result of this desire. On the other hand, it is the insular situation of the country and the direction of the traffic, which causes railroad lines to terminate in large cities more often than is the case on the Continent, where there is more through traffic; consequently, the disagreeable features of terminal stations; the change of the direction of trains, change of engines, etc., are less important. It is only natural that practical Englishmen appreciate the advantages of through stations. This is shown by the great number of very well built through stations, as for instance Victoria station in Nottingham and Waverley station in Edinburgh, and especially by the construction of a new high level bridge over the Tyne at Newcastle in order to avoid turning the train between London and Edinburgh.

In England they like very much to have the cabs directly aside the arrival platform which, by the way, is never the case on the Continent, and considering the peculiar way of handling luggage in England, and the absence of package receipts, this enables travel-

*This is also done in Canada, India, etc.—[Editor.]

lers to leave the station in a cab with their luggage within a few minutes after their arrival. The introduction of cab roads into stations is easier at terminal stations than it is at through stations. It is especially noteworthy, therefore, that cab roads have been provided for with much ingenuity at Waverley, which is a through station.

But there are many other points of difference between English and Continental stations, especially as regards the loading and unloading of horses, carriages, automobiles, milk, etc., within the station trainshed. This is always done on separate tracks, outside the trainshed in Germany, which simplifies the movements within the station. Contrary to this tendency, we are now building at large stations on the Continent—wherever we can—separate platforms for the handling of luggage, even using special elevators for this purpose, in order to avoid interfering with passengers. Considering the way in which luggage is handled in England, and that the traveler himself has to look after his belongings, it would be useless to have special luggage platforms there.

At small stations in Germany the second track is commonly reached by crossing the first track; in England, however, both tracks are accessible from the outside only. An arrangement quite similar is found in France, but there it is customary to place a station building only on one side, and on the other side a shed. In England, however, I have usually seen station buildings of about the same size on both sides. This is more comfortable for the travelers, but more costly for the railroad companies. As a whole, waiting rooms in England are not as spacious as they are in Germany.

I have gathered the impression that England endeavors to use more and more island platforms in connection with the two platforms at the outer side of the tracks. At junctions, and where there are four-track lines, it is necessary to have island platforms. It is more advantageous, as I have noticed at various places, to have in these cases no outside platforms. This not only reduces the cost of buildings, but simplifies greatly the service of the station employees. On account of the great traffic in England there are more four-track lines than in Germany, and an island platform between fast and slow tracks has the advantage that travelers going in one direction will always leave from the same platform.

Continental travelers are often alarmed at the English way of handling luggage without receipts. I soon became acquainted with the English custom, however, and always found my luggage immediately upon arrival. But this is inconvenient in case one has to change trains several times and even English railroad employees advised me that it would be good policy to look after my belongings myself. This is never necessary on the Continent. When traveling between large cities it is not necessary, as a rule, to change trains, and even if the train is divided, one need not care for one's luggage, as each division of the train has its own luggage compartment and unloading and reloading is consequently avoided. Although the English method seems to be appropriate for the United Kingdom, it would never do to introduce it on the Continent, not only because nobody would like to miss the guarantee for safe delivery of luggage afforded by a receipt, but, considering the long distances, the complicated routes and the fact that many journeys extend over day and night, it would be a great inconvenience for passengers to watch their luggage constantly.

One thing which especially strikes the railroad engineer coming from the Continent is the great care taken in England to avoid grade crossings of any description, by either building bridges over the tracks or tunnels underneath. Another remarkable feature in England is that fences are erected often along the entire length of a line. Grade crossings over side tracks or shunting tracks are common, however. I was told that grade crossings between tracks of different companies are not allowed. Furthermore, I have found that junctions occur much oftener outside of stations in England than they do in Germany, as we always endeavor to keep the tracks of parallel running lines separate up to a short distance from the platform, thus bringing the junction under the protection of the home signal of a station. A difference in the working of trains seems to be responsible for this difference of practice. In England it is the signalman who is responsible for the movement of trains, while in Germany a despatcher gives his orders by way of an electrical or mechanical block apparatus to the signalmen in the stations, and the signalmen outside the stations have no influence upon the succession of trains. The latter regulate only the direction of trains, and rear-end collisions are avoided by lock and block signals or other means of the absolute block system. The English method has the advantage that those men who really give the signals and are near to them have all the responsibility. Recognizing this need of nearness, the German management places the despatcher who directs the working of the trains in the most important signal tower of the station. On the other hand it might be an advantage, especially for large stations, to place the command in one hand in order to avoid errors and misunderstandings. Great responsibility is entrusted to English railroad signalmen; but the English railroads have an excellent staff of employees trained from boyhood, and they generally stay at the same place for many years. In Germany we have to reckon with the necessity of employing a large force of men who have served for 12 years in the army. Their railroad training must necessarily be shorter, and, moreover, they change their place of employment rather often.

All our devices relating to signaling, interlocking and the block system have been adopted from England, where much earlier than in Germany the density of traffic required that signals be made mechanically dependent on the right position of switches and that a certain distance be maintained between the trains. It is noticeable, however, that German signaling devices differ widely from those of English railroads. Safety appliances in the United Kingdom are much more simple than in Germany, both in operation and in the design of individual devices. As far as construction is concerned, Germans endeavor to obtain the highest efficiency by constant improvements. The Board of Trade allows a larger freedom than the respective German legislative bodies. For instance, the lock-and-block system is used to a greater extent in Germany than in England. The Prussian and Hessian railroads under governmental control consist of over 8,000 miles of two track main lines, and more than half is equipped with lock and block devices which also control the interlocking at stations and junctions without impeding the free movement of trains. Furthermore, it is required that in Germany all interlocking shall have preliminary or latch locking. Although this construction is well known in England and was formerly much used, interlocking directly by the levers is now preferred, because simpler in construction. In England single wires are used for moving the signals and the Board of Trade evidently allows dependence on a counterweight to return the arm to danger. In Germany this is held to be dangerous, because the wire might be caught and the signal might thus remain in its clear position; or its movements might be prevented by snow or wind; or the position of the arm might be varied by temperature, which is liable to change the length of the wire. For these reasons double wires are used without exception in Germany. A tension weight equalizes the effect of changes in temperature and in case a wire breaks this weight forces the signal arm to "stop." In England locks are only prescribed for facing points, while in Germany all switches have to be provided with them; they are actuated by the same mechanism which moves the switch, an arrangement which I have found in England only in the Crewe all-electric interlocking. While in England rods are prescribed for switch connections double wires are often used in Germany and nearly always in Prussia. In case of breakdown, such as a stone catching in the switch, all conflicting switches are protected by stop signals. For this purpose, of course, complicated arrangements are necessary.

Whether it is better to avoid accidents by improving the mechanism and making it more complete, or whether it is better to make it as simple as possible and rely more upon the efficiency of the employees will always largely depend upon the quality of the latter and, as I have remarked, English railroad employees are of a higher standard than those in Germany.

There is another striking difference; the signal system as a whole is much simpler in Germany than it is in England. A German railroad man is astonished to see the large number and great variety of signals; home, distant, starting, advanced starting, shunting, backing, siding, calling-on, dwarf and disk signals, some of which, however, are practically the same. This is the more noticeable to one who is not accustomed to it. After dark, when danger is increased, one has to be content with two colors, red and green. We have in Germany only two kinds of signals, the distant signal in the form of a round disk and the semaphore, which, in the same form (with one to three arms) is used as home and starting signal. These signals can be distinguished during darkness as well as during daylight. The home signal is called, according to its position, entrance signal, block signal, or protection signal.

The position of single isolated switches is distinguished by switch signals which are distant signals and which show at night as well as at daytime the same color, namely, white. They resemble the English disks and they are low, in order to avoid confusion with the chief signals. There is no doubt that a system having shunting, backing and other signals of this kind is more complete than one which merely indicates the position of a switch, and that it will better protect against accidents, especially during the daytime; but on the other hand, even in Great Britain, they seem to object to having too many kinds of signals. Major J. W. Pringle says, for instance, in his report on the accident of Sept. 17, 1904, at St. Enoch station, Glasgow:

> It is highly desirable, both from the point of view of safety and for traffic purposes, that signalling in a large terminus should be as complete as possible. At the same time there is a danger to be guarded against, namely, confusion owing to a multiplicity of signals.

It seems to be difficult to find out whether accidents occur oftener because there are no special shunting signals, or on account of mistakes caused by too many signals near together.

Not only in regard to the number of signals but also in regard to interlocking, English rules are more stringent. We interlock

switches with signals, but in England they also interlock switches with switches. I was told that this is done to avoid collision between two conflicting shunting operations. The Board of Trade prescribes locking bars and detectors for each facing point; we have a point lock for *all* switches working with the switch movement itself; and at facing points we have detectors. In complicated cases we avoid changing a switch under a moving train by route levers (this by the way has also been done in England occasionally) which lock all switches and which at the same time leave the signal free though it cannot be restored to its first position before the train has either gone over a treadle or an authorized employee has removed the lock by electrical transmission. Although it is difficult to determine the advantages of one system as compared with another, it must be conceded that, as far as accidents are concerned, British railroads have a very satisfactory record.

England is far advanced in the introduction of electric railroads. I have had occasion at various places to become acquainted with these practical and comfortable means of transportation.

As far as freight traffic is concerned, English railroads are more efficient than Continental railroads, especially in regard to the quickness of forwarding parcel goods; this is due to various favorable circumstances, viz., the geographical simplicity and the very complete railroad network of lines, as well as the classification of goods, which makes it possible to send more through cars from one place to another, thus avoiding transferring goods to a greater extent than is possible on the Continent. Very good arrangements are made for quick forwarding. The railroad companies themselves do the trucking of goods to and from the stations and the division of traffic into various classifications is thorough. This makes it easier to carry each class of goods in those vehicles which are the most suitable. Hoisting appliances of many kinds are more frequently used in England than on the Continent. This is apparently due to the fact that open cars are used very extensively in England. I was told, however, that the use of box cars is becoming more frequent, and the application of mechanical lifting is consequently decreasing. Hoists, however, will never lose their importance at stations with several stories. They must be used for hoisting cars from one track level to the other and for moving goods between the different stories. Stations with several stories are not so prevalent in Germany. In England I have been astonished to see how quickly and cleverely plants have been erected on a very limited space and how fast and safely under these difficult circumstances trains are made up by the aid of turn-tables and hoists. Elevators for moving goods from one story to the other of the big warehouses also play a more important part in England than on the Continent, because English railroads not only attend to the freight but also to much of the storage business. Germain railroads, as a rule, do not concern themselves with this. A feature of English railroading is the great establishments with their perfect arrangements for receiving and despatching coal cars, and to unload coal from railroad cars into steam ships.

Transfer stations and shunting yards are less important in England than they are on the Continent, because it is necessary on the Continent to have extensive accommodations for receiving, making up and despatching trains coming from very far and going in many cases to distant places. In Great Britain freight trains go very often from one freight yard to another without any considerable change in make-up. Goods which are shipped in bulk seek naturally the shortest route to tidewater. Thus in spite of the immense freight traffic the establishment of new switching yards is now rare in England. It is remarkable to find a considerable number of old switching yards which, taking advantage of grades, are so well made that they still serve as models. The use of these yards is convenient for the English roads because all freight cars are fitted with lever-brakes, which, as I have observed at Edge Hill, Amtree and Shildon, provide a splendid method for regulating the speed of cars going down grades with a limited crew, whereas we on the Continent have the screw brake system which requires one man for each car. Moreover, not all of our Continental cars are equipped with these screw brakes, so that we have to resort to other braking devices in our switching yards. While our brakes are developed to a remarkable degree, the English lever brakes are superior in flexibility of operation.

I must omit one of the most important subjects in connecting with railroading, that of rates, as I have not had sufficient opportunity to gather the necessary information. I wish to add, however, some remarks about the agreements between the different English railroads and also those institutions and regulations provided by the supervision of the governments. Likewise standards of gage, technical conditions of railroads and rolling stock, through cars, through tickets, bills of lading, etc., have for a long time on the Continent depended upon private agreements of the railroads. It is not until the last third of the last century that the government took an active interest, but now, with us, many and especially the most important standards are regulated by state legislation or by treaty, in the case of shore roads which cross the boundary. In England there has been a similar outgrowth, except that now, as formerly, because of the private ownership's system, private agreements between the railroad companies are more frequent than with us. However, the fact that Great Britain is an island largely eliminates the necessity for shore international treaties which have rendered the task of systematizing exceptionally difficult on the Continent. With us, the ever growing extension of large government railroad systems has limited more and more shore cases in which railroad tracks and terminals have had to be used jointly. In English railroad administrations, agreements to this purpose occupy naturally an important place, and it appears to me, from somewhat hasty observation, that in Great Britain original and complete judicial forms have been developed for such agreements which solve in a comparatively simple and frictionless manner the difficult problem of the exchange of traffic between independent systems. Likewise, England has attained a far reaching uniformity in the matter of rules, regulations, and signaling, through the joint endeavors of the railroad companies and the influence of the Board of Trade. It is now only desirable for this uniformity to be extended in details, as for instance in the form and meaning of certain signals. On the other hand, it strikes the Continental railroad man that very little has been done with those rules and regulations which, according to our ideas, ought to be most uniform. I refer to a uniform loading gage and capacity and a uniform standard in building cars. As to the first point, we have a uniform loading gage, and only two capacities throughout the united German railroad system, i.e., in Germany, Austria-Hungary, Roumania, Netherlands, and Luxemburg. On the other hand, each of the English railroads has its own loading gage. Moreover, on the Continent we have for all countries with a standard track gage (4 ft. 8½ in.) as established by the treaty of Berlin, 1886, on technical uniformity, uniform technical specifications for building those cars and coaches which cannot be rejected on crossing the boundary. In more local associations, as in the United German Railroad Administration and in the German empire, they have made even further progress in systemizing the details of uniform organizations. In the near future, Germany will adopt a joint rolling stock (locomotives, cars and coaches) for all state railroads; that is, for practically the whole German empire. On the other hand, the English railroads have only for private cars the standard specification issued in 1903 which serves, however, as a sort of guide to the railroad companies in building their own rolling stock, without being obligatory. Thus, for example, the through operation of passenger trains over the tracks of several different companies is rendered difficult by the existence of two different brake sysems. However, this difficulty is largely overcome in the case of certain trunk lines by the adoption of joint rolling stock.

By far the greatest uniform organization which the English railroads have developed is undoubtedly the railroad clearing house, whose principal object is the apportionment of mileage and traffic receipts. This, however, serves at the same time as the center of English railroad companies for creating uniform organization and rules and regulations on all lines. I was afforded a chance to become acquainted with the working of this institution, and had occasion to wonder at the simple manner in which it handled the intricate joint traffic problems of the railroad companies. On the Continent, in spite of far more complex situations, we have no similar organization; on the contrary, separate offices have to be maintained to apportion mileage and traffic receipts.

If, in closing, I should attempt to describe the general impression which I had obtained of the English railroading, I would say its most striking characteristic was the excellent handling of the traffic, and earnest successful progress in every direction.

Opening of the Uintah Reservation.

On July 15 President Roosevelt signed the proclamation which in effect throws open to settlement the lands of the Uintah Indian Reservation in Utah on August 28. The total area of this reservation is 2,444,000 acres, of which 1,069,160 acres are available for entry. The mode of procedure for the allotment of these lands will be similar to that in effect at the opening of the Rosebud Reservation in 1904 (*Railroad Gazette*, June 3, 1904). All applicants should register in person at the United States land office at either Grand Junction, Colo., or Vernal, Price, or Provo, Utah. The registry books will remain open August 1 to 12. The drawing to determine the order in which the applicants may choose their quarter section of land and make entry thereon, will be held at Provo, Utah, at the rate of 50 names per day, commencing Thursday, August 17.

A circular issued by the Chicago & North-Western Ry. concerning the opening of this reservation describes it as lying in the north-central part of Utah, in Uintah and Wasatch counties. It extends from the Green river on the east to Heber, county seat of Wasatch county, on the west, and to the crest of the great Uintah mountain range on the north, comprising land rich in agricultural and mineral possibilities. A large portion of this tract of land is remarkably fertile. The climate is temperate, with almost perpetual sunshine. The altitude is from 4,000 to 6,000 ft. above the sea. In addition to

the agricultural lands, there are also large tracts of grazing land on which cattle, sheep and horses may be raised with great success. The lands are watered by the Duchesne and Uintah rivers.

The reservation is reached by the Uintah Railway from Mack, Colo., on the Denver & Rio Grande to Dragon, Utah, and thence by stage across the White river to Vernal. There is daily service from Mack to Dragon.

Railroad Shop Tools.

(*Continued.*)

PLANERS.

The accompanying illustration, Fig. 1, shows a 48-in. planer recently made by the Betts Machine Company, Wilmington, Del., for the Reno, Nevada, shops of the Southern Pacific. This machine planes 49 in. wide by 49 in. high. The bed is long and is well braced with cross girts of box form. The table is 38 in. wide and is driven by cut steel gearing and rack. Its motion can be controlled from either side of the machine. An automatic oiling device is provided for lubricating the table Vs. The machine can be arranged for either parallel or right-angle drive, as desired. All feeds are positive and can be operated at any angle. The cross-rail is of the box girder type, with deep arched back, and is elevated by power. It is of sufficient length, when using two saddles, to permit of one head planing the entire width between the housings. The housings are of double plate construction. This insures ample rigidity for side cutting. The side-heads have independent power feeds in either direction and are counter balanced. This machine can be furnished with from one to four heads, as desired. The weight of a machine of this type having a capacity for planing a piece 14 ft. long is about 36,000 lbs.

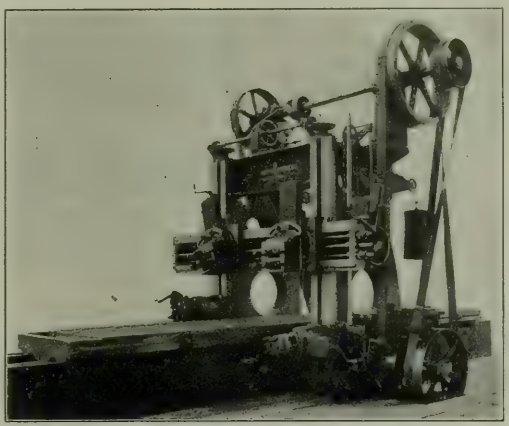


Fig. 1—The Betts 48-in. Planer.

Fig. 2 shows a 42-in. forge planer made by the Niles-Bement-Pond Company, New York. This machine can be furnished with either parallel or right-angle drive. It will plane a piece of work 43 in. high by 43 in. wide and any required length. The movement of the table in the machine shown is at right angles to the line shaft, and it is driven by a train of cut gearing and a rack from a cross belt for the cutting and an open belt for the return motion. The pulleys are of large diameter and are proportioned to return the table at a speed of 54 ft. or more per minute. The belt shifter is designed so that it guides one belt entirely off the pulley before starting the other one. This arrangement permits the stopping of the table instantly from either side without stopping the belts. It is independent of the feed and is arranged to clear the reversing-dog, thus allowing the work to be run from under the tools for inspection. The bed is strongly reinforced where the gearing and uprights are mounted and is nearly twice the length of the table. It has two V tracks with large wearing surfaces and oil pockets and rollers are provided for lubricating the table. The uprights are of box form and have a bearing the entire depth of the bed and are tied at the top by a deep and wide arch. The cross-rail is also of box form. It is raised by power and has a deep arched double-walled back, large wearing surfaces, taper packings for the adjustment of the saddles, and sufficient length when fitted with two saddles so that one can plane the entire width between the uprights without interfering with the other. Variable feeds are provided for all directions. These are driven directly by the driving-gears instead of by friction and can be operated by hand from either end of the cross rail.

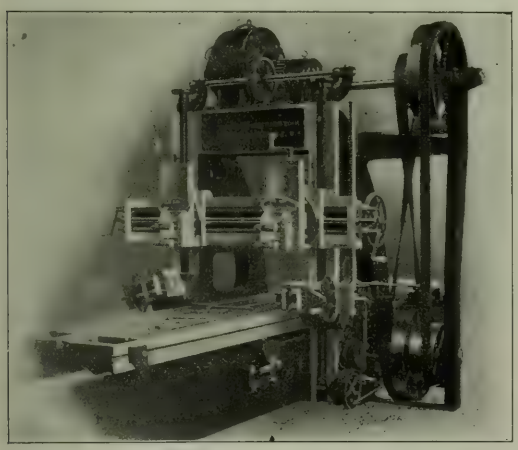


Fig. 2—Niles-Bement-Pond 42-in. Forge-Planer.

The 36-in. x 36-in. extra heavy pattern spur-geared planer shown in Fig. 3 is made by the G. A. Gray Company, Cincinnati, Ohio. This is a powerful machine and is designed to do heavy work. It is made in lengths suitable for planing from 8 ft. to 30 ft. inside of pockets. The table is 32 in. wide and is fitted with two independent pairs of dogs; the extra pair on the rear side of the table operate in connection with an extra shifter lever. This duplex shifter lever is connected by a shaft which runs directly through the bull-wheel shaft. To each lever there is hinged a patent "trip" which is lifted when it is desired to let the table run forward without disturbing the rear dog. Thus the operator can fix the work, set the dogs and start the cut entirely independent of the front side of the machine and without leaning over the table or walking around the planer. Attached to the shifter lever is an automatic locking device by which the belts are prevented from accidentally starting the table. The cross rail is long enough to allow one head to be run entirely out of the way so that the other head can be used to plane the full width of the machine. The cross rail is fitted with a power elevating device and the saddles are made right and left-hand, so that they may be run close together. All feeds are designed to be operated at either end of stroke and the feed screws run in ball bearings. The length of the automatic down-feed is 15 in. and the down-feed screws are provided with micrometers graduated to thousandths of an inch. The uprights are of box form; they are tongued and grooved and are bolted firmly against the sides of the bed.

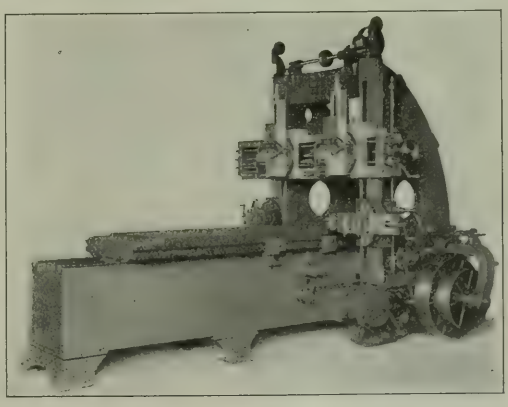


Fig. 3—The G. A. Gray Co.'s 36-in.x36-in. Spur-Geared Planer.

Side heads can be fitted to either one or both housings, as shown. They are counterbalanced and are provided with automatic independent vertical feeds and swivels so that they can be used to plane at any angle. The belt shifter is designed so that one belt is moved entirely clear of the driving pulley before the other belt comes on. The pulleys are wide, thus assuring great power and less slipping of belts. The bearings for the driving shafts are not bolted on, but are of large solid bushings, which fit into holes in the planer bed. The Vs of the bed and table are oiled automatically

by conical rollers which are supported in pockets in the Vs of the bed. These machines range in weight from 16,000 lbs. to 36,350 lbs., according to the length of the bed.

(To be continued.)

Census Valuation of Railroad Property.

The Census Bureau has issued Bulletin No. 21 containing an elaborate estimate of the commercial value of the railroad property of the country, prepared under the supervision of Professor Henry C. Adams, Statistician of the Interstate Commerce Commission. The term "commercial value" is used to denote the value of a railroad as looked at by an investor; that is to say, its market value. The main factors used in arriving at this value have been the capital and net earnings. In calculating capital, obligations not having to do with the direct operation (as, for example, those based on ownership of another railroad) have been excluded; and in calculating net earnings, the taxes and operating expenses have been deducted from gross receipts, but expenditures for improvements have not been deducted. Income from investments of other railroads and outside property is, of course, excluded. The Bureau disavows any purpose to fix a valuation for taxation or as a selling price.

The commercial value of railroad operating property in the United States, computed for the year 1904, was $11,244,852,000. The apportionment among the states is shown in the following table:

Rank of state.	State, or territory.	Commercial value of railway operating property, June 30, 1904.	Latest reported value as assessed for taxation.	Ratio of assessed to commercial value, per cent.
24	Alabama	$150,211,000	$53,926,026	35.9
51	Alaska	100,000	.....	....
44	Arizona	68,356,000	6,667,349	9.7
27	Arkansas	124,626,000	34,709,623	27.8
8	California	350,694,000	92,378,550	26.3
19	Colorado	198,261,000	49,492,135	25.0
32	Connecticut	105,369,000	120,493,648	114.4
49	Delaware	17,285,000	.....	....
50	District of Columbia	5,578,000	2,486,024	44.6
37	Florida	80,467,000	21,817,478	27.1
22	Georgia	156,603,000	63,105,810	40.3
34	Idaho	91,877,000	10,115,378	11.0
3	Illinois	805,657,000	423,700,055	63.8
40	Indian Territory	79,495,000	.....	....
6	Indiana	375,241,000	165,863,367	44.2
9	Iowa	344,847,000	57,535,160	16.7
7	Kansas	356,356,000	60,003,534	16.9
23	Kentucky	155,772,000	77,658,040	49.9
28	Louisiana	123,401,000	29,044,195	28.9
38	Maine	80,146,000	.....	....
25	Maryland	132,342,000	.....	....
15	Massachusetts	250,253,000	.....	....
13	Michigan	277,597,000	196,795,000	70.9
5	Minnesota	466,734,000	.....	....
31	Mississippi	107,884,000	29,847,640	27.7
11	Missouri	309,768,000	97,916,869	31.6
20	Montana	196,209,000	36,759,827	18.7
14	Nebraska	263,170,000	46,082,853	18.5
46	Nevada	43,745,000	13,778,049	31.5
39	New Hampshire	79,786,000	22,625,000	28.3
10	New Jersey	333,568,000*	231,655,525	69.5
36	New Mexico	86,400,000	8,511,538	9.9
2	New York	898,222,000*	229,582,064	25.6
30	North Carolina	113,146,000	69,480,974	61.4
29	North Dakota	123,390,000	22,160,304	18.0
4	Ohio	680,797,000	132,578,945	19.4
41	Oklahoma	78,668,000	11,936,317	15.2
42	Oregon	75,661,000	.....	....
1	Pennsylvania	1,420,608,000	.....	....
48	Rhode Island	25,719,000	15,832,003	61.6
43	South Carolina	75,500,000	29,467,716	39.0
45	South Dakota	49,646,000	14,354,930	28.9
26	Tennessee	131,106,000	58,530,566	46.6
16	Texas	237,718,000	95,269,785	40.0
35	Utah	90,325,000	20,682,461	22.9
47	Vermont	37,311,000	27,344,020	73.3
17	Virginia	211,315,000	63,269,623	37.7
21	Washington	182,837,000	26,066,949	14.3
18	West Virginia	201,799,000	28,771,358	14.2
12	Wisconsin	284,510,000	218,024,000	76.6
33	Wyoming	100,307,000	7,498,232	7.5
..	United States	$11,244,852,000*	.....	....

*Exclusive of Jersey City ferries of the Pennsylvania Railroad system. The value of this ferry property is $5,698,000.

The above valuation does not include the value of Pullman cars or private cars. The physical value of this equipment, that is to say, its value independent of the commercial use to which it is put, is estimated as follows:

Pullman cars	$51,000,000
Private cars	72,000,000

The total number of Pullman cars "available for the business of the company" on July 31, 1904, was as follows:

Standard cars with sleeping accommodations	2,903
Ordinary, or tourist, cars, with sleeping accommodations	547
Parlor cars	464
Composite, dining and other cars	85
Total	3,999

Foreign Railroad Notes.

The state management which succeeded the three operating companies in Italy July 1, works about 6,500 miles of railroad, there being one long line (Bologna to Brindisi with branches) and many short ones worked by the companies owning them. So far many of the arrangements for operation are provisional, continuing the methods which the operating companies followed. The rolling stock was their property, which the government must pay for, and some months ago authority was sought to borrow $200,000,000 for this purpose at 3.75 per cent. Meanwhile, the companies agreed to take bonds for about half of the sums due them; and the Ministry comes on the money market for only $100,000,000 at 3.65 per cent.

The Shanghai correspondent of the London *Express* says that the concession for the Hankow-Canton Railroad has been given up by the American-China Development Company, and that the road is now being built by Japanese engineers. The Japanese engineers are engaged ostensibly by the Chinese Government, but the correspondent says that the capital as well as the brains will come from Japan.

Those who have to plan and execute city underground railroads, which, though very few in number, are of very great importance, and seem likely to be a necessity of existence of all cities of the first class, need all the help they can get, and will doubtless welcome the publication of what is said to be a very elaborate account of the new Paris City Railroad by Prof. Ludwig Troske, of Hanover, who studied it on the spot during its construction, and with the help of 456 engravings has endeavored to make it plain to his professional brethren. In reviewing this work the *Journal* of the German Railroad Union says: "It has an educational importance inasmuch as it doubtless will awaken the mind for the comprehension of great problems in a great way; and such an education is needful where, in consequence of the increasing municipalization and nationalization, the engineer is limited in his development and freedom of action, and therewith insensibly in his habits of thought, and especially in his capacity for making decisions—a danger which comes to notice especially in foreign enterprises." Just so.

New German Passenger and Baggage Rates.

For several years the subject of the revision of the passenger and baggage rates on the German railroads has been under discussion. Endless complications have continually arisen because each state of the empire has reserved the right to regulate the rates on the railroads within its own boundaries. For example, 55 lbs. of baggage was transported free of charge on the Prussian lines, a regulation that was not recognized in the south.

At a meeting of the representatives of all the German railroads held in Berlin on January 16, 1905, the matter was thoroughly discussed and referred to the administrations who called a second conference for March 29. This was again assembled in May. There was a good deal of opposition to the suggestions of Prussia who wished to enforce her own regulations upon all of the other states, although such a course was hardly justified by the declaration of the Prussian minister of finance to the effect that no tariff could be adopted that entailed a loss on the railroads. The reform was therefore based upon a simplification and unification of the tariffs and not necessarily upon a reduction. The difficulty of such a unification was very great, owing to the multiplicity and variations of the German tariffs; the railroads of each state having their own, either with or without free baggage allowances, and with or without taxes on special and express train tickets.

The original Prussian rates took the 4th class at 2 pfennigs per kilometer as a base and added 50 per cent. to this for each higher class, making the rate 3 pfg. for third class, 4.5 pfg. for second class and 6.75 pfg. for first class. The new joint rates are the same, with the exception of the first class, which is 7 pfg. In the matter of return tickets that are good on express trains there is still some variation on the several states. It may be added here that in the case of the fourth class, which was one of the greatest obstacles to the unification of the rates, Bavaria flatly refused to introduce it, and the other southern states that consented to do so did it reluctantly, considering it an anti-democratic move. There is also a variation in the Bavarian tariffs in that while the rate is 3 pfg. per kilometer on express it is but 2 pfg. on accommodation trains.

In the transportation of baggage the passengers have not been favored, and the new ruling will hardly be popular with the German public. All free transportation of baggage has been done away with, and instead a zone system of tariffs has been introduced. The rate is based upon 25 pfg. for 25 kilos. (55 lbs.) of baggage for each run, 25 kilometers with a special rate of 20 pfg. for short zone distances. The first zone extends from 26 to 50 kilometers; the second from 51 to 100, and so on by increments of 50 kilometers up to 500. Thence the progression increases by 100 kilometers up to the fourteenth zone, which is 800 and above.

In the matter of special tickets, such as workmen's cards, Sunday excursions and the like, they remain for the most part unchanged. As to the passengers, especially those of Prussia, while they certainly appreciate the proposed reductions in fares there is a demand for still further lowering of the rates and an extension throughout all Germany of the free transportation of baggage up to 25 kilos.—*Le Journal des Transports.*

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 8. FRIDAY, AUGUST 25, 1905.

The Interstate Commerce Commission statistics of United States railroads, printed in this week's paper, are a year old, as usual, because of the elaborate nature of the facts presented and the time required to get them together. They are open to the criticism that in many cases they are merely averages of results obtained from so large a number of roads, operated under such widely different conditions, that they have no great intrinsic value. This is especially true in figures like those showing traffic density or passenger and ton mileage per mile of line throughout the country; yet even these rather idle averages have considerable news interest and compared with similar returns through a series of years, they would show quite clearly, in a large way, the general trend of American railroad traffic. Some of the items, however, are of great value as representing an aggregate instead of an average figure. It is worth while to know that out of the total route mileage fully reported to the commission of 212,243 miles, only 1,323 miles was operated by receivers. Although this figure is 137 miles greater than that for the year ending June 30, 1903, when the returns are in for the year ending June 30, 1905, this bankrupt mileage will presumably be materially less. It will be recollected that the year ending June 30, 1903, included the last half of 1902, when there was a great shortage of equipment all over the country. It is not surprising to learn, therefore, that the number of ton miles run per freight locomotive was considerably smaller in 1904 than in 1903, and that the average number of locomotives per thousand miles was 220 as against 214 the year previous. It is encouraging to see a very large increase reported in the number of locomotives and cars in service fitted with train brakes, while out of 1,692,194 cars in freight service on June 30, 1904, less than 18,000 were without automatic couplers. The total capital stock outstanding amounted to $2,696,472,010, and of this 42.53 per cent. paid no dividends; but the remainder received dividends equivalent to 6.09 per cent. Two especially striking figures stand out in these traffic returns. One is the aggregate increase of the ton mileage, amounting to 1,003,810,584. The other is the aggregate increase in passenger mileage—1,007,449,655. Both these figures indicate with great certainty the enormous growth in the country's business, but the figure for passenger mileage is the most interesting, for the percentage of increase was over 4 per cent., while the percentage of increase in ton mileage was ¾ of 1 per cent. In the growing up of the country around the lines that only a few years ago were little more than pioneers, it is obvious that this passenger traffic is to have increasingly great returns year by year and be a very important added source of profit to many companies that have been accustomed to rely chiefly on their freight traffic for means of livelihood.

The Coroner of Cuyahoga County and the Railroad Commissioner of the State of Ohio have made reports on the Mentor wreck, but they leave the question of the cause still very much in the dark. The Commissioner does nothing at all about the question of responsibility for the misplaced switch, leaving it to the Coroners (investigations were made by the Coroners of two counties); and the Coroners' action is inexplicable. The Coroner of Lake County appears to remain silent, while Coroner Siegelstein, of Cuyahoga County, gravely informs the public that he has reached a conclusion "by deduction." He believes that the operator at Mentor set the switch for the side track, and he gives a part of his reasons for the belief; but beyond that publishes nothing. Whether he or the Railroad Commissioner examined the operator who is thus seriously accused, or whether either of them possesses any direct evidence in favor of or against him we are told nothing. Railroad Commissioner Morris, in his preamble, assumes that the Governor of the state is "solicitous for the safety of the people." This assumption is undoubtedly correct. Such being the case, and the reports now issued being so incomplete, we are bound to conclude that a solicitous Governor will see that some investigating body, or officer, with full power and authority, gives the public a full and clear account of this mysterious derailment.

CHICAGO PASSENGER TERMINALS.

It is to be hoped that the recent newspaper rumor of a new passenger station in Chicago means either more or less than appears on its face. According to this report, the Wabash, through the Chicago & Western Indiana, a Chicago terminal road, plans to build a new station to be occupied by the same companies which now have their terminals in the present Polk Street, or as it is no less generally known, Dearborn Street station. These are the Wabash, Erie, Grand Trunk, Chicago, Indianapolis & Louisville (Monon) and Atchison, Topeka & Santa Fe. Any such project as this for a new independent station would be a distinct backward step in the ultimate solution of the Chicago passenger terminal problem, for the more extensive the improvements made under existing arrange-

ments, the more difficult and more expensive will it be to abandon them when the time comes for a general reorganization of the passenger terminals in Chicago. This, as is familiar to any one knowing Chicago, must come about through bringing together at least a majority of the 22 trunk lines entering that city. In the *Railroad Gazette* of January 13, page 38, the Chicago situation was described in detail, and a plan was presented by Mr. Frederick A. Delano for uniting most, and if advisable all, of the 22 trunk line passenger terminals in five or six large station buildings side by side and fronting on either Twelfth street or on Taylor street one block north. This site is directly south of three of the present terminals, the Polk Street, La Salle Street and Grand Central stations. Of these the Grand Central is the terminal of the Baltimore & Ohio, Chicago Great Western and Pere Marquette. The La Salle Street station is occupied by the two Rock Island-Frisco lines, which reach Chicago, namely, the Chicago, Rock Island & Pacific and Chicago & Eastern Illinois, and by the Lake Shore & Michigan Southern and New York, Chicago & St. Louis (Nickel Plate). Another Vanderbilt line is soon to use this station, it is said. The Cleveland, Cincinnati, Chicago & St. Louis (Big Four) now uses the track and motive power of the Illinois Central for the 56 miles from Kankakee into Chicago. In order to give this line its own Chicago connection, the Indiana Harbor Railroad, at present a relatively unimportant outer-belt line, is building under Vanderbilt auspices a line from Indiana Harbor on the Lake Shore & Michigan Southern south about fifty miles to a connection with the Big Four near Danville, Ill. When this new line is finished the Big Four will be able to enter the La Salle Street station over the Lake Shore tracks. The five roads which use the Polk Street station have already been mentioned. These three stations are particularly well situated for falling in with Mr. Delano's plan. Leaving out of account the rest of the 22 railroads entering Chicago, there are 12, and with the Big Four 13, trunk lines occupying these stations. In addition there are the Illinois Central, Michigan Central and Wisconsin Central, which run into the Illinois Central station near the lake on Twelfth street, and the Pennsylvania's Pittsburg, Fort Wayne & Chicago line, the Chicago & Alton and the Chicago, Burlington & Quincy, which now run into the Union station. These and the Pittsburg, Cincinnati, Chicago & St. Louis (Panhandle), the other Pennsylvania line, which also uses the Union station, could all with no very special difficulty make use of the proposed terminal, for as Mr. Delano suggested they all enter the city either from the south or from the west, south of Fifteenth street. This would leave the two roads which enter the city from the north, the Chicago, Milwaukee & St. Paul, now in the Union station, and the Chicago & North-Western, which has its own terminal, to unite perhaps in a new station on the north or west sides, or what would be, even in their case, far from impossible, to run their through trains into the proposed new terminal.

The recent newspaper item is suggestive because since the publication of the article on the Chicago terminals, Mr. Delano has been appointed operating and managing head of all the Wabash properties. Although a denial of the story has already appeared which explains that the land purchased by the Wabash is for new freight terminals, it is certainly to be hoped that either the Wabash, through Mr. Delano, or some other road, may soon take the initiative in a successful project for new passenger terminals in Chicago. As Mr. Delano says, the real difficulty of the situation is in bringing together the actually or potentially discordant interests. His plan may not be the best plan, but unless Chicago is willing to settle down permanently to her present scattered and, in more than one case, out-of-date passenger stations, there must be concessions on all sides, in many cases sacrifices, and a general co-operation for the general good. Once let the problem be thus confronted and the long-desired changes are pretty sure to be found comparatively easy of solution. When the plans finally shall be brought to a successful conclusion and a great union station or union of union stations stands in Chicago, the great wonder will be, if similar cases are any precedent, how the old conditions were so long endured.

SOME INFLUENCES AFFECTING TONNAGE RATING.

Tonnage rating is an old topic for discussion, and the principles are pretty well settled as to about what should be done in order to secure satisfactory results. The dynamometer car has taken the place of office calculations, and is apparently better adapted to the practical requirements of both the mechanical and transportation departments. Its advantage lies in the fact that it gives the actual resistance over each section of track and takes all inequalities into consideration in a way that is impossible with purely theoretical work. As an example of this, a calculated tonnage rating assumes a given compensation for curves on grades and a given resistance of cars on curves; assumptions not borne out by fact. With short trains they may be correct within an inappreciable margin of error, but as train lengths increase, the error increases in an unknown ratio until we presently find that the engine cannot haul the maximum train which the figures based on the above assumption tell us that it ought to haul.

This influence of the length of the curve on train resistance does not seem to have received much, if any, attention on the part of the engineering department. It is customary to cut down the grade a certain definite amount, varying in practice, but averaging about 1.4 ft. per mile for each degree of curvature. That this is incorrect if applied to all curves indiscriminately will be readily understood after a moment's consideration. It is generally assumed that because the front wheel of the truck is grinding into the outer rail of a curve and because that outer rail invariably shows the greater amount of wear, that the pressure against the inner rail is comparatively slight and may even be neglected. This is far from being the case. Owing to the inequality in the length of the rails and the equality in the circumference of the wheels, the inner wheels naturally run ahead of the outer ones and crowd the front outer flange sharply against the rail, increasing its pressure as the curvature increases. At the same time the whole truck is swung ahead of the true radial position and the flange of the back inside wheel is also pressing against the inner rail. Whether this pressure is equal to that of the forward outer flange against the outer rail, is not known, as neither of these pressures have yet been measured. It is evident, however, from a purely theoretical standpoint that the pressure against this inner rail must be considerable; due solely to the fact that the truck is out of true radial alinement. This pressure is increased by the pressure of the car body against the center plate. The car is pulled at its end, and, when it is on a curve, there is a tendency on the part of the car at either end to move it towards the inside of the curve; a tendency which adds to the pressure of that flange against the inside rail, so that it is quite possible that this pressure, on slow-moving trains, may be greater than that against the outer. Of course, the inner tendency of the car does not occur where the speed is such that centrifugal force balances or exceeds that increment of train pull tending to move the car towards the center of curvature.

As for the inequality of rail wear, that is easily explicable from a consideration of the relative positions of the wheels and rails. When cutting is to be done with the ordinary tool, either in wood or metal, the edge is advanced and pushed over the surface, and the angle at which it is made to stand to the surface to be cut determines, to an extent, the depth of cut. But if the edge were to be reversed and dragged over the surface, as in the whetting of a knife, there is no cutting, but merely a wear due to abrasion, even though the pressure applied were many times greater than that put upon an advancing edge. So it is in the case of the two wheels of a truck. The forward outer wheel stands at an angle with its flange pressing against the rail. It has a tendency to gouge into and climb over the latter so that it inevitably follows that the wear is severe. The rear wheel, on the other hand, is dragging its flange over the rail like an ax on a grindstone, causing comparatively little wear, but setting up a strong frictional resistance. And this frictional resistance naturally increases with the number of cars and the sharpness of the curvature. There is evidence that this pressure increases with the angle at which the engine stands to the car, and is not entirely dependent upon the angle between two adjacent cars. In other words, the length of the curve has an important bearing upon curve resistance. Dynamometer car tests over two curves on the same grade, will show that the resistance, per ton, will be greater on the longer curves. Of course, after a curve becomes longer than the train, additional length has no influence whatever in increasing the resistance. For example, if the train is 2,000 ft. long, a curve of that length imposes the maximum resistance, and one of 4,000 ft. adds nothing except to the distance over which the maximum resistance will have to be overcome. But it will be found that one of 1,200 ft. will impose much less of a load per ton due to curvature than the longer curve.

Therefore, it is evident that curve compensation on grades should be on a sliding scale, in which train length and curve length should receive due and complementary consideration. It is in determinations such as this that the dynamometer car is of such prime advantage in settling the tonnage ratings. The adjustment for light

and loaded cars has been accepted as the practical solution of the problem of keeping the engine up to its work at all times, and the method of making this adjustment varies on different roads and will probably vary for some time to come until the averages of the different resistances are better known than they are at present.

Practical operation is, however, tending towards greater uniformity, and we find the use of the pusher engine coming more and more into play. Instead of rating an engine for the ruling grade and giving it all it can take over it, the rating is put much above this, and pushers are provided on all the hills. Examples of this can be multiplied indefinitely, but the cases of the Pennsylvania Railroad on the Pittsburg Division, going west out of Altoona, and the Bessemer & Lake Erie, between Pittsburg and Conneaut, where eight hills are provided with pushers, will serve as examples of means of securing a high tonnage rating while keeping the trains moving at speed, with no danger of stalling and the necessity of doubling. Finally, there is coming to be a more general appreciation of the desirability of a reserve of power in the locomotive and of the fact that there must be no danger of stalling. It is desirable, of course, to haul the maximum load between terminals, but this maximum load should not be the heaviest which the engine can haul over the steepest grade, while the remainder of the run is made with a comparativly light load; but load that can be hauled over the division with assistance from a pusher at certain points. For it is certainly more economical to assist a train over the steepest grade than it is to allow a few short sections of five or six miles in length to become the controlling element of the train-load for the whole length of a division.

In the case of the Bessemer line, it was stated in one of the early reports of the company, in commenting on the high train loads that were moved, that it was cheaper to help the traffic over the hills than it would be to reduce the grades. This, however, is a matter of purely local concern, and must be worked out and the proper action taken for each individual case. In a general way, it appears to be the current tendency to rate engines in such a way as to allow them a margin of power for the work they have to do, so as to have this reserve that can be called into action in emergencies; to use pushers liberally and systematically, and to adjust track conditions to best subserve the ends of the traffic requirements. It is to be regretted that the same sentiment does not seem to prevail in the passenger service. Here, there is a constant tendency to overload. Engines are placed on runs that can barely make the schedule with the normal train. An extra car, a head wind or a slippery rail means a continual loss of time, late trains, disgruntled passengers and a disarranged yard service. In this, superintendents seem to forget that there comes a time when the speed is so high that the drawbar pull disappears and the engine can just move itself, and that every machine has its limitations, which should receive as much consideration in passenger as in freight service, if not more.

RAILROAD RUMOR AND REALITY.

At an epoch like the present, when railroad values in the stock market have their times, reaching through weeks, of dancing up and down with acrobatic liveliness, and when a single great company's share capital may rise or fall in the quoted price five or ten million dollars in a day, the student of American railroad history has occasion for some instructive reflections. A "boom" period of railroad securities in Wall Street is peculiarly rich in its contrasts and parallels, both near and far in time. By this we do not refer to the mere comparison of prices between "boom" epochs and those of depression, though such a comparison is often striking as well as instructive. What we do mean is the contrast in the effect of certain forces, partly sentimental, as they bear nowadays upon railroad values in "The Street" in comparison with earlier days of railroad finance and investment. Among a number of such interesting studies is the change which time has wrought in the relative powers of railroad reality and railroad rumor.

Let us illustrate the case somewhat concretely. A few decades ago a bad railroad accident—particularly if the blame fell upon the operating corporation with consequential damages—dropped heavily on the stock of the road. The stock fell instantly, and recovered very slowly. A different kind of calamity may be illustrated by the Schuyler frauds on the New York and New Haven corporation, which needed fourteen years in which to outlive its misfortune. Or, coming down to a later period, wars of rates, while not often sudden, were prolonged and disastrous; and like in kind were the Granger attacks on the Western roads during the early seventies. All these were railroad realities, and very serious ones. They were serious chiefly because they fell on isolated lines, and often on small lines before the days of consolidation and of the modern great railroad "system." All that is now changed. A railroad accident like that in the New York tunnel, huge as was its cost in damages, hardly flinched New York Central stock, and is now all but forgotten. The day after the destruction of the Lackawanna terminal by fire, the stock made a new high record. A war of rates, unless on an immense scale, Wall Street would laugh down as but transitory. Even the attack on rates of the Federal Government awhile ago produced hardly an appreciable effect on values—and that effect but momentarily—and was later eclipsed in the pervasive rise of railroad securities.

But, albeit in an age of materialisms, while the scope and influence of the railroad Reality has thus diminished, or seemingly so, those of the railroad Rumors have waxed big. They range through a vast scale, reaching all the way from the two-line news item that forecasts increased earnings of a petty road up to the column that outlines hypothetically the mergers of a trans-continental system. They crowd page on page of the financial journals; and the strangest fact of all is that so many of them "go," and are interpreted into terms of actual influence. "Time does not wither or custom stale" either their infinite variety or their power. The rumor, well heeled, of a merger, of a holding "company," or shift of shares into bonds, spells bigger results in immediate market values than bed-rock realities or the positiveness of official announcement. One sees, too, some singular outcomes of a secondary character. The railroad "lifted" ten or fifteen points by Rumor will hold its place for months after Rumor has been killed by Reality.

All these are, of course, but phases of our up-to-date railroad speculation which organically fosters rumor and makes the meat it feeds on. But behind the skirmish line of speculation is the solid rank and file of investors, who analyze situations, who study actual returns, who estimate railroad management by its *personnel* and established traditions, and with whom reality still outweighs rumor. In the long run, and counting periods of boom and periods of break together, that class undoubtedly comes out far better than the average railroad speculator who plays on rumor as upon a lute. To the hesitant railroad investor that fact is a warning. To the railroad student the wider play and higher potential of Rumor in contrast with Reality has deeper meanings. It suggests, negatively, the immensely increased number of elements in modern railroading on which speculation can lay its hazards, and positively the resistive power of the modern railroad, not only as against accidental misfortune but as against speculation itself. Spite of Rumor and the results of it in the ups and downs of Wall Street, the shady railroad stock of a few years ago has become very often indeed the regular dividend payer of to-day; and Reality survives as an enduring fact, while Rumor plays her more conspicuous daily antics around her.

July Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of July, printed in another column, contains accounts of 23 collisions and 25 derailments. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
4th	Viley, Ky.	0	22
5th	Wachusett, Mass.	3	2
6th	Springbrook, N. D.	1	32
8th	Marion, N. Y.	3	2
14th	Steiger, Ill.	3	6
15th	Upton, Ind.	4	8
16th	Landry, La.	3	0
18th	Romeo, Ill.	1	3
23d	Unionville, Ia.	3	0
27th	Myers, Mont.	4	0
29th	Diaz, Ark.	2	9
29th	Ozark Junc., Ark.	0	42
29th	Lemont, Ill.	3	18

July shows no such notable disaster as the three which gave such unhappy prominence to the two months preceding, and yet these 13 principal items in the present record aggregate 30 persons killed, an average of 2⅓ to each accident. Moreover, a study of the causes of these accidents is by no means dull reading. In at least three unexplained derailments the tender was the first vehicle to jump the track, a fact suggestive of the need of improvement in the design of tenders or better care in managing them. The butting collision at Viley, Ky., is said to have been caused by one of the trains running a minute ahead of time. Can it be that this loose practice is due to mental confusion arising from the use of the space interval and the time interval mixed together? The circum-

stances of the Springbrook derailment indicate that it came very near being one of the worst disasters. The collision at Romeo, Ill., seems to have been likewise characterized by apparently miraculous escapes. The collision at Steiger, Ill., on the 14th, was like that on the Lancashire & Yorkshire last month, where 20 passengers were killed, the striking difference being that at Steiger the presence of a locomotive at the head of the train protected the lives of th passengers. If we do not take more effective measures to prevent collisions, the general introduction of electric cars will be accompanied by a demand from the public that every electric train be equipped with a dead steam locomotive in front to serve as a buffer!

The number of electric-car accidents reported in the newspapers in the month of July was 22, in which three persons were killed and 127 injured.

The number of express trains on the German railroads was increased materially when this year's summer time-table went into force, and also the number of those running at high speed. The speed has always been limited by law, but the restrictive regulations were changed last November. The greatest permissible speed under the most favorable conditions previously had been 100 kilometres (62 miles) per hour; the new regulations permit a speed of 59 miles per hour on down grades of 41 ft. per mile, 65 miles on grades of 26½ ft., and 75 miles on grades not exceeding 17 ft. per mile. Similar limitations apply to curves: 59 miles per hour may not be exceeded on curves of 2,625 ft. radius, 62 on those of 2,952 ft., 65 on those of 3,280 ft., 68 on those of 3,607 ft., 71½ on those of 3,934 ft., and the maximum permissible anywhere on curves of 4,265 ft. radius. In this connection it must be remembered that a large part of the German cars have long wheel-bases and are four or six wheeled cars.

In accordance with these new regulations, last winter's time-tables had several trains running at speeds previously unattained; but the summer tables have a much larger number, though only in considerable augmentations of speed over last winter's fastest trains.

These latter show 35 trains timed to run at the rate of 50 miles an hour or more over stretches of from 35 to 100 miles where they run without stopping at intermediate stations. The fastest of these runs from Hamburg to Wittenburg, 99⅛ miles, in 1 hour and 51 minutes, which is at the rate of 53½ miles per hour. In the reverse direction it takes 1 minute longer. Continuing from Wittenberg to Berlin, 79 miles, it runs at the rate of 52 miles per hour. From Berlin to Dresden, 117 miles, the time is 51½ miles an hour. Six different trains run from Berlin to Halle, and two from Halle to Berlin, 100½ miles, in just 2 hours. There is a run without a stop for passengers, but one for water, from Berlin to Hanover, 158 miles in 3¼ hours—48½ miles an hour. The number of trains which run 100 miles or more without stopping is 34.

Among the feats accomplished by Japan recently, that of building a railroad the whole length of the peninsula of Korea, some 550 miles, has been obscured by other deeds of a different nature. Readers of the *Railroad Gazette* have been informed of the beginning of this work, which dates back to 1902, but that it should have been completed so soon is surprising; for comparatively little track had been laid when the war broke out, and that on the southeastern end, from Fusan, opposite the Japanese port of Shimonoseki, some 8 or 10 hours distant by fast steamers. Thence to Seoul, the capital, about half way to the Manchurian border, the distance is 260 miles, and the work could be prosecuted in both directions; for Seoul already had a railroad 26 miles long connecting it with its port, Chemulpo,—a railroad built by Americans, but in 1899 transferred to a company consisting of wealthy Japanese. This line from Fusan to Seoul is across a hilly country and has 31 tunnels, aggregating 8 miles in length and 4 miles of iron bridges. The line north of Seoul to Wiju was originally undertaken by a French corporation, but was acquired by Japan when the war began. Very little has been said of the work on this line; but now it is reported completed; though it is yet to be connected by a short line in Manchuria with the Chinese Eastern near Lao-Yang. But besides this line the length of the Korean peninsula, the Japanese have made such progress on a line across it, from Seoul northwest to Wonsan (otherwise Gensan) on the north coast, 160 miles, that there is talk of opening it early next year. Besides this, a branch is begun from a point north of Fusan to the port of Masampo, west of Fusan, which will give the main line two outlets on the coast. Altogether, evidently a great development of traffic in Korea is expected when the war ends.

Buffalo, Rochester and Pittsburg.

The report for the year ending June 30, 1905, shows an increase in mileage worked from 499 to 538 route miles, and also an increase of 51 miles in second track and sidings owned and leased. Gross earnings increased from $7,529,958 to $8,161,079, but the increase in operating expenses was slightly greater, so that net earnings were $3,102,267, as against $3,121,151 last year. The outstanding capital stock was increased during the year $3,000,000 (common) and now amounts to a total of $16,500,000. The proceeds of this were used primarily to pay the balance of the cost of the Indiana branch, which runs into the coal fields located some 40 miles northeast of Pittsburg. The net increase in bonded debt during the year was $592,000, constituting the issue of $789,000 new equipment bonds authorized in former years and the cancellation of 197,000 car trust and equipment bonds. During the year expenditures were made for 15 new locomotives, 1,038 freight cars and other miscellaneous equipment, of which six freight and 21 service cars were built at the company's shops. The equipment account was also credited for equipment sold, transferred or destroyed with $314,192 charged to operating expenses. It is customary on this road when rolling stock is destroyed or sold to charge operating expenses and credit equipment account. When purchasing or rebuilding the cost is charged to equipment account.

Of the total freight earnings of $7,070,150, bituminous coal contributed $4,285,848 as against $3,731,993 last year. General merchandise contributed $1,869,602 as against $1,652,758 last year. Passenger earnings, $1,042,241, increased only $4,000. The expense account, which increased $650,005 as against an increase of $631,121 in earnings, was larger all along the line, especially under the head of conducting transportation. Net earnings per mile ($4,749) are, however, higher than in any previous year except 1904. Both train loading and engine loading show an extremely large increase over any previous year. The average revenue train load in 1905 was 507 tons as against 439 tons in 1904. The average engine load was 374 tons as against 357 tons. This is the largest increase in train load that has been made in any year by the road at any time since 1896, when the train load statistics presented with the current report began.

The following are the principal statistics of the year's operation:

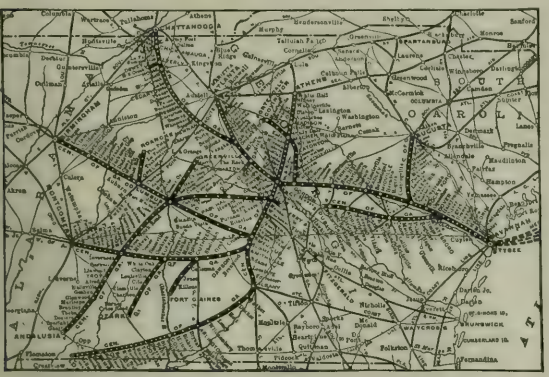
	1905.	1904.
Mileage worked	538	499
Passenger earnings	$1,042,241	$1,038,172
Freight earnings	7,070,150	6,446,366
Total earnings	8,161,079	7,529,958
Maint. way and structure.	676,198	589,412
Maint. of equipment	1,314,407	1,134,748
Cond. transportation	2,898,490	2,516,643
Total expenses	5,058,813	4,408,807
Net earnings	3,102,267	3,121,151

Central of Georgia.

The year ending June 30, 1905, was a prosperous one for this company, formed in 1895 as a combination of six bankrupt properties which had been sold under foreclosure. Gross earnings, which have been increasing rapidly since 1901, passed the ten million mark for the first time in the history of the road, aggregating $10,135,055. The average miles operated aggregated 1,878 as against 1,865 in 1904 and 1,845 in 1903 and 1902; so that with an increase of only 30 miles in line the gain in gross earnings for the last four years has amounted to over 30 per cent. Per mile of line operated the company earned $5,397 in 1905 as against $3,954 as recently as 1900. Operating expenses and taxes this year were $7,417,966 as against 7,187,386 last year, and the total income this year was $2,965,463 as against $2,430,206. Charges on account of equipment trusts, funded debt, rentals and miscellaneous increased in the aggregate less than $9,000, leaving a net income of $854,517, as against $338,467; a sum more than twice as great as the net income in any previous year. The capitalization of the road, dating from the reorganization of the former properties, is an unusual one, since there is only $5,000,000 of stock outstanding, none of which is in the market, but is held by Southern Railway interests. There is no floating debt, and of the total bonded debt of $48,863,000, first, second and third preference income bonds amount to $15,000,000. It is specified that these income bonds, which do not differ much from preferred stock in their earning rights, shall receive not to exceed 5 per cent., non-cumulative. In spite of the small total capitalization, which amounts only to $2,662 per mile, stock, and $26,018, bonds, no dividends have ever been paid on the stock, and the income bonds will this year receive their full 5 per cent. for the first time.

Looking further at the sources of earnings it is seen that considerably the most important increase figured in the percentage of change from the previous year was in the passenger business. In spite of an average decrease of 1.17 cent per passenger mile, passenger train mile earnings increased 8.92 cents, and passenger earnings as a whole increased 11.81 per cent., while freight earnings increased 9.33 per cent. The average revenue train load, which is naturally small on account of the branch line character of much of the traffic, increased from 187 tons to nearly 208 tons. The average haul of revenue tons increased from 142 miles to 148 miles, and ton-mile earnings increased from 1.113 cent to 1.144 cent. The freight traffic, although increased, was carried with a somewhat reduced train mileage, although passenger train mileage increased from 2,758,159 to 2,865,537. As regards specific commodities hauled,

cotton and general merchandise show some little increase, while grain, bituminous coal, lumber and iron fell off somewhat from the year previous, but none of these changes were especially noteworthy. As regards operating cost per mile run, there were considerable increases in the charges for repairs and fuel, slight increases in water supply, oil, tallow and waste, and slight decreases in wages of engineers, firemen and roundhouse men, and in the cost of unclassified supplies.



Central of Georgia.

The following table compares the principal statistics of operation in 1905 and 1904:

	1905.	1904.
Mileage worked	1,878	1,865
Passenger earnings	$2,395,769	$2,164,658
Freight earnings	6,808,639	6,227,550
Total earnings	10,135,055	9,396,931
Maint. way and structure	1,607,530	1,823,517
Maint. of equipment	1,744,226	1,258,597
Cond. transportation	3,394,369	3,446,866
Total expenses, inc. taxes	7,417,966	7,187,385
Net earnings	2,717,089	2,209,546

TRADE CATALOGUES.

Dynamos and Motors.—Bulletin 50 of the Northern Electrical Mfg. Co., Madison, Wis., shows "Northern" spherical dynamos and motors. The various styles of machines are illustrated, also their application to industrial plant service, machine shop work, etc. There is considerable helpful information on these subjects in the bulletin. The "Northern" vertical motor, to the development of which the company has given special attention, is illustrated in a variety of applications. Vertical motors overcome the annoyances from bevel or worm gears, turned belts, etc., in operating vertical shafts. The "Northern" is designed to avoid the troubles due to lubrication of the vertical armature shaft.

Dump Cars.—Kilgore-Peteler Company, Minneapolis, Minn., sends catalogue No. 3 on dump cars. Different capacities and gages of Peteler two-way steel-frame dump cars, varying from 1-yd., 18-in. gage, to 6-yd., standard gage, are illustrated and described. Also gable bottom cars for mines, trestle filling and stone quarries; end dump mine cars; flat cars for stone, structural steel, factories, etc.; steel and wood frame lumber cars. The company also makes a large line of special cars which are listed in the catalogue. Wheels and axles are also included in the products of the company. Two illustrations of Kilgore steam shovels loading Peteler cars are included.

Steam Engines.—The B. F. Sturtevant Co., Boston, Mass., has just issued Bulletins 73 and 76, descriptive respectively of its vertical and horizontal center crank engines. Each type is built in a line of about 20 sizes. The horizontal type is entirely enclosed, provided with watershed partition and equipped with forced lubrication. These engines were particularly designed for the direct-connected driving of generators.

Locomotives.—The Baldwin Locomotive Works send two very interesting pamphlets. One of these describes and illustrates the manufacture, the use, and the efficiency of solid forged and rolled steel wheels. The other gives illustrations and general dimensions of heavy locomotives recently made by the company.

Gas Engines and Gas Producers.—The De La Vergne Machine Co., New York, sends an illustrated catalogue of its Koerting four-cycle gas engine. A full detailed description of this engine is given, including cross-sectional line drawings, and half-tone illustrations. The principle of its operation is clearly explained and diagrams showing its efficiency as compared to other types of engines are also given. The latter part of the catalogue contains a description and illustrations of the Koerting suction gas producer as well as a number of valuable engineering tables and data pertaining to both steam and gas plants.

Roofing and Paints.—The Standard Paint Co., New York, is sending out its August issue of "The Exchange." It contains a number of excellent testimonials in regard to this company's P. & B. paints, as well as reports on tests made by Robert W. Hunt & Co., of Chicago, of the National Paint Company's red, olive and green Flexite metal preservative paints and Flexite primer.

Friction Draft Spring.—The Frost Railway Supply Co., Detroit, Mich., has prepared a little pamphlet on the Harvey friction draft spring, for which it is sales agent. This spring was described and illustrated in the *Railroad Gazette* April 7, 1905, and the pamphlet gives much of the information which appeared in that article, also additional facts and claims.

Small Motors.—The Crocker-Wheeler Co., Ampere, N. J., is distributing its latest bulletin No. 60 entitled "Small Motors." It describes and illustrates motors ranging from ¼ h.p. to 3 h.p. The latter pages of the pamphlet contain technical data intended to be valuable to users of electric motors and generators.

Anvils and Vises.—The Eagle Anvil Works, Trenton, N. J., send two folders descriptive of the "Fisher" double screw parallel leg vise and of its "Eagle" anvils.

CONTRIBUTIONS

Railroad Organization.

New York, August 23, 1905.

To the Editor of the Railroad Gazette:

In view of the interest attaching to the question of organization, will you not elucidate the matter further?

1. Will you please print diagrams illustrating the typical forms of departmental and divisional organizations for a large railroad?

2. Will you please set out in parallel columns the several railroads in this country using respectively these organizations?

3. Is there such a marked inferiority in the operation of the lines using the departmental organization as to justify Mr. Hale's saying?* For many years the Lake Shore was operated on a departmental, and the Fort Wayne on a divisional basis. Will anyone say the operation of the Lake Shore was markedly inferior, or that Mr. Newell permitted any officer of that company to "forget that the object of a railroad is to provide transportation?" For a long time the Chicago & North-Western managed its maintenance on a departmental basis; recently it has been approximating a divisional basis. Can anyone discern improvement in its operation consequent thereon?

4. Will you please set out in parallel columns the merits and defects of the two methods of organization?

5. Will you please say what there is in the peculiarities of organization or in the environment of the systems that determines the owners of the Rock Island to operate their Frisco system on a departmental and their Rock Island on a divisional basis? F.

[The *Railroad Gazette* has devoted considerable attention during the past few years to the study of organization. In 1904, for example, we described the organization of the following roads: Rock Island (departmental), Feb. 19, p. 122; Philadelphia & Reading (divisional), March 11, p. 122; Chicago Great Western (divisional), March 11, p. 173; Boston & Maine (departmental), April 1, p. 253; Buffalo, Rochester & Pittsburg (mixed), April 15, p. 285; Southern Pacific Lines West of El Paso (divisional), June 3, p. 414; Norfolk & Western (divisional), June 3, p. 415; Lancashire & Yorkshire (departmental), June 10, p. 440; Southern Railway (divisional),

*In the *Railroad Gazette*, Aug. 11, p. 122, we quoted the remark of Mr. Arthur Hale, that wherever a department escapes from the hands of the Superintendent it is only too apt to forget that the object of a railroad is to provide transportation; that the engineer will build yards to hold cars instead of to move them, and the master mechanic will think more of his performance sheet than of the amount of tonnage moved.

Sept. 16, p. 348. Following "F's" suggestion, this study will be extended somewhat and within the next few weeks comparisons will be made along the lines suggested by our correspondent. The subject is an important one, and letters to the editor for publication will be welcomed.—Editor.]

Philadelphia's Rapid Transit Railroad.

II.

(*Continued from page 157.*)

Market Street Elevated Road.

The elevated portion of the new rapid transit line which is now building, will extend from the west abutment of the Schuylkill river bridge west on the center line of Market street to the Delaware county line, and then about 690 ft. farther west on private right-of-way to an abutment near the Milbourne Mills, where it comes down to the surface and ends in a terminal yard to be built on a large tract of land owned by the Philadelphia Rapid Transit Co. The total length of the elevated structure will be 19,377 ft., or about 3.67 miles. With the exception of short approach curves at the east and west ends the line is on a tangent and there are no heavy grades other than velocity grades purposely introduced at some of the stations. There will be eight stations, each having platforms and ticket offices on the north and south sides of the structure, connected by a crosswalk suspended under the elevated girders. These stations will be located at the intersections of Market street with the following cross streets: 32d, 36th, 40th, 46th, 52d, 56th, 60th and 63d streets. The surface car tracks will be maintained in their present position in the center of Market street between the elevated columns.

The accompanying drawings show the details of the construction of a typical section of the elevated structure. For about 322 ft. west of the Schuylkill river bridge abutment plate girders will be used for the longitudinal members, the same solid floor construction being preserved as on other sections of the line. From near the county line to the west abutment 680 ft. beyond, an open floor construction will be used, the rails being supported on cross-ties laid on the longitudinal stringers. In designing the structure the main object was to reduce noise and vibration to a minimum, and every member is made heavy and strong with stiff connections to all other members. The ballasted floor will undoubtedly absorb much of the vibration under passing trains and deaden the noise to a great extent. No other structure in use in this country for the operation of electric trains is as heavy and substantial as the one to be built here. Mr. Bion J. Arnold's proposed steel and concrete solid floor structure for the Chicago elevated roads described in the *Railroad Gazette*, April 21, 1905, is perhaps a more substantial and noiseless design, but it has not as yet been tried. With the ballasted floor used, it was, of course, necessary to make careful provision for waterproofing the entire deck and for carrying off such water as would collect from rains and melting snow. These details will be referred to later.

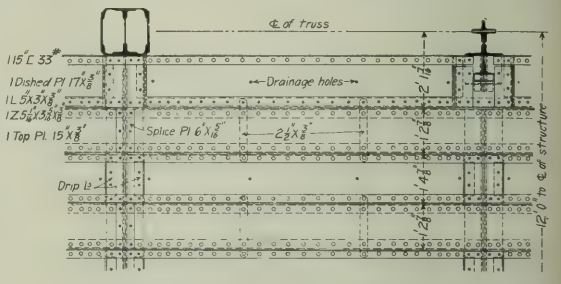
The general design of the structure consists of longitudinal lattice girders 50 ft. long supported on two rows of built-up columns with plate girder floor-beams every 10 ft. carrying a steel trough floor on which the concrete floor and the ballast is laid. The columns are made up of two 15-in., 33-lb. rounded-corner channels, one web plate 14 in. x ⅜ in., and four angles 4 in. x 3½ in. x ⅜ in. The rows of columns are spaced 24 ft. apart, center to center, and the columns in each row are spaced uniformly 50 ft. apart, center to center. The round-cornered channels are placed with the flanges turned in so that the columns have a smooth exterior with no projections.

The lattice girders are 50 ft. long and rest on the column caps which extend up 2 ft. 6 in. below the backs of the top chord angles. The drawings show the material of which the different members are built up and the heavy gusset plate and clipped angle connections used. The light bent angle brackets at the columns add to the longitudinal stiffness of the structure. An interesting detail, not shown on the drawing, is the method of fabricating the bottom chords of the trusses which are made up of two 6-in. x 6-in. x ½-in. angles and double cover plates 14 in. x ⅝ in. The two angles are separated ¾ in. and the space in between is filled to within ½ in. of the top of the angles with cement mortar composed of three parts of sand and one part Portland cement. The remaining ½ in. of depth is filled with Iron Bark cement to keep out water.

The standard depth of the longitudinal girders is 6 ft. 10⅛ in. back to back of flange angles, and the minimum head room between the surface of the pavement and the bottom chord as established by a city ordinance is 14 ft. The girder construction at the stations will be referred to subsequently.

The floor system consists of 34-in. plate girder floor-beams spaced every 10 ft. resting on the inside flange of the bottom chord of the longitudinal girders and riveted to the verticals. At the columns the floor-beams are riveted to the inside channel of the column with connecting angles and further supported by curved brackets made up of a ⅜-in. web plate and light flange angles. The steel trough floor rests on the top flange of the floor-beams. It is made up of 15-in. x ⅝-in. top plates, ⅜-in. Z-bars and special dished plates for the bottoms of the troughs. The enlarged detail shows the method of lapping the joints to make them waterproof. At intervals of about 3 ft. holes 1¼-in. in diameter are punched in the dished plates with a projecting lip on the under side to drain off any water that may percolate through the concrete floor. The projecting lip on the holes forms a drip for the water and prevents it from running along on the under side of the troughs and injuring the paint on the steelwork. At the junction of the dished plates with the floor-beams short lengths of light angle iron are riveted on the under side of the top flange of the floor-beam to act as drips for any water which may leak through. Water dropping off of these angles will clear the bottom flange and will not run down the web plate or across the flanges to the columns. A detail of this is shown on the drawings.

The trough floor is covered entirely over with concrete having a minimum thickness over the top plates of 4 in. This concrete floor slopes 3 per cent. from the sides to a gutter in the center running the length of the structure. Where the structure is on a grade of 1 per cent. or more, this gutter is given the same grade as the track, but where the structure has a grade of less than 1 per cent., the gutter is given a grade of at least 1 per cent. by local inclination between the column bents. At each column bent the water collected by the gutter is led by a pipe through the floor to a light channel which carries it down and out to a collector fastened to the column from which a down spout leads to the pavement. The concrete is retained at the sides by a 15-in., 33-lb. fascia channel, the top flange of which forms a metal finish and prevents the thin wall from being cracked or broken. To hold the concrete against the vertical surface stud bolts wrapped with wire



Part Plan of Steel Trough Floor.

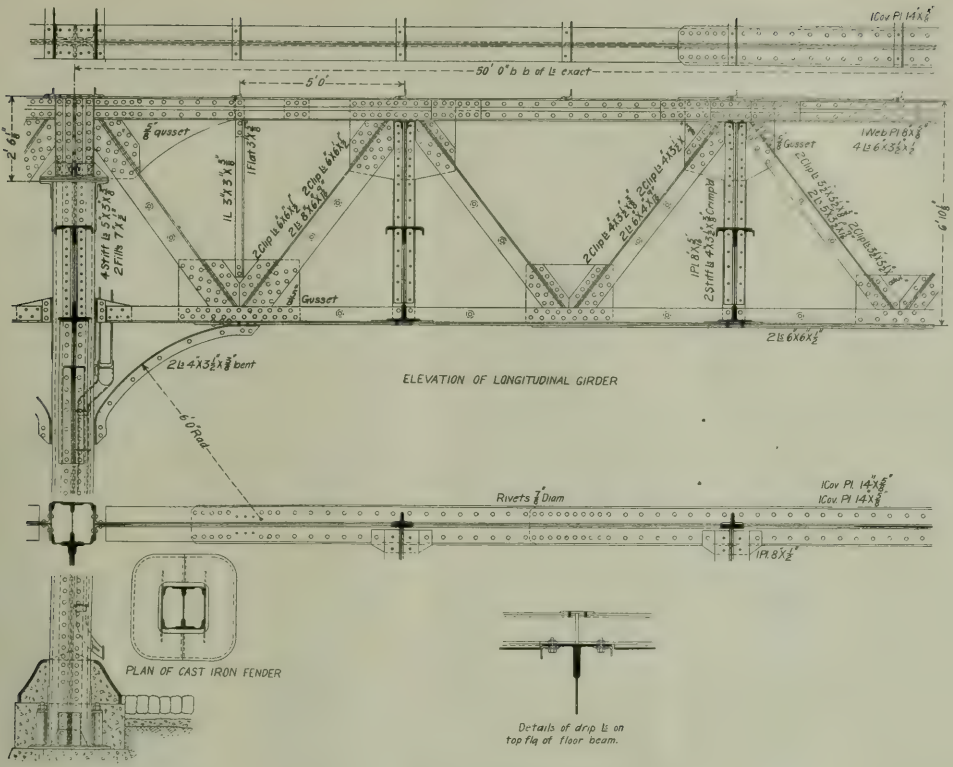
are inserted in the web of the channel at frequent intervals and the concrete surrounds their projecting ends. Steel wire cloth reinforcement is also laid across the entire width of the concrete floor. At the expansion joints which are spaced 150 to 200 ft. apart the concrete is confined by steel plate dams and the wire-wrapped stud bolts are used on these vertical surfaces also. The ballast under each track is held in place transversely by the concrete wall next to the fascia channels and by a low wall next to the central gutter. Where the track is on a 2 per cent. grade or more, transverse ridges are formed in the concrete bed to prevent creeping of the ballast. The top of the concrete bed is given a granolithic finish 1 in. thick, well trowelled, and the stone ballast is laid on this without other waterproofing. A minimum depth of ballast of 5 in. has been specified to prevent any injury to the top surface of the concrete when tamping.

A plank floor gangway is carried along each side of the structure about 2 ft. above the level of the rails. It is supported on curved angle brackets attached on the outside of the longitudinal trusses opposite the floor-beams. The inner edge rests on the top chord of the trusses. For protection a pipe railing is added and particular attention has been paid to the design of all the connections for this railing to prevent any joints from getting loose and rattling. The drawings also show a trolley pole supported on a heavy bracket riveted to the columns. This will be omitted on the structure for the present and power will be supplied to the trains from third rails mounted between the tracks. The feed cables will be carried under the trough floor and will be connected to the third rails with feeder wires running up through pipes set in the concrete floor.

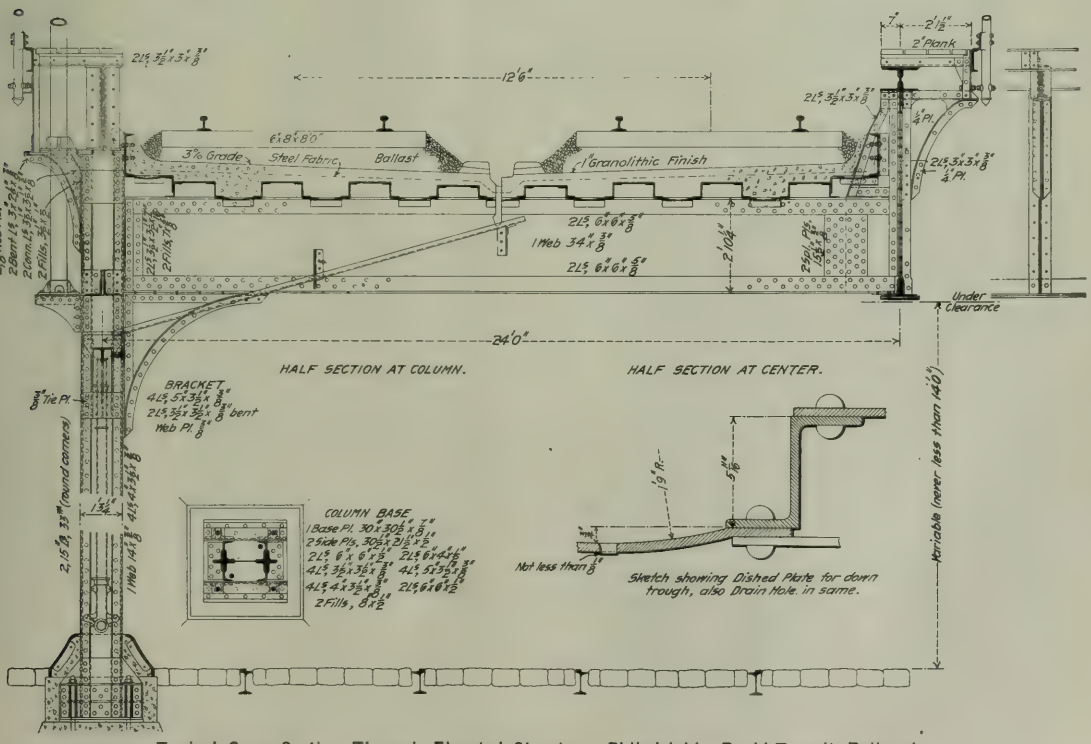
The specifications covering the painting of the steel work contain a number of novel clauses. They are reprinted here almost in full.

The paint to be used on the structure, both at the shops and in the field, shall be as designated by the chief engineer.

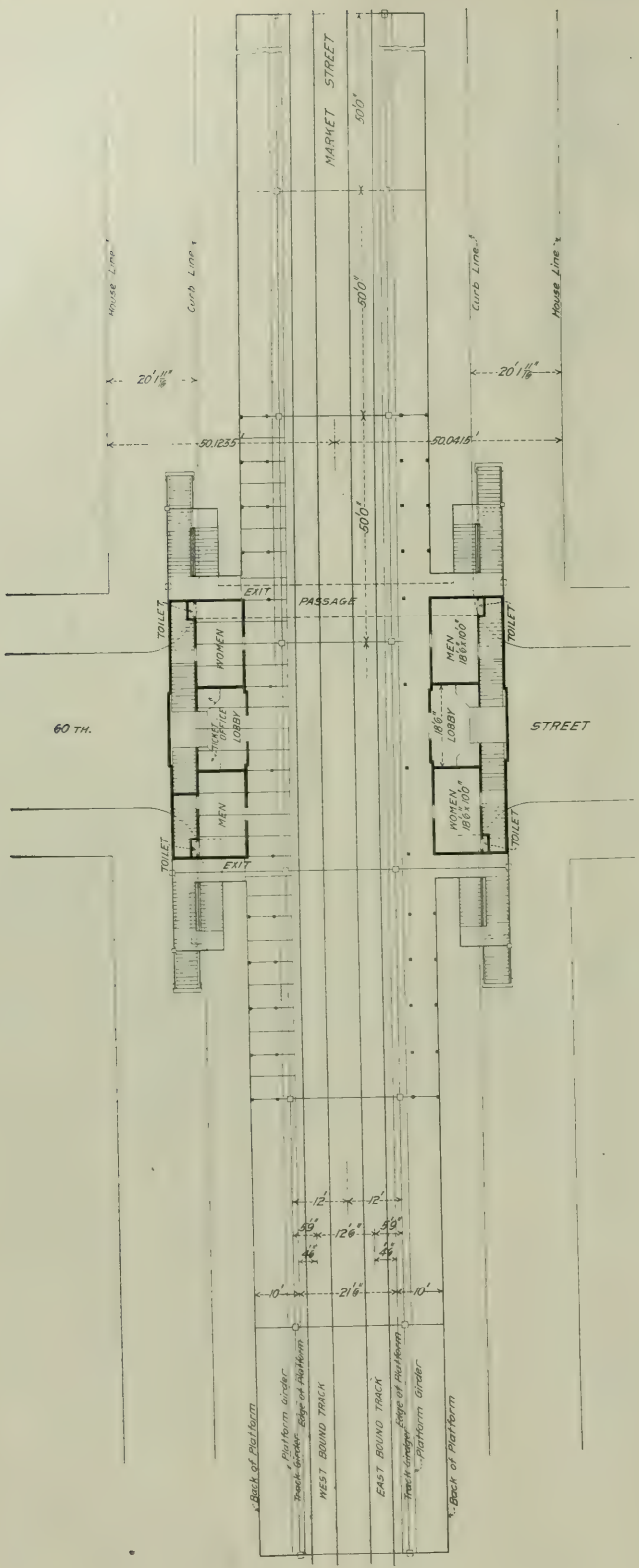
It is to be understood that the requirements for workmanship for the painting at the shops and in the field, will be strictly enforced, and the contractor shall give such detailed instructions as

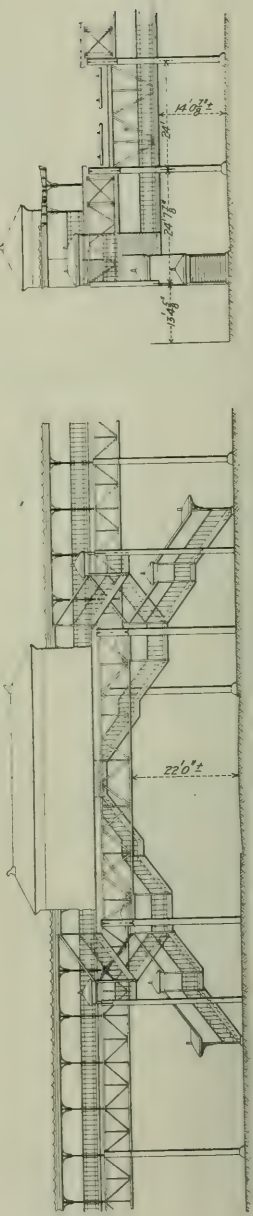


Elevation of Typical Longitudinal Lattice Truss.



Typical Cross Section Through Elevated Structure, Philadelphia Rapid Transit Railroad.





Plan and Elevations of Typical Elevated Railroad Station at 60th and Market Streets.

are required to facilitate procuring the high grade of work prescribed. The prohibition of painting during wet weather on wet surfaces, and during freezing weather, may entail protracted periods after erection, during which painting will be suspended. The contractor is hereby required to take cognizance of such probable delays and make all necessary allowances therefor.

When the general painting is suspended, field rivet heads, the heads of nuts or bolts, or any parts of the structure, where the paint may have become abraded or damaged, during erection or during transit, shall be touched up to cover, so that none of the structure shall become rusty. In all cases where painting is resumed after suspension, all rust which may have accumulated, shall be thoroughly cleaned off before any paint is applied.

Proprietary paints shall be brought to the shop and site in the original packages, unopened, and shall not be adulterated by the addition of any substance whatever. Should any thinning be necessary, it shall only be done with materials supplied, or approved by the manufacturers of the respective paints, and shall be used in accordance with their directions. The packages shall not be opened or used until they have passed examination and been marked by the inspector.

Material received at the shops, and which is not immediately used, shall be protected from rusting. In the case of plates they may be piled, the top and bottom plates and the edges of all the plates to be oiled with pure raw linseed oil.

Before leaving the shop the work shall be thoroughly cleaned from dirt, loose scale, rust, machine oil or other adhering substances by the use of steel brushes, steel scrapers, sandpaper, and other tools or appliances, as may be necessary to thoroughly clean the surface, said cleaning to closely precede the painting, and be subject to the approval of the inspector.

After cleaning, the work shall receive one thorough coat of the prescribed paint, thoroughly applied and well brushed out by skilled workmen, medium sized, round bristle brushes to be used, and the work subject to the oversight and approval of the inspector.

The painting shall be done under cover, and no painting shall be done after loading on cars, nor when the work is exposed to freezing weather, nor unless the metal is perfectly dry.

All surfaces of metal work which are bolted or riveted together to remain permanently in contact, shall receive one thorough coat of paint before being put together. After the shop coat is applied, the metal shall be protected from the weather until the paint is dry.

No metal shall be shipped until the inspector has pronounced the paint sufficiently dry, and care shall be exercised in handling or temporary storing to keep wet paint free from dirt, and in handling and loading, to keep painted surfaces from contact, by using proper packing pieces between them.

After erection all metal shall receive two coats of paint, to be designated by the chief engineer, each coat to be of different tint, so as to be readily distinguishable. Surfaces that will be inaccessible after erection shall be painted before being placed in position. Care shall be taken to work the paint into all crevices, corners, etc. All recesses which would retain water or through which water could enter must be filled with Iron Bark cement manufactured by Edward Smith & Co., of New York, before receiving the final painting. Certain apertures shall be filled with Portland cement mortar, covered with the said compound, as shown in the drawings. The Iron Bark cement shall be heated in a suitable vessel, and poured by means of a spout into the apertures, and shall not be smeared or spilled over the work. All surfaces so close together as to prevent the insertion of paint brushes must be painted thoroughly by using a piece of cloth instead of a brush.

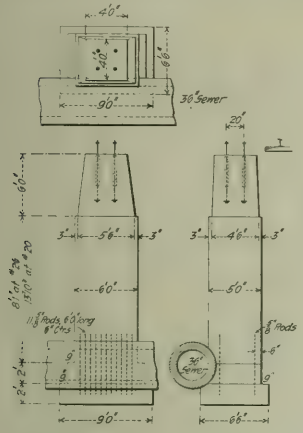
Before any field painting is done, the work shall be thoroughly cleaned in advance of the application of any field paint.

The heads of rivets driven in the field, and the heads and nuts of all bolts shall receive a coat of paint in advance of the two general coats after thorough cleaning.

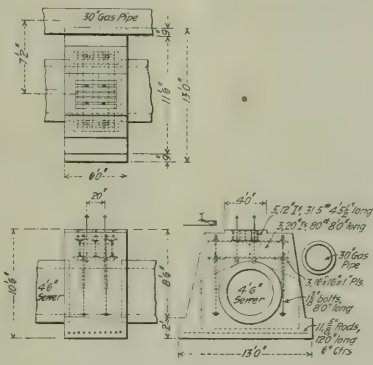
All of the shop painting which may receive damage during transit or erection shall be properly cleaned and painted in advance of the application of the two general coats. Under no circumstances shall any of the painting be done in wet weather or over any wet surfaces, nor during freezing weather.

All work damaged during or after painting shall be repainted with the same precautions as are required in the specifications for the original work.

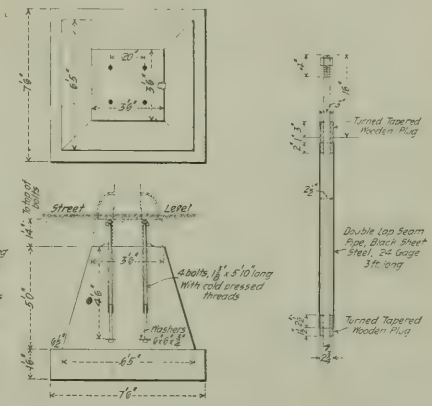
The eight stations on the elevated line are all essentially alike, and the drawings herewith of the station at 60th street show the principal dimensions and arrangement. Wherever possible the grades on the elevated structure on each side of the station have been adjusted so as to provide an accelerating and retarding grade at the station for both eastbound and westbound trains. In order to preserve the minimum head room of 14 ft. under the floor of the cross-passages the platforms are necessarily raised higher than the level of the larger part of the structure. The longitudinal trusses under the stations have been made deeper therefore, in some cases having a depth of 20 ft. This has been done to give additional stiffness and strength to the structure at the point of greatest strain due to the stopping and starting of trains. Where the deep trusses are used, latticed floor-beams have been substituted for the standard 34-in. plate girders to give additional transverse stiffness.



Deep Foundation Over 36-in. Sewer.



Foundation with I-Beam Grillage Over 54-in. Sewer.



Standard Foundation and Detail of Anchor Bolt Casing.

The general arrangement of the stations at the track level, the stairways and cross-passages are shown in drawings. The platforms are 350 ft. long and 10 ft. wide, and will accommodate seven-car trains. Each platform has two stairways leading to the street. The entrance to the stairways is from the sidewalk of Market street and the first two flights lead to a landing at the level of the cross-passages. The stairway directly ahead leads to the ticket office on the level of the platform and the other stairway is for the exit of passengers. The two entrance stairways open into the central lobby of the station building and at the top are flanked by ticket offices. On the right of this lobby is a men's waiting room 18 ft. 6 in. x 10 ft., with toilet room opening off, and on the left is a similar room for women. The platforms are covered with an inverted V roof shed for their entire length, the roof being supported by two rows of columns as shown in the cross-section.

The station building is supported on a deep longitudinal lattice girder resting on two columns 62 ft. 9¼ in. apart, center to center, 24 ft. out from the main columns of the elevated structure. Lattice floor-beams connect this longitudinal girder with the track girders. The platforms beyond the station building are carried on separate girders supported on brackets riveted to the outside of the main columns to avoid vibration.

The foundations for the columns of the elevated structure presented many varied and difficult problems. West Market street, like most city streets, is underlaid with a network of conduits, sewers, gas and water pipes, and where these interfered with placing the foundations it would have been a tedious and expensive job to take them up and relocate them elsewhere in the street. There were encountered, also, many different kinds of subsoil, some of which made unstable bearings for foundations. The problem was very carefully worked out from data secured from a number of sources before actual work was begun in placing any concrete. For

a number of years the Board of Highway Supervisors of Philadelphia has been gathering data and carefully mapping the location of the sub-surface structures under the city streets, and this data was of great value in designing the foundations. The company also excavated in places and took numerous borings to ascertain the nature of the soil under the pavement and the location of obscure pipes, etc. Three examples of standard and special foundations are shown in the accompanying drawings. The standard foundation shown is for good bearing ground holding about 2½ tons per square foot. It is built of concrete with a square base 7 ft. 6 in. x 7 ft. 6 in. The top is 3 ft. 6 in. x 3 ft. 6 in., and is about 20 in. below the surface of the pavement. Four anchor bolts 1⅛ in. in diameter are bedded in the concrete 20 in. center to center in each direction. At the bottoms of the bolts 6-in. x 6-in. x ¾-in. washers are placed above the nuts. To provide for slight inaccuracies in the location of the bolts they are encased for the upper 3 ft. of their length by 2½-in. double lap seam pipe. The bottom of the pipe is closed with tapered wooden plug and the top is closed with a similar plug which can be removed when the column bases are placed and the pipe filled with cement mortar.

One of the drawings shows a deep foundation built around a 36-in. sewer which was under the row of columns. The footing is carried below the bottom of the sewer and the shaft is built up around the side of it with reinforcing rods to compensate for the eccentric loading. The upper portion of the foundation is very similar to the standard design.

Still another method of building a foundation over a 54-in. sewer directly under the center of the columns and quite close to the surface is shown in the third drawing. In this case the sewer was completely surrounded with concrete walls. A double grillage of I-beams was used to transmit the load from the center to the side walls and thence to the footing below.

The proportions of the concrete used for the foundations were 100 lbs. of Portland cement, 3 cu. ft. of fine gravel, coarse sand or stone grit, and 6 cu. ft. of crushed stone. It was mostly machine mixed and placed fairly wet. The tops of the piers were all trowelled to a smooth surface for a bearing for the column bases. Work on the foundations was begun early this year and is now practically completed. As each pier was finished it was back filled and the street pavement replaced so that traffic has not been greatly disturbed. As the erection of the steelwork progresses the foundations will be uncovered only far enough ahead so as not to delay the placing of the columns. When the columns are placed and bolted down with the anchor bolts, the bases will be surrounded with concrete and the cast-iron fenders put on. These are made with openings in the top so that they may be filled with cement mortar after being adjusted to their proper position.

The rolling stock for the Philadelphia Elevated will be very similar to the latest design on the Boston Elevated. The cars will have side doors and wide end platforms with the end bulkhead of the car omitted. The Sprague-General Electric system of multiple-unit control with automatic accelerator will be used. No provision has been made for an express service; all trains will be run as locals, making all stops at stations.

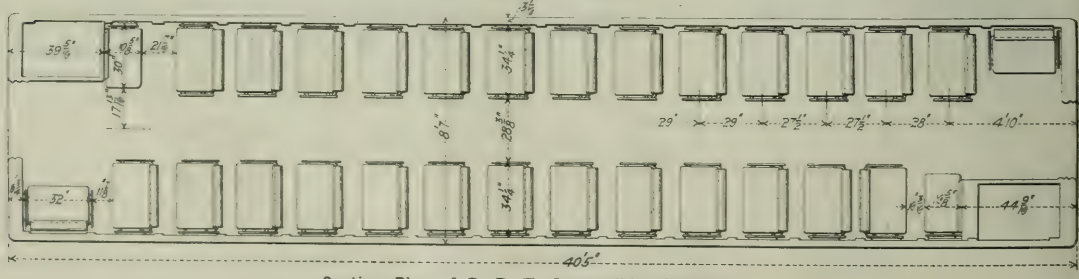
The American Bridge Company has the contract for the fabrication and erection of the steel work, and some of the material is now being shipped but as yet none has been erected.

For the information contained in this article as well as in the previous article on the Subway section we are indebted to Mr. William S. Twining, Chief Engineer of the Philadelphia Rapid Transit Company, and to Mr. Charles M. Mills, Principal Assistant Engineer in charge.

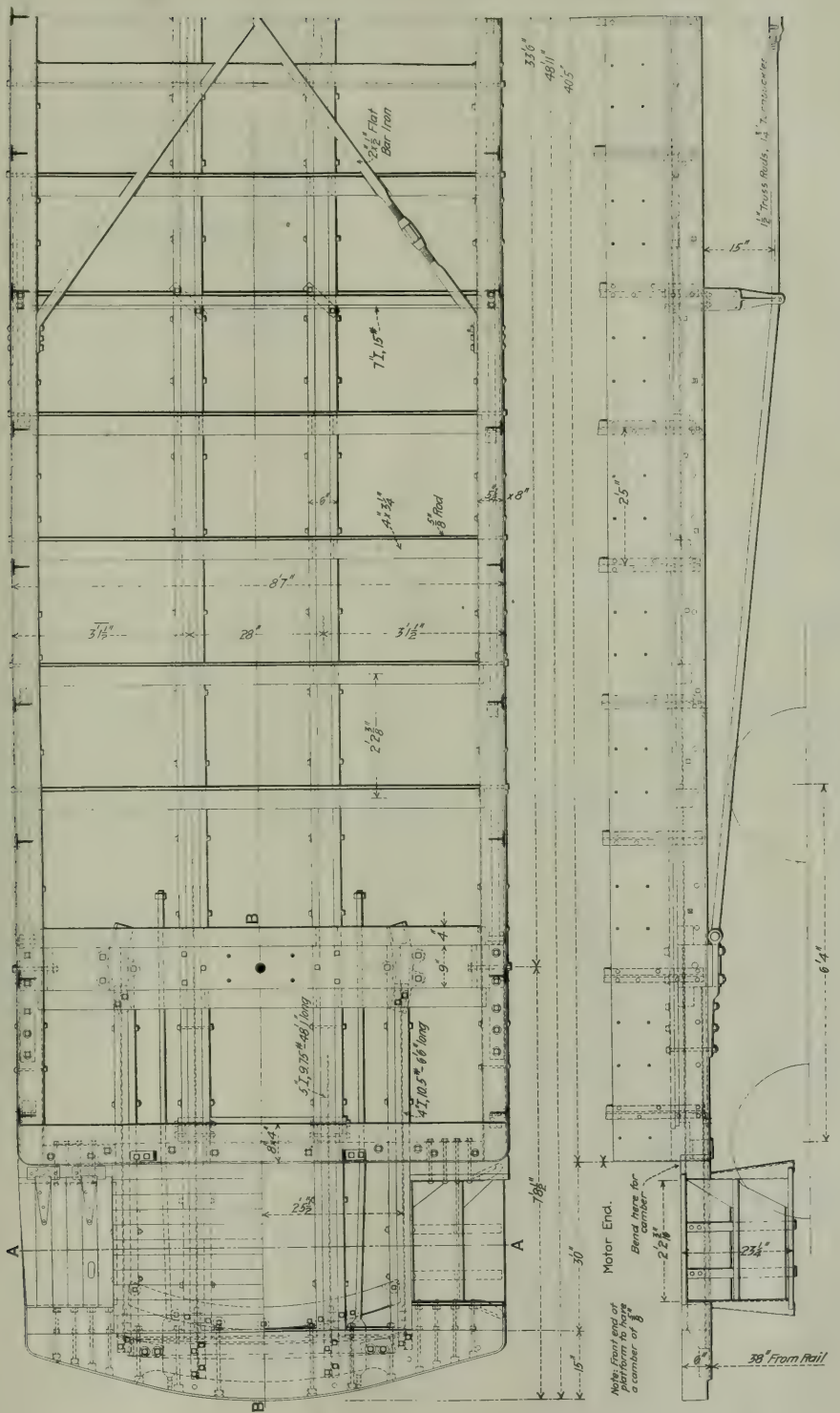
Convertible Electric Motor Cars—Brooklyn Heights Railroad.

The Brooklyn Heights Railroad Company will shortly put in service 100 of its 1905-type convertible electric motor cars. The order for these cars was divided as follows: The Cincinnati Car Co., Cincinnati, Ohio, 50; the Jewett Car Co., Newark, Ohio, 25, and the Laconia Car Works, Boston, Mass., 25. These cars are some-

Half-Cross Section B. R. T. Convertible Motor Car.



Seating Plan of B. R. T. Convertible Motor Car.

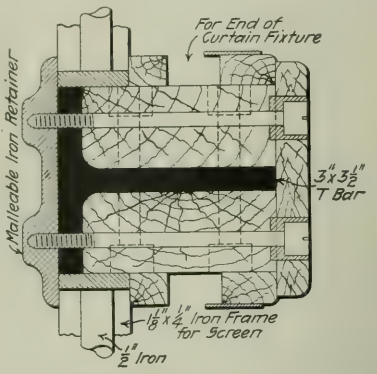


Bottom Framing Plan—B. R. T. Convertible "L" Motor Car.

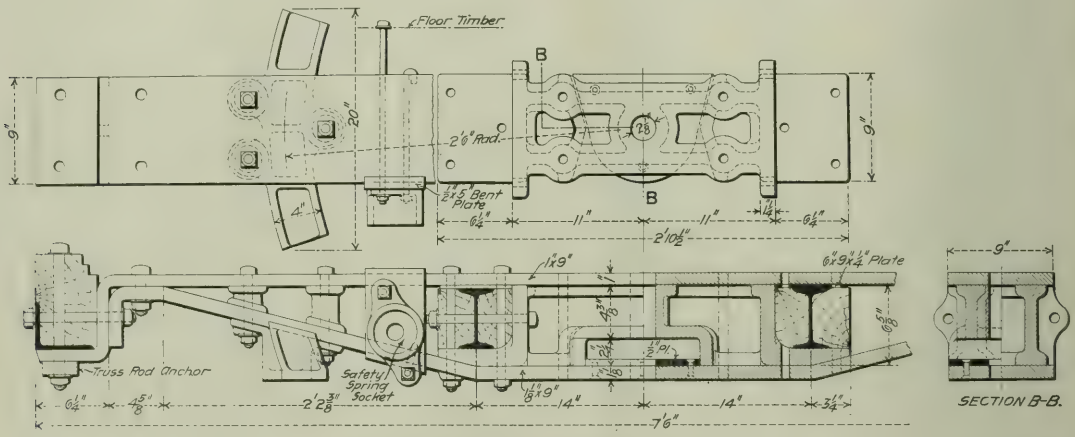
what similar to the open cars which the Brooklyn Heights Railroad Co. designed in 1903, and which were described in the *Railroad Gazette* July 3, 1903. It is claimed that this 1905 type is more nearly a convertible car and will meet the conditions in winter as well as in summer to better advantage than the 1903 type. The new cars have center aisles and are provided with comfortable, spring rattan-covered cushion, cross-seats; are well ventilated with the company's standard type of monitor roof, are well lighted, and all details as to strength and stability, as well as comfort of passengers, have been carefully worked out. They are built with steel underframes sheathed with wood filling pieces.

The center sills are 5-in. I beams with wood fillers and extend to the platform and sill. The two side sills are of 4-in. x 5-in. x ⅜-in. angles and extend only to the car body and sill. In addition to the center and side sills a steel side plate 20 in. x 3/16 in., which extends the entire length of the car body, is bolted to the side sills. Yellow pine floor beams 3¼ in. x 4 in. spaced at about 2 ft. 3 in. centers are supported at each end on angles riveted inside of the side sills. The bottom frame is strongly braced diagonally by 2-in. x ½-in. flat iron bars. These bars are tightened by sleve nuts secured to their ends, as shown in the illustration. The side posts are of 3-in. x 3½-in. steel T bars, and are spaced 29 in. apart center to center. The 3-in. sides of these posts are securely riveted to the bottom side plate of the bottom framing and to the angle along the top of the body plate. The bolster is made as shown in the detail illustration and is provided with a cast-steel center casting and cast-steel side bearings. The safety chain is connected to a safety chain rod which passes through the bolster and to the end of the rod is secured a 3½-in. x 6-in. coil spring which rests in the safety spring socket which is secured to the bolster as shown.

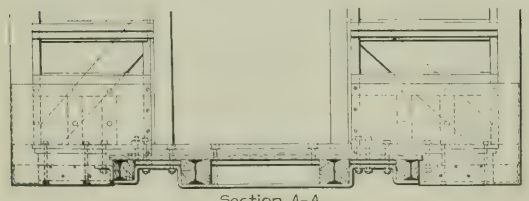
The roof is of the monitor type; it is of tongued and grooved white wood and is covered with a single piece of No. 6 cotton duck. The roof framing is made up of steel and wooden carlines. There

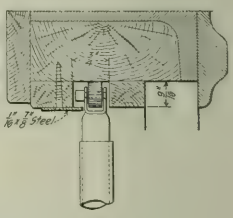


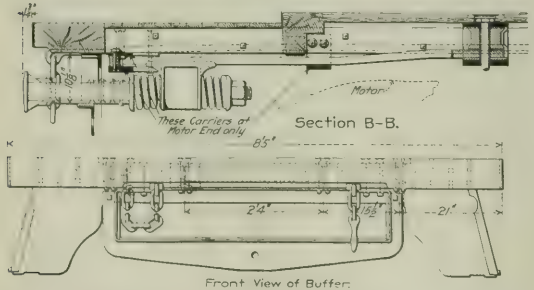
Detail of Window Posts.



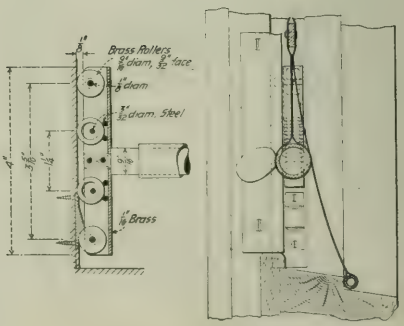
Details of Bolster—Convertible Motor Car.







Section Through Bottom Floor Framing—B. R. T. Convertible Motor Car.



Detail of Curtain Fixture.

is a copper gutter over the front and at each side of each hood and over each motorman's cab window to prevent water from dropping off the roof on the cab windows or on passengers going from car to car. The floor is of Southern pine, 1¼ in. thick, tongued and grooved and laid longitudinally with two trap doors at the motor end of the car. The false floor is of 3½-in. x ¾-in. square-edge maple. The under side of this floor is protected by a layer of transite ¼ in. thick.

The platforms are supported on the two 5-in. I-beam center sills which extend to the outer edge of the platform end sills, and by two platform sills, each formed of one 4-in. I-beam, with wood filler, running from the platform end sill to the bolster. The platform end sill is of white oak 14½ in. wide x 6 in. thick. The platform flooring is of comb-grained Southern pine 1 in. thick x 3½ in. wide, with square edges. Steps at each side of each platform and trap doors covering the steps, with a rubber bumper on the car body and a brass catch to hold the trap doors up are provided. Each platform is equipped with two Pitt gates and one of the company's standard lattice safety gates.

For summer service the sides of the cars are left entirely open except for the side posts and the movable side screen frames. These frames consist of a ¼-in. x 1⅛-in. wrought iron frame 25 in. wide by 3 ft. 8 in. high, having six ½-in. iron rods placed horizontally at about 7 in. centers. In winter these frames are taken out and replaced by side sashes. The side sashes, as well as the side screens, are held in place by malleable iron retainers secured to the side post by bolts, as shown in the detailed illustration. In winter ample ventilation is secured by the side and end ventilators.

The inside finish of the car is of cherry in natural color and the headlining is of three-ply hard wood aggregating about ¼ in. in thickness. The side curtains are all equipped with a specially designed curtain fixture, a detailed drawing of which is shown. The projecting lug and the retaining strip make it impossible for a passenger to dislodge the bottom part of the fixture from its runners.

The total seating capacity of each car is 60 and each car is equipped with two special B. R. T. car heaters, one on either side the motorman's cab, and 24 Consolidated No. 192 single coil heaters. The cars will be lighted by 25, 16-c.p. lamps. There are seven lights in the clerestory and seven beneath the lower deck, as well as four on the two platforms. These latter are controlled by switches, so that they can be thrown to the marker lights, or the markers cut out and the platforms lighted. Peckham No. 40 motor trucks are used under the cars, this type having been adopted some time ago as standard on the Brooklyn elevated lines. The motors are of the Westinghouse 50-L type of 150 h.p. each. Two motors are used. Both are mounted upon one truck at one end of each car, thus making two driving axles per car and on the same truck. The Westinghouse electro-pneumatic, multiple-unit control is used. The air brake equipment consists of the regular standard New York 10-in. cylinders with quick action triple valve and special "Brooklyn Heights" motorman's valve and Westinghouse Traction Brake Company's No. D—2 E G compressors and governors.

Some of the general dimensions of the car are as follows:

Length	over platforms	48 ft. 11 in.
"	over end sheathing	40 " 5 "
"	between centers of trucks	33 " 6 "
"	from center of truck to end of platform	7 " 8½ "
"	from end of body to end of platform	4 " 3 "
Width	over sills (about)	8 " 6 "
"	over sheathing	8 " 7 "
"	over drip rails	8 " 9½ "
Height,	bottom of sill to top of rail	2 " 2½ "
"	rail to bottom of sill	3 " 1½ "
"	rail to top of roof	12 " 4 "
Truck,	wheel base	6 " 4 "
"	total wheel base	39 " 10 "
"	diameter of wheels	33 "

The cars were designed by the railroad company, and we are indebted to its Mechanical Engineer, Mr. R. C. Taylor, for the drawings and information.

The Cost of Locomotive Operation.

X.

BY GEORGE R. HENDERSON.

(*Continued from page* 134.)

WASTE.

This is the smallest item of those accounts regularly kept by railroads; in fact, it is so insignificant that it is now usually classed under the general head, "lubrication" or "oil and waste." Notwithstanding, it is a subject of considerable importance in its proper application and use, as the liability of hot boxes and consequent train delays depends very materially upon the kind of waste used and the method employed in packing the cellars. Very often a freshly packed box will not run as cool as one that has been running for several days, and a good rule is to leave it alone until it shows signs of heating. The proper amount of inspection to determine that the waste is sufficiently oily and that it is in contact with the journal is, of course, perfectly proper, but if the packing is in good shape it had better not be disturbed. The driving boxes of a high-speed locomotive are extremely sensitive, and while some will run for months without giving any trouble, others cause annoyance continuously. This is ordinarily due to some defect in material or finish, but it is often very hard to remedy.

Quality.—There are nearly as many kinds of waste as lubricants, and they are sold at as many prices. Ordinary cotton waste is perhaps the cheapest, costing 3 or 4 cents a pound. Wool waste is more expensive by 50 or 100 per cent., and there are places where one will not answer for the other. For instance, wool waste should be used in driving box cellars, as its elasticity keeps it against the journal, where ordinary cotton waste lies "soggy" in the bottom. Steel wires are sometimes mixed with waste to give it life, and help to maintain it in contact with the journal; in other cases hair is used, also asbestos fibres. Certain patented packings cost as much as 12 cents a pound, and may or may not be worth the price, depending upon the general results obtained.

Wool waste is not suitable for the tops of driving and truck boxes, where cotton waste, on account of its "deadness," lies on the box and prevents the dust and dirt penetrating to the bearing, while not interfering with the application of oil, as it holds it and permits it to percolate through the waste to the cavities, and so to the bearing. Where grease is used, however, waste is not needed, as the former has ample body, and it is held against the revolving parts by pressure, either by a screw plug, as in rod cups, or by springs when used in driving boxes.

Waste used in cellars and journal boxes should be thoroughly soaked in oil and the surplus allowed to drain off before it is used as packing, and the proper knives, etc., are needed to apply it to the journal. This is fully as important as the question of quality, and the service obtained depends upon the faithful performance of this work.

Waste used for wiping parts of engines may be the cheapest kind of cotton waste—in some places rags are used for this purpose, and probably quite as satisfactorily, as nearly any soft material will answer for this work.

Quantity.—After the boxes have been properly packed the amount required for regular maintenance is small, and the best way is probably to include it, as far as cost is concerned, under the general head of "oil and waste." From a report of the Chicago & North-Western Railway, rendered when the oil and waste were charged separately, the cost varied on different divisions from 1-10 to ¼ that of oil, the average for the whole road being 1-7; that is, where the oil cost $2.10 per 1,000 engine-miles, the waste amounted only to 30 cents for the same distance. The oil and waste should ordinarily vary proportionately for engines of different size, so that if we take the waste at one-seventh of the cost of oil, we cannot be very far from the truth. With grease so little waste would be needed that it may be omitted. We should then obtain the total cost of oil and waste per 1,000 engine-miles approximately as below:

Engine.	Service.	Cyl. diam.	With waste.	With grease.
Simple.	Passenger	17 or 18 in.	$1.50	$0.85
"	Freight	17 " 18 "	1.88	1.12
"	Passenger	19 " 20 "	1.90	1.08
"	Freight	19 " 20 "	2.36	1.41
"	Passenger	21 " 22 "	2.54	1.45
"	Freight	21 " 22 "	3.06	1.84
Compound.	Passenger	16 and 26 "	2.08	1.18
"	Freight	16 " 26 "	2.50	1.49
"	Passenger	17 " 28 "	2.54	1.45
"	Freight	17 " 28 "	3.06	1.84

These figures compare tolerably well with practice. In November, 1899, the average cost of oil and waste per thousand miles was $2.40 on the Chicago & North-Western, no engines having larger than 20-inch cylinders. In February, 1903, the Lake Shore averaged $2.90 for freight and $3.20 for passenger engines. This road has some very powerful passenger locomotives, and that these have put up the cost is evident from the fact that the year previous the same item amounted only to $2.70. For the years 1901 and 1902 the Santa Fe figures were $2.29 and $2.40, all classes of service averaged, a number of heavier locomotives having been added during this time.

While the cost of lubrication naturally increases with the size of the engine, it must be remembered that more work is done, and when reduced to a ton-mile basis, upon which profits are figured, the results may look very different. Thus for a main line and a branch division of the Santa Fe during January, 1903, with average tons back of engine of 702 and 416, respectively, the cost of oil and waste per 1,000 engine-miles was $2.80 and $2.40, but the cost per 1,000 ton-miles was .40 and .58 cents. Here we find an increase of the main line over the branch engines of 16 per cent. *per engine-mile*, but a decrease of 30 per cent. *per ton-mile*, which is certainly the most accurate basis of comparison of the two.

As above stated, we cannot take these figures for oil and waste as accurate for any particular road, as there is always a great variation between the highest and lowest figures; but in estimating the comparative cost of operation of various sizes of locomotives they should represent the facts close enough for general purposes. If the cost or quality of the oil is different from what we have assumed, the final figures would need adjustment, but most roads are now using the same kind of oil on locomotive equipment through-

out the country, so that there should be little need of modification in the values given.

Many roads keep an account of the cost of lubrication by individual enginemen, and if one is extravagant he is asked to explain the reason. A new box, or refitted rod, is often a cause for increase in lubrication, but it should average up for the same service in one or two months.

TOOLS.

The tools usually supplied to locomotives include not only hammer, wrenches and chisels, but the various assortment of oil cans, lanterns, signals, scoops, firing bars, torches, etc. While not strictly tools, they are included under this general designation. After the engine is once equipped, the cost of maintenance should be very small indeed, but in reality it is often quite large, and the amount does not bear any relation to the size of the engine, but rather to the disposition of the men upon the engine.

It is important, in the first place, that the tools should be made of the proper material. Perhaps the greatest wear comes upon the scoop or coal shovel. Some roads have specifications for these scoops, defining the weight, size and quality of material to be used, actually designating the chemical composition of the steel of which the scoop is made, and the method of riveting it to the handle. While these scoops do not cost very much, on account of the large number used, it is important to see that they are not maltreated. For this reason it is customary, when a fireman needs a new one, to make him bring in the old one as evidence that it has not been ruthlessly destroyed. Before this was done, it was quite common for the shovels to disappear altogether—they would either go into the firebox (of course, accidentally!) or land in the ditch alongside of the track. The oil cans are apt to be very short lived, unless made of heavy material. One and two-gallon tin supply cans are of little service, as the necks get broken off and the sides knocked in with very short service. This can be improved by the use of sheet steel cans, which are now placed upon the market. Sometimes torches are given out at a surprising rate. The writer recollects one case where the company had adopted a new pattern, which took the fancy of the men so quickly that the old models were thrown into the ditch or broken intentionally, so that the new style might be obtained.

Marker lamps are often damaged by being used as a foot-step in reaching the headlight, and it seems like a business proposition to make everything about a locomotive strong enough for a man to stand upon.

One road furnished each locomotive with expensive traversing jacks, that is, a screw jack mounted on a base upon which it could be moved by means of a screw and ratchet. They were so seldom used that they were generally rusty and inoperative, and cost a considerable sum to put them in order at frequent intervals.

The small tools should be kept locked up in metal boxes upon the tender, or turned in after each trip to the care of an attendant. Some roads check up the tools turned in after each trip, and if any are short or broken hold the engineer to account for same. This encourages care on the part of the engineman, and reduces materially the cost of such supplies, but on the other hand, it means an outlay for the wages of such inspectors. Where engines are assigned to one or two crews, there is generally little trouble about loss of tools, unless they are actually stolen from the box. This is not an uncommon feature. An official of the Pennsylvania, while traveling in Ireland, is said to have met a man one night carrying a lantern on which were moulded the letters P. R. R., indicating that the bearer was a "Pretty Rough Rascal" in actuality.

Where pooling exists, it is very necessary to keep strict watch over the engine tools, as they will be distributed about the road regardless, and engines will go out without the proper equipment, and in case of trouble much delay and inconvenience will ensue.

As may be surmised from the foregoing, it would be impossible to give a figure for the maintenance of locomotive tools that would have anything like a general application. It will vary more with the section of the country and the type of men employed than with the size or style of the engine. When the men are naturally careful, the cost should be insignificant. Where they are unruly and careless, the figures may run quite high. One road kept account of the supplies furnished to the individual enginemen, and prepared a statement each month, giving the expense in this line by each man. In those cases where the withdrawals seemed excessive or above the average he was asked to explain and improve his methods. It is only by constant surveillance that these costs can be kept down to a reasonable figure, and this requires eternal vigilance.

As it is customary to include tools and miscellaneous supplies under one head in the accounts of railroads, the actual cost to be allowed will be worked up together with the items included under the next heading.

MISCELLANEOUS.

The miscellaneous supplies ordinarily include the various tools which we have just discussed, and other movable articles which usualy go with the locomotive, such as lampblack, packing material, sand, soap, switch keys, metal polish, torpedoes, etc.; in fact, it generally covers all the articles except fuel, water and lubricants. In the monthly statements of locomotive expenses gotten out by many roads, water is often excluded altogether, and does not appear in such statistics, probably being charged to a water supply account, although it properly is a locomotive operating charge just as much as coal or oil, but it is probably never charged individually, as no means are provided to ascertain how much is used by any engine or class of service. As with tools, these supplies of a miscellaneous character bear little ratio to the size of the engine, but more to the diligence of the men.

The cost of "tools and supplies" is sometimes stated in two ways—the cost per "turn" or per "engine handled," which means the number of times that engines come into the roundhouse, practically the number of trips made, and the cost per engine-mile or ton-mile. If we were seeking a strict basis for comparison, we would probably find that a combination of the ton-miles made and the number of trips completed would be required for our foundation, as they both affect the cost, so ordinarily a long run or division would be expected to cost more per turn and less per *ton-mile* than a short one. This is apparently borne out by comparing two contiguous divisions of the Chicago & North-Western, where the freight traffic is nearly the same, but one division having much longer runs than the other. For a number of months we find that the charge, "tools and supplies," is smaller per *ton-mile* for the division with the long runs than for that with the shorter runs. The figures are as follows, in cents per 1,000 ton-miles:

	Per 1,000 ton-miles.						
Short runs	$0.0027	$0.0034	$0.0025	$0.0026	$0.0019	$0.0027	$0.0020
Long runs	.0021	.0025	.0022	.0022	.0015	.0019	.0017

The tonnage per engine-mile was not greatly different on the two divisions, but it was somewhat in favor of the short run section, *which had the highest costs.*

In the *Railroad Gazette*, February 19, 1904, appeared an article by C. H. Fry on costs of locomotives at terminals, and from this we find that the supplies are given for one road at one cent an engine turned. As these figures are the same throughout the turn included, they excite some suspicion, especially as very little can be put upon an engine for this amount. This is more than likely the cost of labor connected with sanding engines, etc., rather than the cost of supplies themselves. By figuring over several statements it seems as if an average would be in the neighborhood of 20 cents per trip for tools and supplies.

Coming now to the cost on a mileage basis, comparison of a number of statements from both Eastern and Western roads reveals a variation of from .13 to .34 cents per engine-mile, with the average between .20 and .21 cents. But half of these various costs lie within 10 per cent. variation from .20 cents, so that if we consider one-fifth of a cent per engine-mile as the cost of "tools and supplies," we are not likely to be far from the truth, although individual cases may vary considerably. If we consider that a locomotive comes into the roundhouse once a day on the average, and makes 3,000 miles a month, or 100 miles a day (which is not far from the ordinary conditions in this country), we should have $\frac{100}{5} = 20$ cents per trip, which checks with our former assumption.

Besides the regular miscellaneous articles there are others which may or may not add to the expense of operation. Oil burning headlights are very cheap to operate, but if we want a better illumination we must go to acetylene or electricity. The cost of operating these lights per hour seems to run about as follows:

Oil	$\frac{1}{4}$ cent per hour.
Acetylene	$1\frac{1}{2}$ " "
Electricity	$2\frac{1}{2}$ cents " "

The latter, when run by a small dynamo, as is generally the case, exerts its influence on the coal pile, and with fuel costing $1.50 per ton, the expense will be about as given above. While this is the most expensive as far as actual cost of operation is concerned, the illumination is immensely greater, being estimated at from 50 to 100 times that of oil; for equal quantities of light, therefore, it is much the cheaper, considering illumination. There are one or two disadvantages connected with the use of the electric headlight, however, and one is, if for any reason it is inoperative, the darkness seems much more intense, as the previous illumination was so great. If the apparatus is carefully installed and maintained, there need be little of this trouble, and for passenger locomotives there is no doubt that it is the most desirable light. On double-track roads it occasions certain discomforts to engineers of opposing trains, and it is very difficult to judge the distance of an approaching train, the light being so intense.

In warm climates the acetyline light is quite satisfactory, but in the north it is subject to a certain amount of trouble from freezing. The illumination is much better than with the oil lamp, but, of course, it cannot approach the electric arc.

Steam heat applied to the cars of a passenger train and supplied by the locomotive is another item of additional cost, though quite small. In some tests made by the Gold Car Heating & Light-

ng Co. on the Northern Pacific Railroad in extremely cold weather, y catching the drips from the cars, it was found that 62 pounds of ater per car per hour were obtained; ordinarily it would not aver- ge over 50 pounds, so that if we assume ten pounds of coal burned n the engine per car per hour, in addition to the regular amount eeded for moving the train, we will be on the safe side. With 10- ar trains this would be only 100 pounds per hour, and while it hould not be noticeable to the enginemen, it exists and must be rovided for. Of course, if there are leaks in the train pipe, as ometimes occur, especially at the couplings, the amount will be ncreased.

Electric lighting of trains, whether the current is generated by steam engine and dynamo in the baggage car, or whether the enerators are driven by the axles of the cars, places an increased oal consumption upon the engine. The Northwestern Limited rains between Chicago and St. Paul were lighted by the former ethod, the current in use during the evening representing about 15 ilowatts, or 20 horse-power. If each car is lighted with 600 candle- ower, there will be about 2,400 watts required, or, say, 3 horse- ower per car, and this will represent in round numbers about 15 ounds of coal per car per hour. Of course, this figure will vary, ut this is perhaps an average condition.

Under certain conditons there may be other items to which we ave not specifically referred, but while they cause some increase n the cost of operation, it is not, as a rule, large. These figures do ot include repairs or maintenance of any of these special appli- nces, but merely the amount of supplies necessary to operate them. reight trains ordinarily contribute few extra drafts upon the lo- omotive, unless it be in the matter of leaky air-brake pipes, which as been referred to previously.

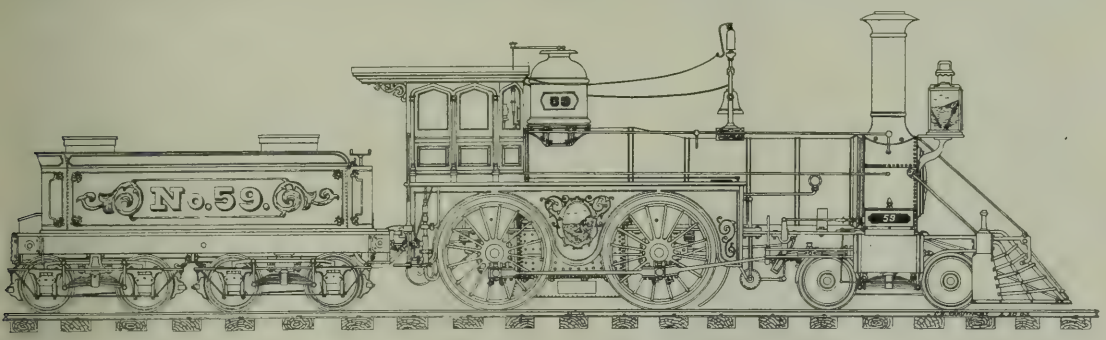
There will be an extra amount of water used to correspond ith this the coal consumption noted, but the value of this is so light that it would be a useless refinement to consider it for our urpose.

(To be continued.)

A Handsome Passenger Locomotive of 1861.

BY C. H. CARUTHERS.

The exigencies of the Civil War early made serious inroads pon the efficiency of the rolling stock and motive power of many f the northern railroads. None of the companies realized this to greater degree than the Pennsylvania, and that corporation soon



Rebuilt Pennsylvania Passenger Locomotive Monongahela, 1861.*

laced large orders with M. W. Baldwin & Co., and orders of larger ize with R. Norris & Son and with the Rogers Locomotive and Machine Works, for larger and more efficient engines than has been sed on its road, and it also began to overhaul the 211 engines in ervice at the beginning of 1861. Forty-nine of these engines were mall, and a number of the 49 were about worn out, but most of he remainder were of a fair size for that period, and justified the xtensive repairs which in some instances almost converted them nto new engines. The prevailing high cost of materials seemed to nerit retaining even a very small part of the engine in rebuilding, f such part were in fair condition.

The drawing shows an engine so rebuilt at that time, partly at Pittsburg and partly at Altoona, which went into service in its new form in December, 1861. It was one of twelve built by R. Norris & Son in 1853 and bore that firm's construction number of 643. Originally it had cylinders 16 inches x 24 inches; driving wheels, 60 inches; and weighed about 57,000 lbs. Its boiler was of flush-top type, its valve-gear was "V" hook type with an independent half-stroke cut-off. The fuel used was wood. The running-boards were protected by stout hand-rails on the outside, and the frames from the front bumper to the first driving-box pedestal were of slab type, about 9 inches high. The driving springs were two in number, one on a side, bracketed at the center to the side of the boiler immediately under the dome, and having the ends connected by adjustable posts to a long equalizer which rested directly over the tops of the boxes.

As rebuilt, only the cylinders, square-bottomed smoke-box, and first three rings of the boiler barrel were retained from the original engine. All else was new. The firebox was made longer and fitted with Gill & Co.'s smoke condensing device, consisting of an iron diaphragm provided with water circulation, and a combustion chamber about 30 inches long placed in the tapering ring which united the boiler barrel to the new roof-sheet of wagon top type. The deflector occupied practically the position of the firebrick arch adopted later. Drivers 66 inches in diameter were used, and frames similar to those used until the recent introduction of those made of cast steel were used with four driver springs, but the equalizers of these were placed between the upper and lower bars, and were pivoted on the lower.

The hook motion gear was replaced by shifting links with an underhung reversing shaft—an arrangement used considerably in those days. The sand boxes were two in number and placed, one on each side of the boiler, behind the wheel covers; and the bell-frame entirely surrounded the bell and had the whistle placed upon its top, one side of the frame being cored out to allow steam to pass from the boiler to the whistle.

This was the first Pennsylvania R. R. engine to have the tallow cups placed in the cab, and the connecting pipes entered the steam supply pipes instead of the top of the steam chest. The cab was elaborately built of black walnut with ash window sash, and was not painted, but was varnished inside and out, thus showing the beautiful grain of the wood to advantage. The "water-works" were wofully defective and during three years of their retention gave frequent trouble. In rebuilding, both of the original pumps had been removed, and were replaced by a single adjustable brass injector of the original Gifford type placed vertically behind the rear driving wheel on the right hand side of the engine.

The straight stack shown had no netting or spark arrestor of any kind, and nine months after the engine came out, was replaced by a semi-balloon type designed by John P. Laird and used by the company on all passenger and many freight engines until 1870. The engine was painted in bright colors; vermilion wheels, center panel of tender, and number plate; peach-blossom wheel covers with landscapes in the centres; and the whole neatly ornamented with striping, arabesques, and lettering in gold leaf. It compared favorably in service with larger and later engines, following closely, as will be noted, modern lines of practice, and was only retired and cut off in 1881, strange to say, retaining the original walnut cab placed on it twenty years before, but of course painted in its later years with the company's standard black. In these later years of its service (from 1868) the sand-boxes were removed from behind the wheel casings and were replaced by a round one of standard type, set on the top of the boiler; the single brass injector was replaced by two Sellers, 1876 type, and the cast-iron steam chest casings with panels containing the number in raised figures were replaced by those of standard type. Three other Norris engines were similarly rebuilt on the same lines as the 59, except that one retained the 60-in. driving wheels in order to make it more efficient in its service as passenger helper on the mountain.

*Originally built by Richard Norris & Son., Philadelphia, in 1853. Cylinders, 16 in. by 24 in.; first drivers, 60 in., after change, 66 in. First P. R. R. engine with tallow cups placed in cab. The pipes from cups entered steam chest through the admission ports and will be noticed just below valve-rod glands. Bell and whistle in one fixture and sandbox under wheel casing. One injector and no pumps.

After finishing the work at Port Belgrano, the new military port in Argentina, which has a dry dock, etc., the Italian engineer, Luigi Luiggi, has returned home, and has been appointed State Councillor for the management of the Italian railroads.

Handling Fast Freight on the Santa Fe.*

About three years ago the Atchison, Topeka & Santa Fe put into general use on its main line trains between Chicago, Galveston, Denver, El Paso, San Francisco and San Diego a system of handling all high-class and special freight, known as the Red Ball system, which had been in use on some parts of that road since 1892. The movement and tracing of freight has been greatly facilitated by the change and the auditor's office relieved of a mass of correspondence relating to car movements and delays. The list of commodities handled under this system includes nearly every class of general merchandise and perishable goods; but unless by special instructions, or in order to fill up trains to the tonnage rating of the locomotive, no dead freight, such as lumber, coal, cotton, wheat or similar classifications, is handled in Red Ball trains.

Certain of the more important stations, about 60 in all, have been designated as Red Ball billing stations. Each of these stations is designated by a letter or letters and is assigned a series of numbers beginning with one and running up to from 20 to 700, depending on the number of loaded cars forwarded, which numbers are used in numbering the envelopes carrying the waybills for cars loaded with Red Ball freight. Each billing station uses its numbers consecutively, commencing with the lowest number; when the highest number in the series assigned has been reached, the serial numbers begin over again with one and this is repeated indefinitely. Each car loaded with Red Ball freight has tacked on the side as a destination card, a card 7 in. x 9 in. with a large red circle printed on it. These cards are tacked on each side of the car. On the red disk is printed in white letters the number of the train in which the car is to travel. On arrival at destination these cards are removed.

Accompanying each car of Red Ball freight and every empty car handled as Red Ball freight is a Red Ball freight envelope 5 in. x 11 in. The front of the envelope is printed with copying ink on red paper. The forms used are substantially the same as those shown for the Canadian Pacific, in the *Railroad Gazette*, Sept. 23, 1904. At the top are blank spaces for filling in an identification of the car and contents and instructions for routing to destination. Below these are blank spaces for inserting the number and symbol of the train in which the car is traveling and also the symbol letter and serial number of the forwarding station. Blanks are also left for recording the weight of the car and for a reference to the regular waybill. At the bottom are printed a few simple instructions to conductors and agents. On the back are blank spaces for entering the record of the car's movement. Each conductor when the car is turned over to him at the forwarding point or at a division point must enter in the space provided, the number of the train and train symbol, station taken from and left at, date and signature. When loaded cars are accompanied by the regular waybills all of the waybills for the car are enclosed in the envelope.

When all of the cars containing Red Ball freight which are to go forward from any station in one train are ready, the envelope covering the car for the nearest destination is given the lowest symbol number and envelopes covering cars for points beyond are given successive symbol numbers in order. For example, Chicago forwards Red Ball freight on a certain train as follows: One car for Joliet, three cars for Pekin, five cars for Galesburg and four cars for Nemo. These envelopes would all bear the Chicago symbol "C. H." and the opening symbol number, which, for example, is 12, would be given to the car for Joliet; 13, 14 and 15 would be given to Pekin; 16, 17, 18, 19 and 20 would be given to Galesburg, and 21, 22, 23 and 24 to Nemo. The opening number for the next envelope of Red Ball freight from Chicago, regardless of destination, would be 25.

Trains carrying Red Ball freight and originating at Chicago, Kansas City, Denver, Galveston, San Diego and Port Richmond are known as symbol trains and bear symbol letters showing the date of departure in addition to the train number. For example, train No. 33 leaving Chicago on the first day of the month carries the symbol 33A, clear through to San Diego, where it arrives nine days later. The same train leaving on the second day of the month is known as 33B and so on for each day. These symbols are used in reporting the trains or cars in the trains and in all tracing.

When a train of Red Ball freight has been made up and sent out from any terminal, the envelopes are all in the hands of the train conductor. The agent at the forwarding point reports to the Superintendent of Transportation all cars sent forward in Red Ball trains, the report giving all symbol letters and numbers. It is known as a "Consist Report" and is made by telegraph immediately after the car has gone forward. All conductors and yardmasters handling Red Ball freight are furnished with a form known as "Set-out Car." In the event of a car being set out of a train of Red Ball freight for any cause this form is made out giving full information about the reasons for the delay. It is a distinctive color and is mucilaged on the back so that it can be pasted on the face of the red envelope accompanying the car. It indicates to every one that the car has been delayed by being set out and must not be set out again except for bad order. When the car is set out between terminals the conductor makes out the report and if set out at a terminal yard the yardmaster makes it out. The report with the envelope attached is left by the conductor or yardmaster with the telegraph operator at the point where the car was set out and he immediately telegraphs in full the information given thereon to the Superintendent of Transportation. If the freight is transferred to another car, the necessary information is entered on the red envelope accompanying the shipment, but no change is made in the original symbol letter and number; this identifies the shipment to its destination.

A form known as "Delayed Cars Forwarded Report" is used by agents and yardmasters to report by wire to the Superintendent of Transportation the forwarding of all cars of Red Ball freight which have been delayed. This form is also used by division yardmasters in reporting the forwarding of such cars delayed for whatever cause when not sent out in the same train of the same date on which they arrive.

As a train of Red Ball freight proceeds over the road it is reported by telegraph to the Superintendent of Transportation from certain stations designated for that purpose. These reports are made out on a form known as a "Passing Report," which shows the train number and symbol, station symbol and serial number of each car in the train, and the time the train passed with any detailed explanations that may be necessary about the cause of delays. When the train or cars in the train arrive at destination the conductor turns over the red envelope containing the waybills to the agent and the agent reports the arrival by symbol letters and numbers. If a car of Red Ball freight is to be delivered to a connecting road or branch line the Red Ball billing is applied only to the junction point, but every effort is made by the agent, trainmaster and superintendent to have the car forwarded from there as nearly on time as possible. Agents report such cars on the "Passing Report" showing time of arrival and departure over the connecting

Red Ball freight in cars loaded at stations between district terminals is forward by local train to the first district terminal and there switched into a solid Red Ball freight train for through transit. Agents at stations not designated as Red Ball billing stations advise the agent at the first Red Ball billing station on the route of the car when a car entitled to the special classification is forwarded from this station and he applies Red Ball cards when the car arrives and makes all reports the same as if the car originated at his station.

Local merchandise cars traveling as Red Ball freight are forwarded as such to the last district terminal reached before distribution begins and are then set out to be forwarded in a local freight train. For example: Chicago loads a car of local freight for points between Newton and Dodge City. This car is red balled to Newton, where it is set out and put in the local train between Newton and Dodge City. All such cars are reported with time of arrival at the point set out and time of departure in the local train, on the "Passing Report."

The object of the whole system is to run all important freight through with a minimum amount of red tape and telegraphic reporting and to insure its prompt delivery at destination. The Superintendent of Transportation is at all times kept informed of the location of all Red Ball freight on the road and the reasons for any delays. By running trains of high class freight through solid and bunching consignments to intermediate points as much as possible the maximum train loads can be maintained. When necessary any train can be run in two or more sections and the deficiency in loading of the last section made up from cars of dead freight consigned to the same points, a supply of which it is attempted to maintain at all times.

*A previous article in this series, describing the system in use on the St. Louis & San Francisco, appeared in the *Railroad Gazette*, Aug. 18.

D., L. & W. Improvements at Newark, N. J.

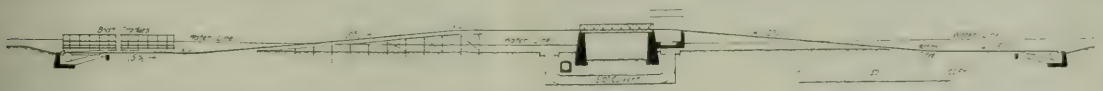
In the Lackawanna improvements at Newark, N. J., which were described in the *Railroad Gazette*, Nov. 27, 1903, the work was divided into three sections, as follows: Section No. 1, extending from the Passaic river to 200 ft. east of Boyden street, which was all elevation, and all but 300 ft. of which was built on a new line; section No. 2, extending from 200 ft. east of Boyden street to Third street, and section No. 3, extending from Third street to the East Orange line. The latter two sections are depression, and the new location is almost identical with the old. The making of two sections of the depression was necessitated by the location on section No. 2 of the Morris Canal, the bottom of which is four feet above the new top of rail in the depression. As there had been a great deal of talk of abandoning this canal, no definite plan of taking care of the canal to allow the railroad company to complete the depression was adopted, until the spring of 1904. Hence section No. 1 was completed, and section No. 3 nearly completed, before the work on section No. 2 was begun.

The grade of the old tracks from High street to Nesbitt street

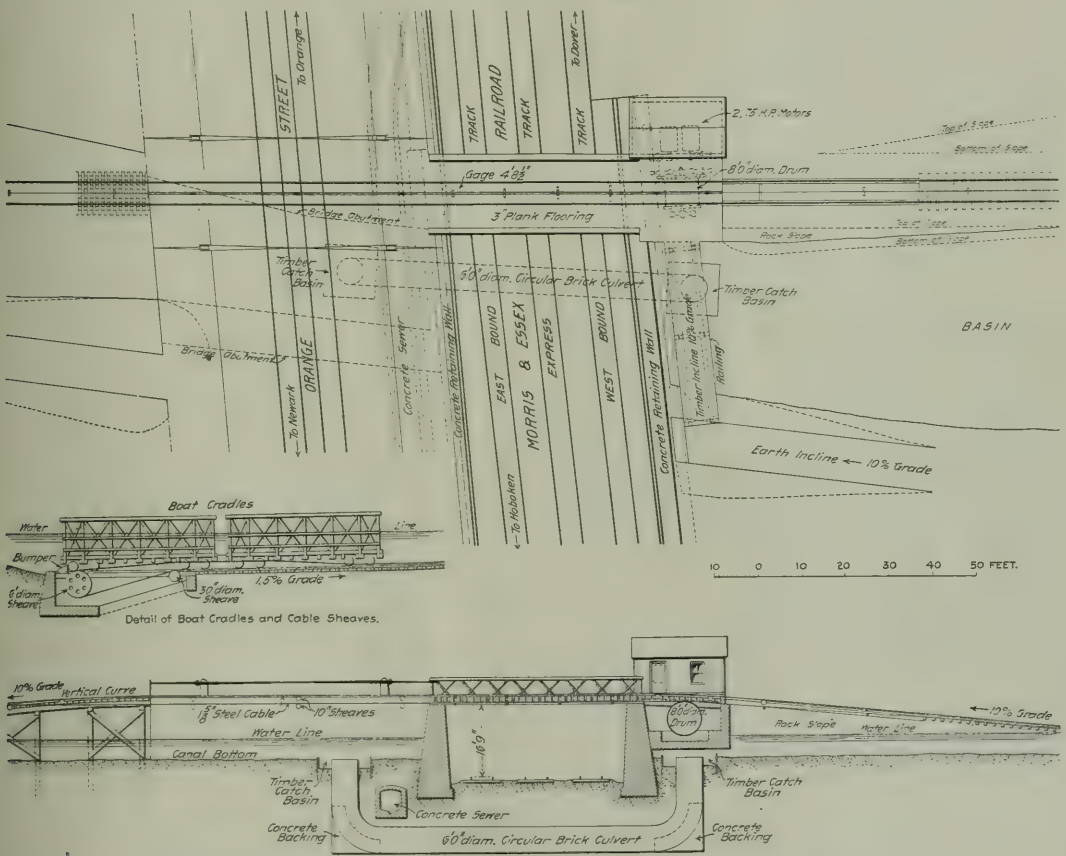
was 2.7 per cent. ascending, and from Nesbitt street to Seventh street the old grade was about parallel to the new one, which is 1.14 per cent. from High street to Seventh street. In order to go ahead with the completion of section No. 3 without waiting for the question of section No. 2 to be settled, a temporary grade line was adopted from the old grade at the Morris Canal to the new grade just east of Third street.

Great difficulty was encountered in this work inasmuch as uninterrupted traffic had to be maintained for nearly 100 passenger trains each way per day, besides the local freight. Aside from the traffic difficulties the construction work had all to be done within a 60 ft. right of way. The only special problems on section No. 2 were the Morris Canal crossing and the moving of the large retail coal pocket between Sheffield street and Nesbitt street to a new location between High and Boyden streets.

The method of operating a canal across a railroad in a depression where the top of rail of the road is 4 ft. below the bottom of the canal is a novel one, and was designed by Chief Engineer Lincoln Bush, and is shown in the accompanying illustration. An inverted brick syphon 6 ft. in diameter was built from the north side of the north retaining wall to the south side of a 5-ft. x 6-ft. sewer south of the south retaining wall. This sewer was constructed under the canal in April, 1902, as a part of the intercepting sewer built on section No. 3, in the south retaining wall from the Milbrook sewer in Branch Brook Park, east of the canal to 14th street. This inverted syphon is to equalize the level of the water in the canal on each side of the depression. The boats will be floated into racks mounted on wheels which are similar to those used by the Morris Canal on its inclines at different points over the



General Elevation of the Morris Canal Inclined Plane Over the D. L. & W. R. R. at Newark, N. J.



Detail of Boat Cradles and Cable Sheaves.

Details of the Morris Canal Inclined Plane Over the D. L. & W. R. R. at Newark, N. J.

The method of building section No. 2 was almost identical with that adopted on section No. 3. The retaining walls were built on either side of the proposed depression, and a temporary timber trestle was erected in a core excavated to the new grade adjacent to the south wall. A double track trestle was constructed between Sheffield and Nesbitt streets, and between Eighth avenue and Third street. By making an amicable agreement with each of the property owners having a business entrance on the M. & E. Railroad avenue between Nesbitt street and Eighth avenue south of the tracks the city authorities allowed the railroad to run one of its temporary tracks on this street, the other temporary track being supported on a trestle across the south retaining wall, between these points. The traffic at this date has been turned over on the temporary trestle from Sheffield street to east of Eighth avenue, and the work of excavating the core proper has been begun. This is done by moveable derricks of the stiff leg type, which load the material in cars on a track located on the north retaining wall.

The method of operating a canal across a railroad in a depression where the top of rail of the road is 4 ft. below the bottom of the canal is a novel one, and was designed by Chief Engineer Lincoln Bush, and is shown in the accompanying illustration. An inverted brick syphon 6 ft. in diameter was built from the north side of the north retaining wall to the south side of a 5-ft. x 6-ft. sewer south of the south retaining wall. This sewer was constructed under the canal in April, 1902, as a part of the intercepting sewer built on section No. 3, in the south retaining wall from the Milbrook sewer in Branch Brook Park, east of the canal to 14th street. This inverted syphon is to equalize the level of the water in the canal on each side of the depression. The boats will be floated into racks mounted on wheels which are similar to those used by the Morris Canal on its inclines at different points over the State of New Jersey. The boat is then pulled up the incline, which is a filled-in bank on the north side, across the depressed tracks on a lattice truss bridge, across Orange street at grade and down into the canal on a pile trestle incline south of Orange street. The power proposed to be used is electric motors. The inverted syphon was built in March and April of the present year, and it is proposed to build the incline after traffic is stopped in the canal this fall. In order to construct the depression to either side of the canal during the canal season, a timber flume was constructed across the proposed depression and the canal is operated through this flume at present. This will allow the railroad to excavate the core and lay the new tracks up to the canal on each side, and when traffic is stopped in the canal the railroad company expects to be able to drop its traffic into the depression within three weeks.

The D., L. & W. operates a retail coal pocket at Newark, which is located between Sheffield and Nesbitt streets. In the depression

of the tracks a new location between High and Boyden streets was decided upon for this structure. The entrance to the coal pocket for teams was planned at the High street end. As the grade of High street is about 16 ft. below that of the new top of rail, however, it was deemed advisable to build the pocket in a depressed area, the bottom of which was to be level with the grade of High street. This necessitates the excavating of about 40,000 cu. yds. of material, three-fourths of which is solid rock. This excavation is being done with a steam shovel. By adopting this plan a pocket with a capacity of 4,500 tons and an approach of a 3 per cent. grade was procured. The present coal pocket is a gravity affair, and the new pocket will be almost exactly similar to the present one, except that all exposed surfaces will be covered with corrugated iron to comply with the fire ordinances of the city of Newark. It will be necessary to have the new coal pocket completed before tearing down the present one. The railroad company expects to have the new pocket completed and ready for operation by January, 1906.

The area between Boyden and Nesbitt streets, south of the main tracks to Orange street, will be excavated for a carload delivery yard. The grade of the yard at Orange street will be three feet higher than the grade of the main tracks exactly opposite, making the grade of the diagonal team tracks level.

The work of depressing section No. 2 is being done by Sandford & Harris Co., of Hoboken, N. J., who also did the work on section No. 3, and the river work on section No. 1. The excavation and concrete foundations for the coal pocket is being done by Burke Bros., of Scranton, Pa. The superstructure is to be erected by Sandford & Harris Co.

The work was all planned by Chief Engineer Bush, of the Lackawanna Railroad, and is being constructed under the general supervision of Mr. E. I. Cantine, Division Engineer of the railroad company. For the above information we are indebted to J. H. Philips, Assistant Engineer, D., L. & W. R. R.

Time Freight on the Boston & Maine.

In response to a request for a description of the system used by the Boston & Maine for handling time freight, W. J. Hobbs, Fourth Vice-President and General Auditor, sends the following statement of the method used at Boston, Warren Bridge, which is typical. It is, of course, very simple as compared with that of the Atchison, shown in another column.

Trains are made up in proper order with empty cars during the night, and cars loaded to various points are in the same position every day. Traffic via Fast Freight Lines is all loaded at No. 10 house, which is 1,400 ft. long and has 47 doors on track side. There are six tracks and about 120 cars are placed at one placing. Tracks are numbered from 1 to 6, and from numbers of doors and tracks the location of the various cars is obtained; for example, for car set at No. 15 door, 4 track, we use the term 15-4, and checkers and freight handlers understand from this information what car to load.

For each car a slip about 8 in. long and 3 in. wide is made, which gives destination, Fast Freight Line, car number and location. Slips are made each morning as soon as car numbers are taken and destination arranged for by the foreman for the different places to which cars are loaded. The slips are placed in pigeon holes in a large rack in which are sorted receipts for freight in the house. Each pigeon hole represents a car and is marked in the same manner as loading slip.

The receipts for freight received from teams are sent to the foreman's office by receiving clerk as fast as received, and they are there sorted into the proper pigeon holes in the rack. It is customary to start a straight car for any point when it has 6,000 lbs. or more; for example, pigeon hole and loading slip will be marked "Chicago Transfer, C/o C. & N. W.-M. D. T." This indicates that all freight for points on or via C. & N.-W. consigned via M. D. T. should be loaded in this car. The checker will be given all receipts in the proper pigeon hole with the loading slip, and each receipt is marked by the receiving clerk with the door number where the freight is taken into the house, which is as nearly as possible opposite to the car.

Each checker has a gang of five or six men, consisting of one man tipping on to truck, and three or four truckmen and man in car stowing freight. The checker designates freight to be sent to car, and the freight handler is given the location of the car, as, for example, 15-4, which means No. 15 door and No. 4 track, and when he returns from depositing the first load he brings back the car number to the checker, who compares with number shown on loading slip, and if the number agrees, it is proof that the property is being placed into the correct car. He continues loading the same car until all receipts in hand are finished. The loading slip is then returned to the rack to be again given out when further receipts are sorted. As fast as property is loaded, the weights are shown on the loading slip, and when the car is completed, they are footed, which gives us total weight of freight in car.

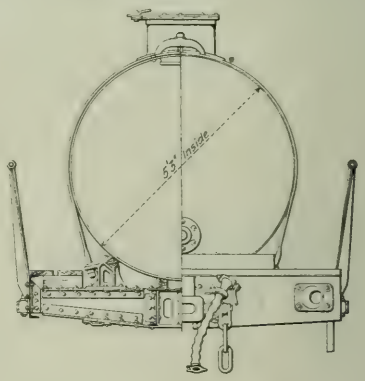
Fast trains 257 and 259 are closed 15 and 25 minutes, respectively, previous to leaving time. This amount of time is allowed for closing of doors, sealing cars and testing air. Train 257 leaves Boston at 3.30 p.m., and 259 leaves at 3.40 p.m., arriving in Rotterdam at 1.20 a.m. and 1.30 a.m. next morning, respectively; a run of 212 miles in 9 hours and 50 minutes.

All freight received up to 3 p.m. for the fast trains is loaded before closing at 3.15. For this fast train service, transfer cars from manufacturing towns in the near vicinity of Boston are also handled. Waybills are sent direct to the freight house, and the cars are ordered by the foreman to the most convenient spot, to avoid long trucking. For all the items on the waybills the company makes an expense voucher, giving complete information, and on each voucher is marked the car number and location of car to which each shipment is to be transferred, and the same method follows in handling transfer shipments as loaded from freight house floor. All shipping receipts and transfer vouchers are sent to the local office as fast as loaded, for billing purposes.

A running slip is made for each car and accompanies same to destination. The running slip gives full information as to route, fast freight line, etc. Waybills are made as soon as possible and forwarded under cover, in some instances by United States mail, some by train mail and some by express, to proper junction point in accordance with arrangements in force with each fast freight line.

Tank Cars for the Argentine Government Railways.

The accompanying drawings show the principal details of the tank cars recently built by the Middletown Car Works, Middletown, Pa., for the San Juan extension of the Argentine Government Railways in Northern Argentine Republic. This lot of 25 tank cars is part of a large order of equipment for this new line, the other cars being box, flat, gondola and stock. The box cars were illustrated in the *Railroad Gazette*, July 14, the gondola cars, May 5 and the flat cars March 3, 1905. These tank cars have underframes as nearly like those for the other types of cars as it was possible to make them and provide for securing a tank of the required size. The cars are 33 ft. 10 in. long, back to back of end sills, and 7 ft. 2 in.

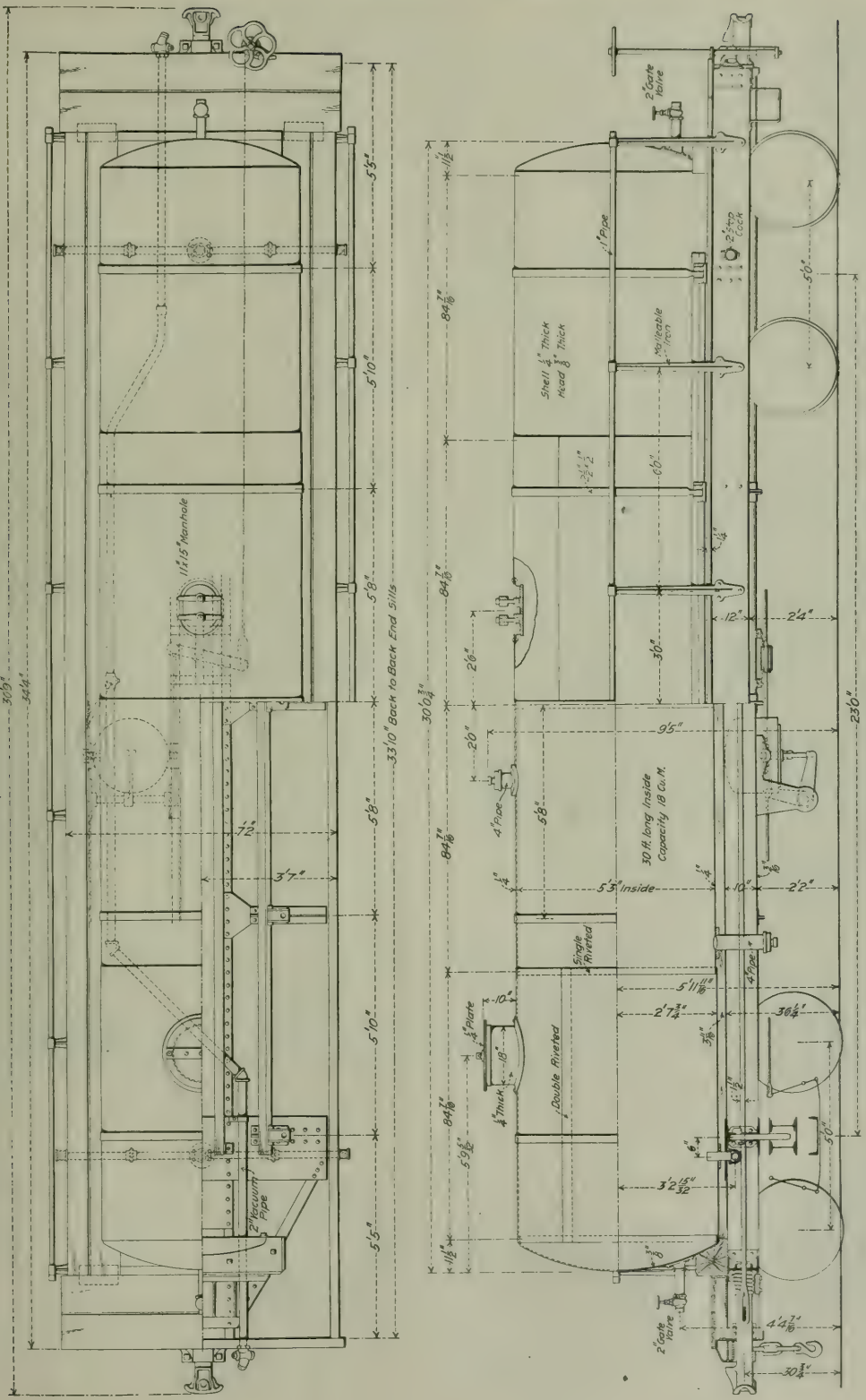


Part End Elevation and Cross-Section.

wide over side sills. The underframe is built up of 12-in. channels for longitudinal sills, built-up bolsters and bent plate end sills. They are mounted on diamond arch bar trucks of meter gage and are equipped with vacuum brakes, continuous draw-gear and link and pin couplers.

The tank is 30 ft. long inside and 5 ft. 3 in. in diameter and has a capacity of 18 cubic meters or 4,754 U. S. gallons. It is made of ¾-in. plates and the spherical ends are formed from ⅜-in. plates. In the top are placed an 11-in. x 15-in. manhole, an 18-in. dome, 10 in. high and a 4-in. filling pipe. The contents can be drawn off through a 4-in. pipe in the bottom, extending below the center sills or from 2-in. cocks which are outside of the side sills at the ends of a branch pipe near one end of the car. Two-inch gate valves at the ends of pipes leading out of the tank heads can also be used for drawing off the greater part of the contents. The tank is mounted on substantial oak head blocks secured on top of the center sills between the end sills and bolsters and on bearing strips carried in brackets riveted to the tops of the bolsters and cross bearers. These brackets also secure the tank bands which are 2½ in. x ½ in. A 1-in. pipe railing runs along each side of the tank and a narrow running board is fastened on top of the cross-members of the underframe. The ends of the car are decked over between the end sills and head blocks.

We are indebted to Mr. George I. King, Vice-President and General Manager of the Middletown Car Works, for the drawings.



Part Plan, Side Elevation and Sections of 4,700-Gallon Tank Car for the Argentine Government Railways.

Reports on the Mentor Disaster.

Coroner Siegelstein, of Cuyahoga County, on August 16 rendered a verdict in connection with the wrecking of the Twentieth Century Limited at Mentor, Ohio, on the night of June 21, in which 19 lives were lost. The Coroner holds that Walter F. Minor, the telegraph operator at Mentor, opened the switch which caused the accident. The verdict, in part, is as follows:

"I find that the switch was opened by Walter F. Minor, the night telegraph operator in charge of the station. I reach this finding by deduction; i.e., after having read over the notes on the testimony taken at the Painesville inquest, which I attended, and the testimony taken at my own inquest, I find that the time (according to observations taken by this office), from which the headlight of the Twentieth Century Limited train is seen approaching from the station platform at Mentor until it reaches the switch, is a maximum of 31 seconds. During this brief period of time, if Mr. Minor did not throw the switch on that night, and another person did, then that person must have appeared at the switch from some unknown place, unlocked the lock with a key, removed the lock, taken the coupling pin out, turned the switch, put the coupling pin in place again, placed the lock in the hole of the coupling pin, locked the lock and disappeared—a physical impossibility in my opinion. In the 500 folios of typewritten testimony taken at my inquest there appears not one word tending to show the presence of anyone but Minor, who was in charge of the station that night, in the immediate vicinity of the station or the switch, immediately preceding the wreck or afterward.

"Hence I can only come to the conclusion, which is reinforced by other points of the evidence, that Walter F. Minor opened the switch, but whether he did so of his own volition or by telegraphic orders of a superior officer I am not prepared to say."

State Railroad Commissioner J. C. Morris on August 17 made a report from which we take the following essential paragraphs:

"The derailment took place about 70 ft. east of the frog. The main track was found to be in good condition and the switch points, stand, bridle rods and all attachments were found in good working order and neither main track nor switch showed any signs of having recently received any repairs, which proved at once that neither the physical condition of the main track nor of the switch was in any degree responsible for the accident.

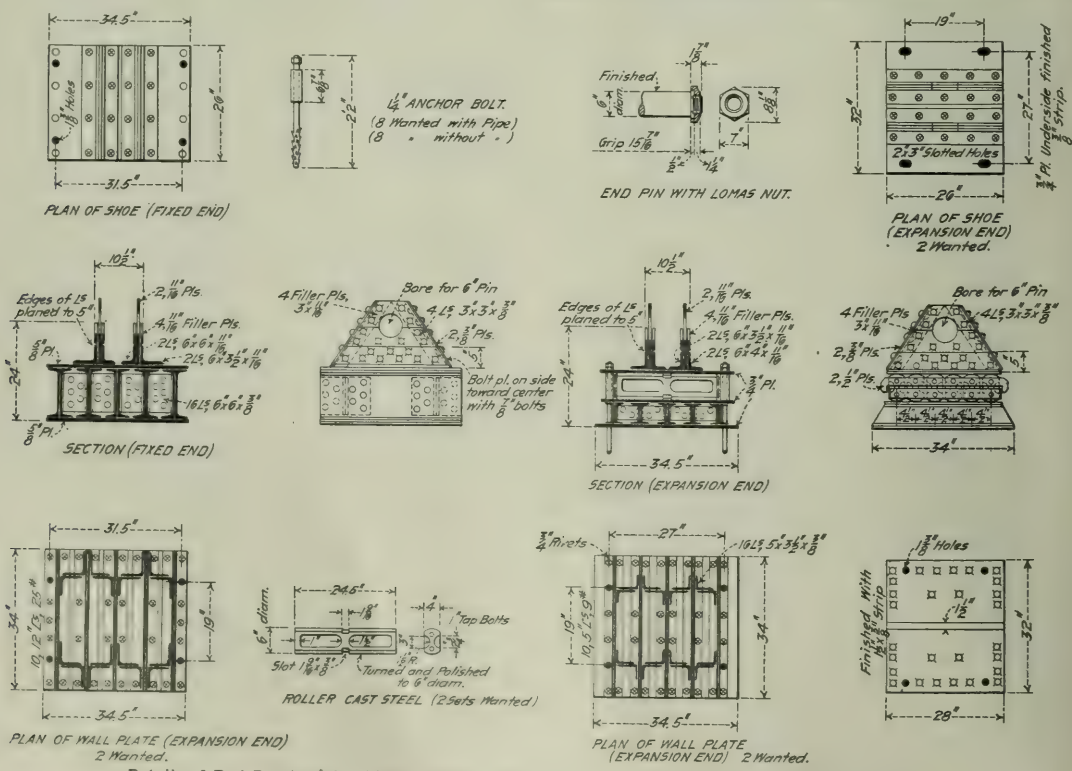
"An examination of the operator's train report showed that no trains passed Mentor in either direction between the passing of train No. 10, eastbound, at 8.31 p.m., which did not stop, and the arrival or No. 26, the wrecked train. A further examination of the operators' train reports at Wickliff and Willoughby, telegraph points immediately west of Mentor, and the original train sheet kept by the train despatcher at Buffalo, confirms this and shows no discrepancies in the records in any manner. A number of persons were interviewed and their statements, together with the testimony as given by the operators, train despatchers and train crews before the Coroner of Lake County, corroborate the official train sheet in the despatcher's office at Buffalo. The only eastbound train between Collinwood and Mentor was freight train 5919, which was passed by No. 26 on the four track portion of the road about nine miles west of Mentor, 5,919 running on track number 4 and No. 26 on track number 3. Owing to the distance from Mentor to the point where No. 26 passed 5,919, and the fact that there are two telegraph offices, one at Willoughby and the other at Wickliff, between these points, would indicate the improbability of the switch [at Mentor] being opened for the purpose of permitting 5919 to clear the main track for No. 26. I find that the switch was in the position of "open" and had been placed and locked in that position by some person in possession of a switch key."

Commissioner Morris then recommends distant signals for facing point signals, and the use of easier curves at the entrances to passing tracks. He says nothing as to who misplaced the switch except that the coroners and the railroad company have put forth every effort to discover the one responsible.

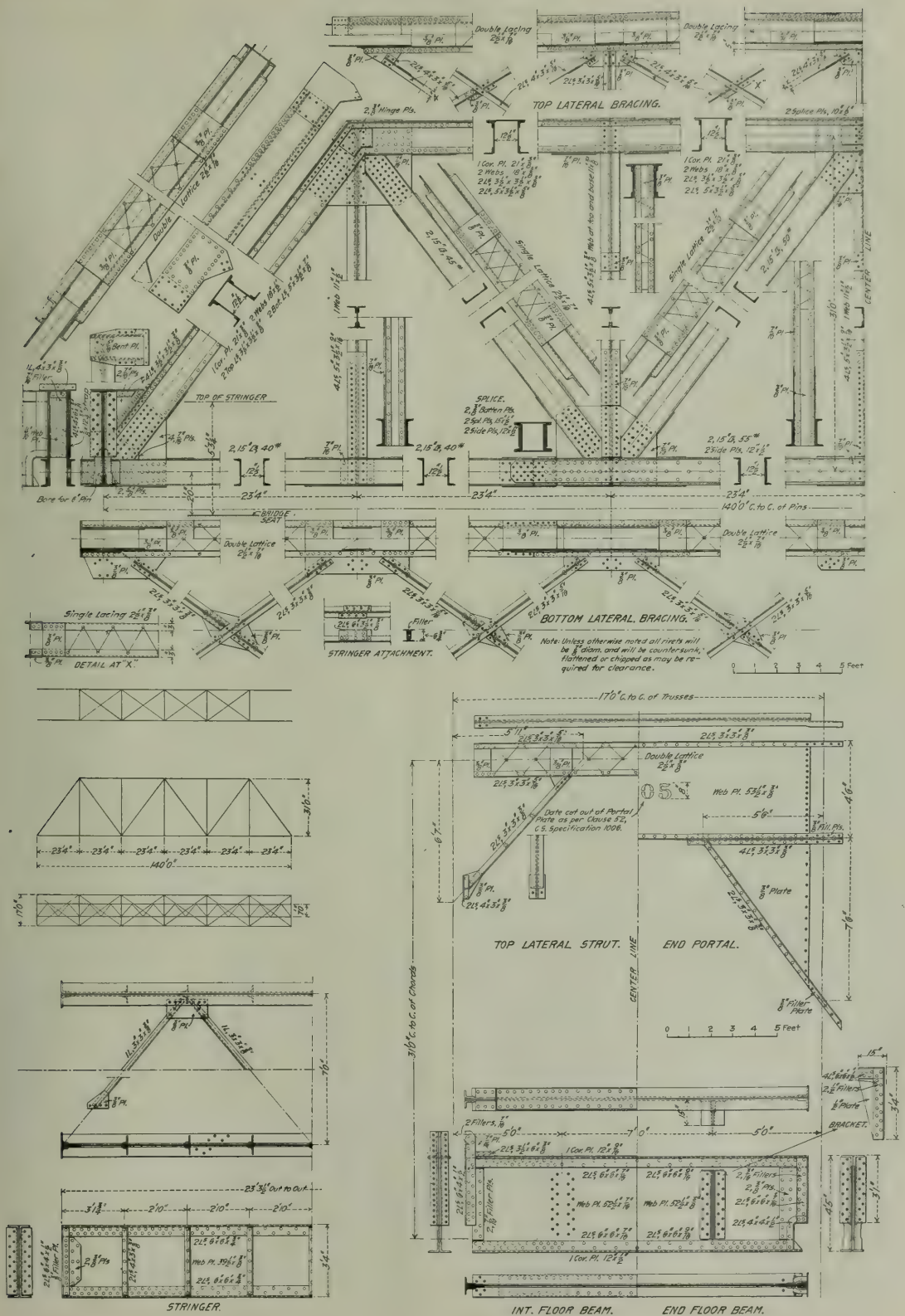
Standard Bridges on the Harriman Lines.*

The 140-ft. riveted through truss bridge shown this week again has some differences in the details of the various members over any of the shorter spans previously shown. The number of panels has been increased to six with single diagonals in each panel. These are made up of two 15-in. channels, 45 lbs. and 50 lbs. per ft., with single lattice across the top flanges. The top chord is built up of a cover plate 21 in. x ⅜ in.; two webs 18 in. x ⅜ in., spaced 12½ in. apart; two top flange angles 3½ x 3½ in. x ⅜ in., and two bottom flange angles 5½ in. x 3½ in. x ⅝ in. The end diagonals are fabricated in a similar manner but of heavier sections. For the bottom chord two 15-in. 40-lb. channels with ½-in. side plates are used as in the 125-ft. span. The estimated weight of one span complete is 273,000 lbs.

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, August 11 and 18.


PLAN OF SHOE (FIXED END)
1¼" ANCHOR BOLT. (8 Wanted with Pipe) (8 " without ")
END PIN WITH LOMAS NUT.
PLAN OF SHOE (EXPANSION END) 2 Wanted.
SECTION (FIXED END)
Bolt pl. on side toward center with ⅞" bolts
SECTION (EXPANSION END)
PLAN OF WALL PLATE (EXPANSION END) 2 Wanted.
ROLLER CAST STEEL (2 Sets Wanted)
PLAN OF WALL PLATE (EXPANSION END) 2 Wanted.

Details of End Bearings for 140-ft Riveted Through Truss—Common Standard, Harriman Lines.


TOP LATERAL BRACING.
BOTTOM LATERAL BRACING.
SPLICE.
TOP OF STRINGER
BRIDGE SEAT
140'0" C. to C. of Pins.
23'4"
DETAIL AT 'X'
STRINGER ATTACHMENT.
Note: Unless otherwise noted all rivets will be 7/8 diam. and will be countersunk, flattened or chipped as may be required for clearance.
0 1 2 3 4 5 Feet
170'0" C. to C. of Trusses
TOP LATERAL STRUT.
END PORTAL.
CENTER LINE
316" C. to C. of Chords
INT. FLOOR BEAM.
END FLOOR BEAM.
STRINGER.
BRACKET.

Details of Side Trusses and Floor Framing of 140-ft. Riveted Through Span—Common Standard, Harriman Lines.

Statistics of United States Railroads in 1904.

The Interstate Commerce Commission has published the advance sheets of its statistics of the railroads of the United States for the year ending June 30, 1904. The total route mileage at that time was 213,904 miles (partly estimated), having increased 5,927 miles in the year ending on that date. This increase exceeds that of any previous year since 1890. The 19 states and territories for which an increase in mileage exceeding 100 miles is shown are Alabama, Arkansas, California, Illinois, Iowa, Louisiana, Minnesota, Mississippi, Missouri, North Dakota, Ohio, Pennsylvania, Tennessee, Texas, Utah, West Virginia, Indian Territory, New Mexico, and Oklahoma. The aggregate mileage (fully reported), including tracks of all kinds, was 297,073 miles, being classified as follows: Route, 212,243 miles; second track, 15,824 miles; third track, 1,467 miles; fourth track, 1,046 miles, and yard track and sidings, 66,492 miles.

The number of corporations included in the report was 2,104. Of this number 1,086 maintained operating accounts, 848 being classed as independent operating roads and 238 as subsidiary roads. In the course of the year, companies owning 5,600 miles of line were reorganized, merged, consolidated, etc. For the year 1903 the corresponding item was 10,486 miles.

The length of mileage operated by receivers on June 30, 1904, was 1,323 miles, showing an increase of 138 miles as compared with the previous year. The number of roads in the hands of receivers was 28, and at the close of the previous year 27, six roads having been taken from the hands of receivers and seven having been placed in charge of the courts.

On June 30, 1904, there were in service 46,743 locomotives, the increase being 2,872. As classified, these locomotives were: Passenger, 11,252; freight, 27,029; switching, 7,610. There were also 852 not assigned to any class.

The total number of cars of all classes was 1,798,561, this total having increased 45,172 during the year. The assignment of this rolling stock was, to the passenger service, 39,752 cars; to the freight service, 1,692,194 cars; the remaining 66,615 cars being in company service. Cars owned by private companies and firms are not included in this statement. The average number of locomotives per 1,000 miles of line was 220, showing an increase of six. The average number of cars per 1,000 miles of line was 8,474, showing a decrease of 66 as compared with the previous year. The number of passenger-miles per passenger locomotive was 1,948,384, showing a decrease of 30,402 miles. The number of ton-miles per freight locomotive was 6,456,846, showing a decrease of 351,096 miles as compared with June 30, 1903.

The aggregate number of locomotives and cars in the service of the railroads was 1,845,304. Of this number 1,554,772 were fitted with train brakes, indicating an increase during the year of 92,513, and 1,823,030 were fitted with automatic couplers, indicating an increase of 52,472. Practically all locomotives and cars in passenger service had train brakes, and of the 11,252 locomotives in that service 11,113 were fitted with automatic couplers. Only 602 cars in passenger service were without automatic couplers. With respect to freight equipment it appears that most of the freight locomotives had train brakes and automatic couplers. Of 1,692,194 cars in freight service on June 30, 1904, 1,434,386 had train brakes, and 1,674,427 automatic couplers.

The number of persons on the pay rolls was 1,296,121, or 611 per 100 miles of line. These figures, when compared with corresponding ones for the year 1903, show a decrease of 16,416 in the number of employees, or 28 per 100 miles of line. The classification of employees includes enginemen, 52,451; firemen, 55,004; conductors, 39,645, and other trainmen, 106,734. There were 46,262 switch tenders, crossing tenders, and watchmen. With regard to the four general divisions of employment, it appears that general administration required the services of 48,746 employees; maintenance of way and structures, 415,721 employees; maintenance of equipment, 261,819 employees, and conducting transportation, 566,798 employees. This statement disregards a few employees of which no assignment was made. The amount of wages and salaries paid to employees during the year ending June 30, 1904, as reported, was $817,598,810.

The par value of the amount of railroad capital outstanding on June 30, 1904, was $13,213,124,679, which represents a capitalization of $64,265 per mile. Of this capital $6,339,899,329 existed as stock, of which $5,050,529,469 was common and $1,289,369,860 preferred, and the remaining part, $6,873,225,350 as funded debt, which consisted of mortgage bonds, $5,746,898,983; miscellaneous obligations, $723,114,986; income bonds, $229,876,687, and equipment trust obligations, $173,334,694. Current liabilities are not included. These amounted to $881,628,720, or $4,288 per mile of line.

Of the total capital stock outstanding, $2,696,472,010, or 42.53 per cent., paid no dividends. The amount of dividends declared during the year was $221,941,049, being equivalent to 6.09 per cent. on dividend-paying stock. For the year ending June 30, 1903, the amount of dividends declared was $196,728,176. Of the total amount of stock outstanding, $6,339,899,329, 5.80 per cent. paid from 1 to 4 per cent.; 14.65 per cent. from 4 to 5 per cent.; 10.64 per cent. from 5 to 6 per cent.; 8.50 per cent. from 6 to 7 per cent., and 9.80 per cent. from 7 to 8 per cent. The amount of funded debt (omitting equipment trust obligations) that paid no interest was $300,894,215, or 4.49 per cent. Of mortgage bonds, $175,817,862, or 3.06 per cent., of miscellaneous obligations, $61,048,625, or 8.44 per cent. and of income bonds, $64,027,728, or 27.85 per cent., paid no interest.

Of the total amount of stock outstanding, $1,942,858,359 was reported as owned by railroad corporations, and of the railroad bonds, $558,472,242 were so reported.

Passenger-mileage for the year was 21,923,213,536, having increased 1,007,449,655. Ton-mileage was 174,522,089,577, the increase being 1,300,810,584. The number of tons carried one mile per mile of line was 829,476, which indicates a decrease in density of freight traffic of 25,966 ton-miles per mile of line.

The average revenue per passenger per mile for the year was 2.006 cents, the average for the preceding year being the same. The average revenue per ton per mile was 0.780 cent. This average for the preceding year was 0.763 cent. Earnings per train mile show an increase for passenger but a decrease for freight trains. The ratio of operating expenses to earnings, 67.79 per cent., also increased in comparison with the preceding year, when it was 66.16 per cent.

Gross earnings from the mileage fully reported, were $1,975,174,091, being $74,327,184 greater than for the previous year. Operating expenses were $1,338,896,253, or $81,357,401 more than in 1903. The following figures give gross earnings in detail, with the increase of the several items as compared with the previous year: Passenger revenue, $444,326,991—increase, $22,622,399; mail, $44,499,732—increase, $2,790,336; express, $41,875,636—increase, $3,543,672; other earnings from passenger service, $10,914,746—increase, $1,093,469; freight revenue, $1,379,002,693—increase, $40,982,667; other earnings from freight service, $4,568,282—increase, $101,257; other earnings from operation, including unclassified items, $49,986,011—increase, $3,193,384. Gross earnings from operation per mile of line averaged $9,306, the corresponding average for the year 1903 being $48 less.

The operating expenses were assigned as follows: Maintenance of way and structures, $261,280,454; maintenance of equipment, $267,184,739; conducting transportation, $758,238,681; general expenses, $51,579,196; undistributed, $613,183. Operating expenses were $6,308 per mile of line, having increased $183 per mile in comparison with the preceding year.

Net earnings amounted to $636,277,838, a decrease of $7,030,217. Net earnings per mile for 1904 averaged $2,998; for 1903, $3,133, and for 1902, $3,048. The amount of income obtained from other sources than operation was $212,933,990. The total income was $849,211,828. Deductions for fixed charges, etc., aggregated $570,425,902, leaving $278,785,926 as the net income for the year available for dividends or surplus. The amount of dividends declared during the year (including $115,546, other payments from net income) was $222,056,595, leaving as the surplus from the operations of the year ending June 30, 1904, $56,729,331, that of the previous year having been $99,227,469.

The foregoing figures, being compiled from the annual returns of leased roads as well as of operating roads, necessarily include duplications in certain items of income and also of expenditure.

ACCIDENTS.

The total number of casualties to persons on the railroads for the year ending June 30, 1904, was 94,201, of which 10,046 represented the number of persons killed and 84,155 the number injured. Casualties occurred among three general classes of employees, as follows: Trainmen, 2,114 killed and 29,275 injured; switch tenders, crossing tenders, and watchmen, 229 killed, 2,070 injured; other employees, 1,289 killed, 35,722 injured. The casualties to employees coupling and uncoupling cars were: Employees killed, 307; injured, 4,019. The casualties connected with coupling and uncoupling cars are assigned as follows: Trainmen killed, 269; injured, 3,506; switch tenders, crossing tenders, and watchmen killed, 23; injured, 420; other employees killed, 15; injured, 93.

The casualties due to falling from trains, locomotives, or cars in motion were: Trainmen killed, 457; injured, 4,757; switch tenders, crossing tenders, and watchmen killed, 25; injured, 301; other employees killed, 75; injured, 570. The casualties due to jumping on or off trains, locomotives, or cars in motion were: Trainmen killed, 116; injured, 3,926; switch tenders, crossing tenders, and watchmen killed, 14; injured, 278; other employees killed, 61; injured, 506. The casualties to the same three classes of employees in consequence of collisions and derailments were: Trainmen killed, 613; injured, 4,337; switch tenders, crossing tenders, and watchmen killed, 20; injured, 138; other employees killed, 90; injured, 854.

The number of passengers killed in the course of the year 1904 was 441 and the number injured 9,111. In the previous year 355 passengers were killed and 8,231 injured. There were 262 passen-

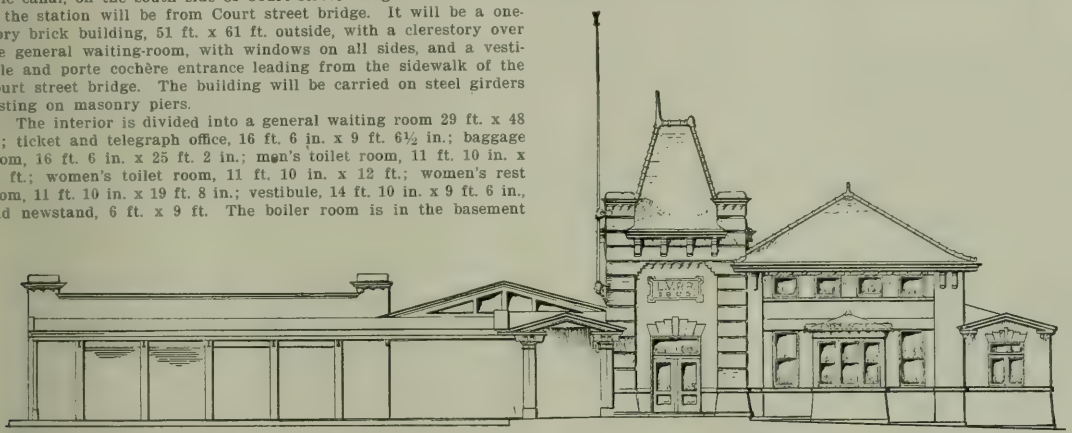
gers killed and 4,978 injured because of collisions and derailments. The total number of persons, other than employees and passengers, killed was 5,973; injured, 7,977. These figures include the casualties to persons classed as trespassing, of whom 5,105 were killed and 5,194 were injured. The total number of casualties to persons other than employees from being struck by trains, locomotives, or cars was 4,749 killed and 4,179 injured. The casualties of this class were as follows: At highway crossings, passengers killed, 4; injured, 10; other persons killed, 804; injured, 1,453; at stations, passengers killed, 28; injured, 108; other persons killed, 458; injured, 525; at other points along track, passengers killed, 9; injured, 38; other persons killed, 3,446; injured, 2,045.

In 1904 one passenger was killed for every 1,622,267 carried, and one injured for every 78,523 carried. For 1903 the figures show that 1,957,441 passengers were carried for one killed, and 84,424 passengers were carried for one injured.

New Passenger Station of the Lehigh Valley at Rochester, N. Y.

The Lehigh Valley is building a new passenger station at Rochester, N. Y. The station and approach is an elevated structure built over the Genesee river and the raceway, adjoining the Erie canal, on the south side of Court street bridge. The entrance to the station will be from Court street bridge. It will be a one-story brick building, 51 ft. x 61 ft. outside, with a clerestory over the general waiting-room, with windows on all sides, and a vestibule and porte cochère entrance leading from the sidewalk of the Court street bridge. The building will be carried on steel girders resting on masonry piers.

The interior is divided into a general waiting room 29 ft. x 48 ft.; ticket and telegraph office, 16 ft. 6 in. x 9 ft. 6½ in.; baggage room, 16 ft. 6 in. x 25 ft. 2 in.; men's toilet room, 11 ft. 10 in. x 16 ft.; women's toilet room, 11 ft. 10 in. x 12 ft.; women's rest room, 11 ft. 10 in. x 19 ft. 8 in.; vestibule, 14 ft. 10 in. x 9 ft. 6 in., and newstand, 6 ft. x 9 ft. The boiler room is in the basement and the coal bins are hung from girders under the building. The clear height of the general waiting room is 21 ft. 4 in. and of all other rooms about 11 ft.



Front Elevation of Lehigh Valley Passenger Station at Rochester, N. Y.

All platforms around the station will be of concrete and covered, except the extension of the Court street bridge concrete sidewalks in front of the building. The platform along the east side of the building will be 16 ft. wide, and on the south side or rear of building 18 ft. 6 in. wide. There will be a neat pipe railing around all platforms.

The viaduct track approach and train shed will be carried on a steel bridge construction resting on stone walls and piers built along the river and in the raceway. The train shed platform will be of wood, 365 ft. long, with a wooden umbrella canopy roof 305 ft. long. The canopy will be 13 ft. wide. The viaduct approach will be 566 ft. long. There will be a driveway or court-yard about 60 ft. x 70 ft., leading in from Court street bridge. The driveway will have asphalt finish on a concrete bed supported by steel girders resting on masonry piers.

The express building will be a one-story brick building, 28 ft. x 50 ft., with a concrete platform 11 ft. wide in front of it. The exterior of the passenger station will be built of dark mottled buff pressed brick, with a battered base of rock faced dark red vitrified paving blocks, with blue stone water table and sill course. Keystones of arches, lintels and sills will be dressed blue stone. The tower finials and trim will be terra cotta. The roof of the main building will be slate, with copper flashing, and the exterior finish of the express building will be similar to that of the main building.

The interior finish of the passenger station will be plastered walls with quarter-sawed oak wainscoting and trim. The ceiling of the general waiting-room will be a beamed ceiling with ornamental composition consoles. Floors will generally be maple except in the vestibule and toilet rooms, where there will be a concrete marble chip terrazzo floor. The interior of the building will be well lighted by windows at each end of the general waiting-room and upper lights in the clerestory. The lighting at night will be by electric fixtures. The building will be heated by steam from a boiler in the basement under the east side of the main building.

Mr. F. D. Hyde, 7 East 42d street, New York City, designed the station, has the contract for its construction, and also the approach. It is expected that the new station will be placed in use by next December.

The Thirteenth Annual Convention of the National Railroad Master Blacksmiths' Association.

The National Railroad Master Blacksmiths' Association, which will be known hereafter as the International Railroad Master Blacksmiths' Association, held its annual convention in Cleveland, Ohio, August 15-17. The attendance was larger than at any previous meeting. President Keane called the meeting to order and Mayor Tom Johnson welcomed the organization to the city. A donation of $200 was received from W. W. McLelland, of Denver, who is a retired blacksmith, having worked for the Denver & Rio Grande for many years. The following officers were elected: President, David B. Swinton, Canadian Pacific, Montreal, Canada; First Vice-President, John S. Sullivan, P., C., C. & St. L. Ry., Columbus, Ohio; Second Vice-President, G. H. Judy, B. & O. R. R., Pittsburg, Pa.; Chemist, G. H. Williams, B. M. Jones & Co., Boston, Mass.; Secretary and Treasurer, A. L. Woodward, C., H. & D. Ry., Lima, Ohio. Papers on the following subjects were read: "Forging Machine Formers, Bulldozers, etc."; "Spring Making, Repairing and Tempering"; "Oil Furnaces"; "Manipulating Tool Steel, Including High-Speed Varieties"; "Tools and Formers for Steam Hammers"; "Best Material and Methods of Forging Motion Work"; "Ideal Blacksmith Shop"; "Best Methods of Repairing Locomotive Frames, Both Iron and Steel"; "Best Methods of Testing Materials and Selecting Same for Uses Intended."

Train Accidents in the United States in July.[1]

bc, 1st, 1 a.m., Seaboard Air Line, Franklinton, Va., butting collision of freight trains; one conductor killed.

xc, 1st, 1 a.m., Southern Pacific, Winnemucca, Nev., westbound passenger train No. 5 collided with a freight train in the yard, wrecking an engine and seven freight cars; 12 persons were injured.

rc, 2d, 1 a.m., Southern Railway, Spartanburg, S. C., a freight train approaching the station at uncontrollable speed ran into the rear of a preceding freight, making a bad wreck. One trainman was killed and two others were injured.

bc, 4th, Louisville & Nashville, Viley, Ky., butting collision between an eastbound L. & N. passenger train and a westbound passenger train of the Chesapeake & Ohio, damaging both engines and several cars; 22 persons were injured. The trains were near their appointed meeting place, and it is said that the westbound (not scheduled to stop) was a minute ahead of time.

xc, 4th, Chicago & North-Western, Escanaba, Mich., collision of

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

switching freight trains, due to a misplaced switch; one trainman killed, two injured.

xc, 5th, Boston & Maine, Wachusett, Mass., an eastbound freight train approaching the station at uncontrollable speed collided with another freight which was switching, and both engines and many cars were wrecked. Three trainmen were killed and two injured.

dn, 5th, Rio Grande Western, Park City, Utah, a passenger train was derailed at a misplaced switch and the fireman was killed.

dn, 5th, 11 p.m., Buffalo Creek Railroad, Buffalo, N. Y., a switching engine of the Pennsylvania road ran into an open draw and fell into the Blackwell canal. Three men were carried down with the engine beneath the water, and were injured, being nearly drowned, and a fourth was injured by falling from the tender to the bridge.

*unx, Great Northern, Spring Brook, N. Dak., a passenger train was derailed and most of its cars were wrecked. Thirty passengers and several trainmen were injured, one of the latter fatally. Several passenger cars took fire and were burned up. It is said that the fire was started by the explosion of the gas tank under the smoking car. Many of the injured persons were somewhat burned by the fire, being unable to get out of the wreck until after some delay.

*rc, 8th, 4 a.m., Pennsylvania road, Marion, N. J., a freight train which had been unexpectedly stopped was run into at the rear by a following freight, and the caboose and several cars were wrecked. Three trainmen were killed and two injured. The wreck took fire and the city fire department had to be called out to extinguish the flames. There was a dense fog at the time, and the engineman of the approaching train claims that he saw the automatic block signal indicating all right.

xc, 9th, Cleveland, Cincinnati, Chicago & St. Louis, Oakalla, Ind., an eastbound passenger train running at high speed, collided with a freight train which was entering a side track. One engine and two cars were ditched. The fireman and the engineman of the passenger train were injured, the former fatally.

xc, 9th, Long Island road, Long Island City, N. Y., collision between a westbound passenger train and a switching engine. Three passengers and one trainman were injured.

dn, 10th, Louisville & Nashville, Lexington, Ky., passenger train No. 16 was derailed by a misplaced switch, and five passengers were injured.

xc, 11th, Southern Ky., Citico, Tenn., collision of freight trains; one employee killed and one fatally injured.

bc, 11th, Southern Railway, Tryon, N. C., butting collision of freight trains, wrecking both engines and 14 cars. Four trainmen and two other persons were injured.

xc, 11th, Pennsylvania Lines, Allegheny, Pa., collision between a passenger train and a freight train in the yard; three trainmen and one passenger injured.

unx, 13th, 3 a.m., Texas & Pacific, Marshall, Tex., the tender of the engine of passenger train No. 104 was derailed and, with the express car, broke through a bridge. Two express massengers were injured.

†xc, 14th, Chicago & Eastern Illinois, Steiger, Ill., a northbound through passenger train ran over a misplaced switch and into a suburban passenger train, wrecking one passenger car of the latter. The engineer of the suburban train and two passengers were killed and six persons were injured.

bc, 15th, Louisville & Nashville, Upton, Ind., butting collision of freight trains, wrecking both engines and many cars. Four trainmen were killed and eight persons were injured. The collision was due to confusion in sending train orders.

eq, 15th, Pere Marquette, Cheboyganing, Mich., the tender of the engine of a passenger train (the engine running backwards), was derailed while moving at about 40 miles an hour, and the engine and tender were ditched. The engineman was killed and the fireman injured. It is said that the derailment was due to a loose wheel.

bc, 16th, 4 a.m., Norfolk & Western, Midvale, Va., butting collision of freight trains, each drawn by two engines, wrecking all four engines and several cars. One brakeman and one fireman were killed and four other trainmen were injured.

unf, 16th, Southern Pacific, Landry, La., a freight train was derailed at a switch which had been maliciously misplaced, and the engine and 12 cars were ditched. The engineman was killed and two trainmen were fatally injured.

unx, 16th, Gulf, Colorado & Santa Fe, Buckholts, Tex., a freight train was derailed and the engine and 12 cars were ditched. One brakeman was fatally injured.

bc, 18th, Atchison, Topeka & Santa Fe, Romeo, Ill., butting collision between a passenger train and a freight; one express messenger killed and three trainmen injured. The smoking car of the passenger train, which was next to the engine, was completely wrecked and the 20 passengers riding in it were injured, but none very seriously.

xc, 18th, 4 a.m., New York Central & Hudson River, East Rochester, N. Y., a westbound passenger train collided with a freight train which was backing through a cross-over track and the engineman and fireman of the passenger train were injured, the former fatally.

eq, 18th, Chicago, Rock Island & Pacific, Phillipsburg, Kan., westbound passenger train No. 41 was derailed, presumably by something dropping on the track from a truck of one of the passenger cars, and four passengers were injured.

dn, 18th, Norfolk & Western, Prospect, Va., an excursion train was derailed at a point where the track was being repaired and where, it is said, the man in charge of the work neglected to give a caution signal, and six cars were ditched. Five passengers were injured.

unx, 18th, Oregon Railroad & Navigation, Umatilla, Wash., a freight train was derailed at a switch and the engine was overturned. Two cars of the train fell from a bridge to the ravine below, and a tramp, sitting on the bank of the river, was killed.

bc, 20th, 4 a.m., Pennsylvania road, Mocanaqua, Pa., butting collision of freight trains, damaging both engines and several cars. One fireman was killed and one engineman was injured. One of the trains appears to have run beyond the switch at the appointed meeting station.

xc, 21st, New York, New Haven & Hartford, Worcester, Mass., a passenger train collided with a freight train; two passengers injured, one of them fatally.

unf, 21st, Southern Pacific, Dryden, Tex., a westbound passenger train was derailed and wrecked, and the engineman and fireman were killed. It is said the derailment was due to malicious loosening of the rails.

bc, 22d, Louisville & Nashville, Pulaski, Tenn., butting collision of freight trains; one fireman killed; three other trainment injured, one of them fatally.

unx, 22d, Alabama Great Southern, Whitney, Ala., northbound passenger train No. 2 was derailed and six trainmen and 10 passengers were injured.

unf, 23d, Pennsylvania road, Duncansville, Pa., a freight train was derailed by running over a cow, and a brakeman was killed.

*unx, 23d, Chicago, Rock Island & Pacific, Unionville, Iowa, a freight train was derailed, making a bad wreck. A car of oil took fire and exploded, and with 14 other cars was burned up. Three trainmen were killed.

unx, 26th, Central of Georgia, Atlanta, Ga., a freight train was derailed and an engine and five cars were wrecked. Three trainmen were killed and two seriously injured.

unf, 27th, Northern Pacific, Myers, Mont., a freight train was derailed at a bridge which had been undermined by a flood, and the engine and four cars fell into the stream. Four trainmen were killed.

unx, 27th, Gulf, Colorado & Santa Fe, Silsbee, Tex., the tender of the engine of a freight train was derailed near a bridge and, with one span of the bridge and seven cars, fell to the stream below. One trainman was killed and one injured.

bc, 28th, Central Illinois Traction Company's Line, Mattoon, Ill., butting collision of passenger cars, both going at good speed. Both cars were wrecked and the motorman and 14 passengers were injured.

unx, 28th, Southern Railway, Jellico, Tenn., the locomotive of a freight train, running tender first, was derailed and wrecked and the fireman was killed. The engineman was seriously scalded.

*dn, 29th, St. Louis, Iron Mountain & Southern, Diaz, Ark., passenger train No. 5 was derailed at a misplaced switch. The engine was overturned and several of the cars took fire and were burned up. The engineman and fireman were killed and five trainmen and four passengers were injured.

unf, 29th, Pere Marquette road, Alpine Mich., a passenger train was derailed at a washout, and the baggage car and four passenger cars were ditched.

unx, 29th, 3 a.m., Little Rock & Fort Smith, Ozark Junction, Ark., a passenger train was derailed and the passenger cars fell down a bank; 42 passengers were injured.

†unx, 29th, Atchison, Topeka & Santa Fe, Lemont, Ill., a passenger train was derailed and one passenger car was wrecked. One passenger was killed and 20 injured, two of them fatally.

unf, 30th, Wheeling & Lake Erie, Forest City Park, Ohio, a freight train was derailed by sand which had been washed upon the track, and several cars were wrecked. The fireman was killed and the engineman was injured.

unf, 30th, St. Louis, Iron Mountain & Southern, Cotter, Ark., a train, consisting of a locomotive and caboose, was derailed at a washout and fell 25 ft. to the stream below. One employee was killed and five were injured.

xc, 31st, Chicago, Rock Island & Pacific, Joliet, Ill., a passenger train ran over a misplaced switch and collided with a work train on a gravel-pit track. One passenger car was badly damaged and four passengers and one employee were injured.

xc, 31st, Atlantic Coast Line, Bainbridge, Ga., collision between a freight train and a switching freight train; engineman and one brakeman killed.

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 9. FRIDAY, SEPTEMBER 1, 1905.

We print this week a digest of a circular issued by a well-known grain trading firm in the West which is distinctly on the bull side of the market, but which nevertheless gives a good idea of the situation when this one limiting fact is kept in mind. Indications point to an exportable surplus of from 150,000,000 to 200,000,000 bushels of wheat this coming year as compared with an almost total shortage in the year just closed (4,394,402 bushels); with 44,230,169 bushels in the year ending June 30, 1904; with 114,181,420 bushels in 1903, and 154,856,102 bushels in 1902. It is still a little too early to tell just how the crops are going to turn out, but it is evident that there is to be an extremely large rail and ocean movement not only of wheat but in flaxseed, where a bumper crop is predicted, and in corn. We have pointed out before, that when a good wheat crop is supplemented by a good crop of corn, oats and other grains, more wheat finds its way to the seaboard than when there is a shortage in these other crops, and the farmer has to keep the poorer quality of wheat at home to be mixed for feed. We also have pointed out that the producing capacity of the country at a present average of some 12½ bushels per acre is about taken up; this statement not including Canada, but referring merely to the wheat producing area within the boundaries of the United States; and that unless care is taken to introduce improved methods of culture, for which there seems at present to be no great disposition among the farmers, wheat exports must tend steadily to decrease, in view of the fast growing home consumption. The crop this year has been produced under extraordinarily favorable climatic conditions, and seems likely to make an export record which will hold for some time; until the great Canadian Northwest, which can be described as scarcely developed at all at present, begins to rapidly increase its output. There can be no doubt that the Grand Trunk Pacific will add enormously to the export grain tonnage, after it has built up its northern country. The grain trade bulletin which we reprint this week is inclined to predict a shortage of ocean carriers and consequently high ocean rates, but to this belief we must demur. Rumors of the great crop have preceded its movement by so long a time that it seems quite as reasonable to expect that the charter ships which will come over here looking for grain will exceed the demand. At the time of the last great wheat crop, in the year ending June 30, 1902, there was no such over-production of shipping as there has been in the last two years, and ocean freights have now had a long period of depression because of the lively competition for cargoes. The effect of an abundance of carriers, however, is felt more by the European consumer than by the American producer.

SOME RESULTS WITH CONCRETE TIES.

About a year ago, in giving a brief resume of the cross-tie situation in these columns, it was asserted that makes of ties other than wood must have a life of at least ten years to enable them to stand on an even basis of cost with the latter; and that all experiments up to that time with substitute ties had proven a failure before the end of ten years, with one or two exceptions, which had lasted about that long. Mention was also made of forms of ties then in use for three or four years, which apparently were yielding hopeful and instructive results, although not all could be classed as unqualified successes, and some were far from such. The Pennsylvania Lines West of Pittsburg have been trying reinforced concrete ties for several years, and the results to date have been quite unsatisfactory, according to information furnished us by Mr. R. Trimble, Chief Engineer of Maintenance of Way of the Northwest System. Three different designs have been tried. In the first case, tried about six years ago, a lot of 30 reinforced concrete ties were removed at the end of a year, principally because of the weakness of the fastening between tie and rail. Some of the ties also are quite badly broken. About three years later an experiment was made with another design of reinforced concrete tie. There were 300 of these ties in the first lot, which were received in the winter time, and 21 were put into the track at once. All were removed within a month, because the concrete broke away from the reinforcing metal. These were then replaced by new ties, which were put into the track in the spring, along with the balance of the original lot of 300. Breakage of a great many soon ensued, however, and by the middle of the summer about half of them had been removed. Two more lots of 100 each were added between that time and the fall, to replace broken ties. But removals were continuous, so that by the spring of the present year only about a hundred were left, and most of these were imperfect. Inspection of them ceased at that time, as they were considered a failure. These ties were laid in stone ballast, and were subjected to very heavy traffic. Some of this same design laid in a division where traffic was lighter gave slightly better results. That is, they broke less quickly, although many of them

were broken within a year's time; but despite their poor condition the track remained in good condition as to line and surface with a small amount of labor. Last year trial was made of another design, 100 being used. These also were a total failure, and all had been removed by spring of the present year. This design failed by the concrete crumbling and breaking under and outside of the rail, and showed transverse cracks at the rail-holding bolts.

Somewhat in contrast with the results on the Pennsylvania is the experience of the Lake Shore with the same design of tie most largely used in the former's trials. Chief Engineer Rockwell advises that they have a very large number of these ties which have not failed, nor do they expect them to fail. Certain of the ties, which were placed in a position where the worst possible test could be given them, have failed, he says, partially on account of poor concrete and partially on account of the jar from fast moving trains.

Three years ago we gave an illustrated account of a piece of work involving the use of concrete ties in three-quarters of a mile of city street, with the object of providing a permanent track construction. (*Railroad Gazette*, August 29, 1902.) The ties were laid in cement mortar on a bed of concrete. A recent inquiry regarding the condition of these ties and roadbed elicited the information that not a single tie has broken, that the track is in as perfect line and surface as when laid, and this with no attention in the interim. It should be known in connection with this piece of track that trains with heavy locomotives pass over it at full speed, except at one end, where the brakes are applied preparatory to the station stop.

One rather significant point to note in connection with the Pennsylvania results is the statement that regardless of the poor condition of the ties on the division having the lighter traffic, the track remained in good condition as to line and surface, with little labor. Mr. Rockwell, of the Lake Shore, expresses the belief that there is a large field for concrete ties, although he is inclined to think they should not be laid in fast tracks, as undoubtedly the material is not suited for continuous heavy shocks. Another well-known chief engineer of a railroad, in referring to this phase of the matter, pointed out that there is an important difference between steel-concrete and concrete-steel ties; the distinction having reference to the manner of combining the two materials. In the former, he asserted, the steel takes the load and vibration, jarring the concrete loose, and a failure is the result.

THE CENSUS OFFICE RAILROAD VALUATION.

The valuation of the railroads of the United States which has been made by Professor Adams and his assistants in the Census Bureau (*Railroad Gazette*, August 18, page 168) is one of the most elaborate mathematical studies of business conditions that a statistical idealist ever evolved, and it would do credit to the faculty of a German University. And, on the whole, the theoretical basis on which it is founded is right and proper. But how much good it will do is another question. If any state assessing officer has become weary of fixing railroad valuations by tossing a penny, or by guesswork, or as the result of three-day wrangles with railroad lawyers, he can here find a way of escape—provided he is possessed of a backbone like a telegraph pole. No argument is needed to show the reasonableness of Professor Adams' theory. Every assessor knows that railroad valuations based on first cost or cost of replacement are utterly worthless; that valuations based on the total of stocks and bonds often produce unjust assessments; that the gross earnings of a year tell nothing about the real profit, and that dividends often conceal more than they show. Every investor or other person who desires to know the real present value of a railroad, and who has access to the necessary information, proceeds on the same theory that is here employed in the census. The cost of a railroad may have been made grossly excessive by bad judgment or by fraud, and on the other hand, it may be far less than the present value by reason of growth of population and of land values. The face value of stocks may be ten or fifty times the value of the property, or it may be far less than the true value; and even the market value may represent many factors besides those based on the railroad itself—as, for example, profitable investments in a distant state. Gross earnings may increase while profits and ability to pay taxes may decrease.

In spite of the strong support that Professor Adams finds for his theory in the simple rules of logic and common sense, it is not surprising to find railroad officers and their spokesmen protesting against what he has done; for in discussing valuations with state taxing officers, railroad men find that logic and common sense are often more honored in the breach than in the observance. The railroad officer usually finds himself forced to use every possible argument for a reduction, for the reason that on the other side every possible argument is used for an increase. Prof. Adams disavows any purpose to fix values for taxation, but that will not hinder state officers from using the values for that purpose. All of the state tax valuations reported by the census office, except for Connecticut, are now below the true valuation, and most of them very far below; but this is explained, more or less fully, by the fact that all valuations of every kind of property are usually much below real values and by the fact that railroads pay some taxes in other ways than by state valuations.

Of course, the rational method of assessing is to ascertain real values, and, where values which have been too low are raised, to reduce the rate of taxation accordingly. That is what was done in respect to real estate values in New York city two or three years ago. There was a great hue and cry then about the injustice of raising valuations, but when the tax bills appeared, not materially increased, the complainers found that they had been making a false alarm. If the old and the new valuations are both equitable, as between one taxpayer and another, a change in figures can, of course, make no change in the actual burden. The trouble with the taxes of railroad companies is that usually they are not equitable; they are wholly or partly inequitable, as related to other taxpayers, and often are subject to renewed efforts, in successive years, to make them still more inequitable. Theories of taxation are so varied and discordant that no assessor makes any headway in trying to improve his own theories by studying the experience of other states, and all theories are subject to so many exceptions that few assessors feel themselves to be on firm ground. Nowhere does the student of economics find confusion worse confounded than in the field of state taxation of railroads. Of course, this confusion is not by any means due entirely to the difficultly of finding and applying correct theories; it is largely due to perversity in state officers who are "agin' the railroads" or of railroad lawyers who attempt, by securing low valuations or assessments, to get even with the public for all of the real or supposed injustice that the railroad may have suffered at the hands of the legislature or the courts.

But if this valuation of railroads, made solely for the purpose of filling out the Census Bureau's estimate of the total wealth of the nation, is in any degree injurious to the railroad interests the injury is already done; for the figures have been published throughout the country. The only course now for the railroad attorney to take in the matter is to fight for equity in actual rates and assessments. If that has been his course heretofore he can but continue in the same line. If he has hitherto tried to reduce taxes by deceiving the assessors as to values he may have to change his methods. If the interminable discussions before state boards over railroad taxes, which use up so much valuable time, can be changed from rivalries in the art of confusion to sane efforts to secure the application of equitable rates to all property, it is possible that great good may be accomplished.

In the meantime, Professor Adams's essay affords an interesting study in the details of the task of finding the commercial value of a railroad. His first principle is to base the value of the railroad on its net earnings from operation (excluding income from outside investments or from securities of other railroads), capitalizing these at a rate based on the market value of the company's stock and bonds. To avoid the influence of fluctuations in business he takes an average of the income of the railroad for a period of five years. From the operating expenses he deducts sums spent for permanent improvements, which, of course, inure to the profit of the stockholder. The net operating expense thus found is deducted from the gross earnings and the remainder is called the true net earnings from operation. Next the taxes are deducted, leaving the true profit from operation. Where profits have shown a steady falling off for five years the average for the last three years is taken, and sometimes the three-year term is used where profits have increased. This last course is pursued more rarely because the purpose was to obtain a conservative estimate of profits. Where the operating mileage has changed, one average for the whole five years has been taken, except where this showed a profit appreciably larger than during the last year, when a reduction was made.

For a suitable rate of capitalization, instead of taking arbitrary interest rates, which would involve the element of personal judgment, an elaborate study was made of the New York stock market quotations for a period of 27 weeks ending July 1, 1904. The price of bonds was stripped of accrued interest, and stocks were stripped of the value of expected dividends, in cases where the dividend

history of the company seemed to warrant such expectation. Professor Adams gives a long explanation of the rules by which he computed his average of stock-market prices, and his assistant, Mr. Wm. J. Meyers, gives in the appendix a still longer one. The arithmetic average was adopted, rather than weighted averages (which take account of the volume of transactions) because the simple average results in a lower price. Where stocks or bonds were not quoted, valuations were made by analogy with other issues in the same system. Current liabilities were excluded. The rate of annual return on bonds selling above or below par was computed by Deghuee's tables.

Having found what the stock and bonds receive, and dividing this by their present value, he has the average *rate* received by all the investors in that property. But the total *amount* received by the investors may represent much more than the profit from the operation of the railroad, for the stock and bonds may cover extensive outside investments. But this *rate*, which the investor receives on all his interests in the company, is deemed a fair rate for him to receive on that part of his interest which is based strictly on the operation of the railroad. The net profits from operation for a year are what must furnish the funds for the payment of the investor and therefore the capitalization of these profits, at the rate found, gives the true value of the railroad operating property.

The Census office required the valuation to be distributed to the several states and territories. As no engineer's estimate of cost of construction was available, and as distributions by track mileage, or by stock and bonds, or population, or density of traffic, or car mileage, are inexact, and as no data were available for net earnings, while most roads had divided or could divide gross earnings, the gross-earnings basis was adopted. In some cases, where the railroads could not make the division, a special compilation was made for a single month and the ratios thus reached were used. The value of a terminal is spread over the line or lines that make use of it, and no attempt was made to decide as to how earnings should be divided between a main line and a feeder. No inquiry was made of the railroads concerning their rule for reporting gross earnings by states, where the trunk line was located in one state and the branches or feeders in another.

To test the results of the census work, Mr. J. Shirley Eaton was employed to examine the valuations made by railroad experts of a number of important railroads which have changed hands during the past nine years. These studies showed that the methods adopted by the Census Bureau conformed very closely to those followed in the business world. Comparisons were made, also, with the formal or implied valuations of railroad properties made by state tax boards; but, as might have been expected, this work amounted to nothing. Agents were sent to a large number of states to study the records, but the great variety of state laws and the marked divergence in practice made it impossible to arrive at any tangible results. A comparison was made, however, of the commercial values, as found by the census, with the latest reported valuations as made for taxation. The reader will recall that this table, as given in the *Railroad Gazette* of August 18, showed many extreme discrepancies. Some of these are explained. For example, in Connecticut, where the tax valuation is 114 per cent. of the census valuation, it appears that, under the law, the assessors base their statement on the stock and bonds and floating debt taken at their market value; and these securities include, of course, all the property of the railroads within the state. In the case of the New York, New Haven & Hartford, this probably includes large investments in steamboats and in street railroads.

In the first part of the bulletin Professor Adams says that the "strategic value" of a railroad was considered in estimating the figure at which it ought to be capitalized. It does not appear from the bulletin how much use he has made of this idea, but in the list of railroads, given in the table showing the rates of annual return on capital—which list, however, does not include every railroad in the country—there are four cases in which the rate of capitalization finally adopted is different from the rate of return on all the securities as computed. For example, the securities of the Gulf & Ship Island produce an annual return of 5.248 per cent., while the rate of capitalization adopted is 5.250. The Pacific Coast Company's securities yield 8.333, but the rate of capitalization is 7.500. The bonds of the Duluth, South Shore & Atlantic yield 4.410, but the stock yields nothing, and the rate of capitalization adopted was 4.400. The stocks and bonds of the Mineral Range road yielded 5.494, but the rate adopted is 5.500.

A large part of the interest of this bulletin centers in the essays which figure as supplements; the general explanation of Professor Adams being amplified by more detailed discussions by Professor B. H. Meyer, of the University of Wisconsin; Mr. W. J. Meyers, of Chicago; Professor H. M. Bowman and Professors M. E. Cooley and W. D. Taylor, and Mr. Eaton as already mentioned. Professor Meyer describes methods of valuation, methods of distribution of values among the states and methods of valuing railroads in foreign countries. Mr. Meyers describes the refined mathematical processes by which the rate of capitalization was computed. The other gentlemen named tell what has been done in Michigan and Wisconsin, where Professor Adams was engaged, four years ago, to prepare a plan for the valuation of the railroads. Professor Adams's own description of this work is also given.

The computations on which this census report is based must have involved an enormous amount of labor, even with the aid of tables and mechanical aids to computation. How much it has cost is not stated, of course. Those who declaim against the whole enterprise as academic and unnecessary, if not unjust, will declare the whole sum wasted. But as Mr. Eaton, in his essay, says that Speyer & Co., in valuing the Rock Island, last year, spent something like $100,000 on the job, the Census office will probably claim that the Bulletin represents a fairly wise expenditure of public money. And it is not for the humble editor to deny the claim!

Street Railway Capital and Earnings in 1905.

The statistics of street and elevated railways throughout the United States and Canada, compiled from returns of the various properties as given in "American Street Railways Investments" and printed in abstract in the *Railroad Gazette* August 11, are very incomplete, but they constitute the only regular annual statistics of street railways in this country. The recent report of the Census Bulletin for the year 1902 was presumably compiled with great care, but it was over two years old when it came from the press, and American street railway properties are changing some of their characteristics with such rapidity that this lapse of time takes away much of the value of the figures. According to the returns at hand there were 993 roads in the United States in 1904 and 42 in Canada. The track mileage in the United States was 29,548 as compared with 27,754 in 1903; and in Canada the track mileage was 861, an increase of only one mile from the previous year. Following the mileage figure the returns which are naturally sought next are the gross earnings and operating expenses, and these are conspicuous by their absence. It is a singular commentary on the American street railway situation at this critical and interesting period of its development that no authority publishes the earnings and expenses of these roads in annual form. It is most desirable that this should be done, for, although an aggregate figure of this character has in itself no *prima facie* value to the investor, except as showing the general trend of developments, it was found that the statements of the steam railroad companies were greatly improved when annual returns were required from them. At present the returns of the street railway companies are made in a more or less haphazard manner, and it would be very helpful if they were all required to present uniform reports in which certain items would always be found under certain heads. It is with the greatest difficulty at the present time that the expense accounts of many of these lines can be analyzed, and a suspicion often exists, which it is frequently impossible either to prove or disprove, that dividends are not earned.

The figures of capitalization are shown fully, although we cannot vouch for their accuracy. The total capital liabilities of these 29,548 miles of line during 1904 are stated at $3,217,091,971. This sum was made up of capital stock aggregating $1,761,571,812, and funded debt to the amount of $1,455,520,159. Per mile of track the average capitalization—total of stocks and bonds—throughout the country was $108,876. This is too high, and it is entirely safe to say that a good proportion of it is made up of stock which represents little more than promoters' profits and has no especial relation to the cost of the plant. The best sidelight on this figure of average capitalization is obtained by taking the figures of capital stock and funded debt in the State of Massachusetts, where the Railroad Commission limits these issues to what it terms "fair replacement value." The cost in Massachusetts is accentuated by the expensive elevated and underground system in Boston; also by the fact that in a populous state franchises cost more, real estate and right of way cost more, and larger equipment is necessary, and a comparatively great proportion of the mileage is made in city streets. Yet, in spite of all these elements which would tend to higher cost, the average capitalization in Massachusetts per mile of track was only $49,158 in 1904; considerably less than half of that of the country as a whole, including Massachusetts. The average capitalization (stocks and funded debt) of the steam railways in the United States was approximately $45,683 in 1903. The figure ordinarily given for capitalization is that of route mileage rather

than track mileage, but track mileage makes a much fairer comparison since the mile of track and not the mile of route is the unit of cost.

The figures at hand divide the street railway mileage of the country into five groups. The first group contains the six New England states, with 4,606 miles of track; the second group contains seven other Eastern states and the District of Columbia, with 9,156 miles of track; the third group contains nine Central states, with 10,728 miles of track; the fourth group contains nine Southern states, with 1,495 miles of track, and the fifth group contains 17 Western states and territories, with 3,563 miles of track. In 1903 there was no street railway mileage in South Dakota, Nevada and New Mexico. To-day, every state and territory except Alaska is represented, but there are ten states in the western group and five in the southern that have less than 100 miles apiece. Ohio leads all the states with 3,437 miles; a mileage almost as great as that of the entire western group. Pennsylvania is a close second with 3,319 miles, and New York, with 3,192, is third. Massachusetts has 2,734 miles and Illinois 2,080. It is rather surprising to find only 73 miles in North Carolina, and there is every reason to suppose that the southern and western states will soon receive the great influx of these lines which has been so marked as far west as the Missouri river and as far south as the Potomac.

Indian Railroads in 1904.

The Administration Report on the railroads in India for the calendar year 1904 shows that 27,565 miles of line were open. Of this mileage about 20,000 miles is owned by the state, something over 3,000 miles by native states, and about 835 miles by branch line companies receiving rebates from traffic interchanged with main lines, and the balance of the remainder by companies receiving some form of governmental guarantee. Something more than half of the entire amount is 5 ft. 6 in. gage, and the majority of the remainder is 3 ft. 3⅜ in. gage; although there is about 800 miles of 2 ft. 6 in. gage and something under 300 miles of 2 ft. gage. The history of these railroads begins with the year 1853. In 1860 approximately 1,000 miles were open; in 1870, nearly 5,000 miles; in 1880, 9,000 miles; in 1890, 16,000, and in 1900 nearly 25,000. During 1904, 621 miles of line were opened for traffic and 850 miles additional were sanctioned. Gross earnings of all Indian railroads in 1904 amounted to approximately 3,965 lakhs of rupees (say, $126,880,000) against 3,601 lakhs of rupees ($115,232,000) in 1903. Net earnings reduced to American currency amounted to $66,799,040, in 1904, an increase of $6,327,680 over the year previous. These net earnings yielded a return on the capital outlay of open lines and lines partly open, of nearly 6 per cent., which is an improvement of about ½ per cent. over the return yielded in 1903. The passenger traffic of these Indian lines is an extremely important source of income. Out of the total earnings in 1904 passenger traffic contributed almost a third; a proportion which has held roughly from the first. Much of this passenger traffic is carried in the very lowest class, with accommodations considerably inferior to any found in Europe, and at rates very much lower. The average passenger mile rate from all classes was under ½ a cent a mile, and the average distance traveled was about 40 miles. There have been no material fluctuations in these figures since 1884.

The financial result of the working of the state and guaranteed railroads in 1904 was a net gain to the state of $8,423,040; the largest amount yet earned in any year, after meeting, in addition to the expenses of working, all charges for interest on capital outlay by the state and on capital raised by the companies, and also the annuity payments for railroads purchased by the state, including both interest and sinking fund payments. This is the fifth consecutive year that there has been a surplus. Since the appearance of the last annual report, the railroad administration has been centered in what is known as the Railway Board, instead of in the Railway branch of the Public Works department, as heretofore. This is the outcome of a suggestion made by Mr. Thomas Robertson, C.V.O., in his report on the working of Indian railroads made by order of Parliament in 1903. Mr. F. R. Upcott, Government Director of Indian Railway Companies, is Chairman of the Board, and the other members are Mr. W. H. Wood, General Manager of the Hull & Barnsley Ry., England; Mr. T. R. Wynne, Agent and Chief Engineer of the Bengal-Nagpur line, and Mr. Neville Priestley, Secretary. These gentlemen assumed office in March, 1905.

The total capitalization of the lines open at the close of 1904 amounted to $1,113,021,120—$40,378 per mile. As is customary with Colonial, and especially with Indian reports, a tremendous amount of statistical information is included in the volume at hand, in sharp contrast to the meager returns given by the home companies. The report of Indian railroads for 1904 consists of 271 pages of the standard blue book size (8 x 13 in.), and the statistical information is given with fullest detail, frequently dating back to the beginnings of each line. In the joint interests of utility and economy, something between the standard British report and the standard Indian report would seem to be desirable.

The New York *Independent*, a weekly magazine with an intelligent and enterprising editor, has lately entertained its readers with a number of articles by unusually clear headed "working men"—using that term in its broadest and best sense—setting forth the position and claims of one or another class as against capital, or to meet the criticisms of the public; and in the last issue a veteran locomotive runner tells "The Engineer's Side of It"—gives the public the engineman's defense in connection with collisions and derailments where the engineman has been charged with the chief responsibility. He does not specify cases, but, after giving an account of experience, which is of a kind too familiar to our readers to require reproducing in this place, he says:

> No class of men on the face of the earth have a keener appreciation of their responsibilities than locomotive engineers. "In case of doubt take the safe side" is a fundamental rule of train operation, a rule that is drilled into an engineman from the very moment he begins service as a fireman until it becomes part of his life, a constant admonition to caution. He is drilled to regard the sacredness of a train order, the importance of a strict observance of signals and rules the great need of caution, and the absolute necessity of keeping his wits about him and never forgetting a meeting point or the slightest detail of an order. He lives constantly in an atmosphere of caution, of admonition. The necessities of his calling, the responsibilities connected with it, become a part of his life. He lives in a world of his own and belongs to a class set apart from other men. . . . Now, I ask, is not this training calculated to develop men of keen and retentive memory, men who have a minute regard for detail, men who are more likely than others to strictly obey orders and observe signals, men who are unlikely to take unnecessary chances? If the people suffer from the errors of engineers to a greater extent than they believe they should suffer is it not right to take into consideration the services they are forced to perform before pronouncing judgment?

We refer to this article here only for the purpose of adding the obvious conclusion, which the *Independent* omitted to give to its readers. Accepting the engineman's defense just as he offers it, must not the public demand an improved system? Either the men or the system must be wrong, or we should not have the distressing collisions and derailments; and if the men are already as good as can be found, the method of managing and regulating trains must need changing. So far as collisions are concerned, this conclusion is coming to be quite generally accepted, the space interval being adopted in place of the time-interval—though not fast enough. The editor of the *Independent*—who, by printing articles of this kind anonymously, assumes some responsibility for the discussion of the subject—ought also to have called for more detailed explanation. The veteran engineer confines himself too much to generalities. The public wants to know how it is that there are so many exceptions; so many enginemen who evidently do *not* "live in an atmosphere of caution"; who have not been "drilled to regard the sacredness of a train order."

Lehigh Valley.

A brief historical résumé of this property was printed in the *Railroad Gazette* last year (Sept. 30, 1904). It is sufficient here to mention that the road was originally an isolated coal carrier, very prosperous. Under the presidency of the elder Packer, the terminals at Lyons, Cayuga, Elmira, Mt. Carmel and Philadelphia, and a New York entrance, were established, and left unchanged for many years. Hartshorne succeeded Packer in 1880. H. E. Packer succeeded Hartshorne in 1883, and Wilbur succeeded the younger Packer in 1884. Under Wilbur's administration extensions were made to Buffalo, Lake Ontario, etc. Too much money was paid out in dividends, and the road was in thoroughly bad shape in 1893. It was left to Alfred Walter (1897) to put the property on its feet by turning earnings back into it, in spite of protesting stockholders. E. B. Thomas succeeded Walter early in 1903, and has conducted the enterprise with great energy and judgment.

The report for the fiscal year ending June 30, 1905, is the fifty-first annual one to be presented to the directors. The year was extremely prosperous, the large increase in gross earnings being only slightly offset by increased operating expenses. Total earnings were $31,275,843, an increase of $1,394,105. Operating expenses were $18,929,701, an increase of only $59,400; leaving net earnings $12,346,141, an increase of $1,334,704 from the returns for 1904. The most unusual feature of these returns was the decrease of $290,768 under the head of conducting transportation in the general expense account, since there have been indications of extravagance that have shown particularly in this part of the expenses on almost all of the railroads which have recently made their reports. The other income added to net earnings, consisting of dividends on stocks, etc., would have been larger this year than last except for a considerable increase in the deficit from the working of water lines. This deficit amounted to $120,851 in 1905 as against $13,315 in 1904. Deductions from total income were not materially changed during the year, although they aggregated slightly more. The net income of the Lehigh Valley Coal Company was smaller in 1904, but the total net income ($6,028,437), after all deductions, was $916,440 greater than last year.

Exclusive of its water lines, the company has doubled its net earnings since 1902, and this has been accomplished not so much

through the actual increases in gross, although these have been good, as by the radical reduction of operating expenses. The gains in passenger traffic constitute an interesting feature of the report. The best passenger year the company ever had was in 1902, when it was in position to make a strong bid for Pan-American traffic, and the department earned $3,664,820. This year, however, with no obvious special sources, its passenger business brought in $3,509,825, an increase of over 11 per cent. from 1904. The increase in general freight traffic, including both merchandize and coal, was 8½ per cent., while coal and coke tonnage alone, not including company's service, increased 7 per cent.

Taking up the operating statistics in further detail, it appears that the company obtained a slightly better average loading; average revenue tons per train mile amounting to 501 in 1905 as against 486 in 1904; and average tons per loaded car mile amounted to 20.31 as against 19.76. With an additional car mileage of 3,548,202, ton miles were increased 207,273,153. Of the 26 detail items under the head of conducting transportation there were minor increases in 15, as was to have been expected from the considerable increases in traffic, but these were far more than offset by the decreases. The most important decrease was in the cost of fuel for locomotives. The total locomotive mileage was 485,180 miles greater than in 1904, yet coal cost $192,531 less; the increase being $2,457,800 for 20,077,442 locomotive miles, an average fuel cost of about 12 cents a mile. The other chief decrease under this head was in rents of tracks,

Lehigh Valley.

yards and terminals, which cost $129,913 less than in 1904. There was also a tremendous increase in switching charges, which cost the road only $1,457 in 1905 as against nearly $50,000 in 1904, and in injuries to persons, the cost of which to the company decreased over 100 per cent. Maintenance of way and structures for the year cost $3,269,383, an increase of $210,125; the principal items of increase being repairs of roadway and renewals of rails. The total mileage of the company is 1,393, of which 576 miles has second track and 35 miles has third track. There are also 1,000 miles of yard tracks and sidings on the system; but, excluding these and deducting mileage controlled by stock ownership and trackage rights, the company appears to have spent about $1,847 for maintenance of way and structures per mile of single track. Maintenance of equipment in 1905 cost $4,894,269, an increase of $148,928; the principal item of increase being repairs and renewals of locomotives. The repairs and renewals cost, on the average, approximately $3,150 per locomotive owned; a figure obviously very liberal. The number of locomotives at the end of the year was the same as last year, but the total tractive power was increased 162,572 lbs. Twenty-six locomotives were rebuilt during the year and 20 heavy freight locomotives and 20 75,000-gallon tenders were purchased and charged to expenses and equipment renewal reserve in the capital account. Repairs and renewals of freight cars cost $1,820,172, a decrease of $9,593. This is at the rate of over $50 per car.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	1,394	1,393
Coal earnings	$13,530,337	$12,835,076
Other freight	12,432,583	11,994,701
Passenger	3,509,825	3,155,715
Total earnings	31,275,843	29,881,738
Maint. way and structure	3,269,383	3,059,258
Maint. of equipment	4,894,269	4,745,342
Cond. transportation	10,179,078	10,469,806
Total expenses	18,929,701	18,870,301
Net earnings from operation	12,346,141	11,011,437

NEW PUBLICATIONS.

Electricians' Hand Book. By Prof. T. O'Conor Sloane. The Norman W. Henley Publishing Co., New York, 1905. Leather 4½x6½; 760 pages. Price, $3.50.

Professor Sloane has written a most valuable handy reference book for electricians. It is not a collection of formulæ and miscellaneous data for the designing electrical engineer, but a practical guide for those having to do with the installation, care and operation of electrical machinery of nearly every description. The author discusses theoretical considerations only far enough to explain the operation of machines and the wording of such discussions is always clear and intelligible. Practically every important application of electricity is considered more or less at length. The book is profusely illustrated with diagrams and drawings. An index covering 24 pages adds greatly to the convenience of the book for reference purposes.

Machine Shop Tools and Methods. By W. S. Leonard, Instructor in Machine Shop Practice and in Practical Machine Design, Michigan Agricultural College. New York: John Wiley & Sons, 1905. 6 in. x 9 in.; 554 pages; 689 figures. Cloth. $4.00.

This is the third edition of this work. The two preceding editions were published in loose-leaf form, and, as stated by the author, served their purpose well as text-books for the students in the Mechanical department of the Michigan Agricultural College. This third or enlarged edition is presented with the hope that it may be equally valuable in connection with engineering departments of other schools. Owing to the purpose for which this book has been gotten up, it is naturally of an elementary character throughout. The author makes no attempt at describing the proper method of tool design, nor does he attempt to teach the machinist how to use the tools; but he does give very clear descriptions and illustrations both of hand and of machine tools, and the most advanced method of using the same. The illustrations as a whole are good, especially the line drawings. There are 32 chapters and an appendix, which contains questions on the text. The first chapters are devoted to describing the different forms of measuring and laying out tools, as well as hand tools; such as rules, micrometers, gages, calipers, surface gages, hammers, chisels, files, etc. Simple machines such as drill presses are then taken up, and the author gradually proceeds to describe the more complex machines and their tools; such as lathes, boring machines, planers, shapers, key-seating machines, milling machines, grinding and polishing machines, etc. The last two chapters describe the use of jigs for making interchangeable parts, and other modern machine shop methods. The information given in the text as a whole is good and no doubt will prove of great value when used in connection with practical shop work. As in other works, it would be of help to the reader if the author would insert self-explanatory captions beneath each cut, rather than figure numbers only. Full captions are especially desirable in books of an elementary character.

R. C. D.

TRADE CATALOGUES.

Hoisting Engines and Steam Pumps.—The Allis-Chalmers Company, Milwaukee, Wis., sends an illustrated catalogue descriptive of its hoisting engines and accessories as well as two bulletins which describe and give tests of two large pumping engines. One of these is of 30,000,000 gal. capacity and is installed in the Baden high service station of the St. Louis Water Works. The other is of 15,000,000 gal. capacity, and is installed in the Chestnut Hill high-service station of the Metropolitan Water Works, Boston, Mass.

Graphite.—The Joseph Dixon Crucible Co., Jersey City, N. J., sends its September issue of "Graphite." It contains a number of interesting short articles in which the value of graphite as a lubricant is set forth. Illustrations of a number of prominent buildings in which the steel work has been painted with Dixon's Silica graphite paints are also shown. The second installment of W. H. Wakeman's article on "Something About Condensers" is also given, as well as the usual amount of light reading matter.

Financial Publications.—The Moody Corporation, New York, publishers of Moody's Manual and other financial and reference books, is distributing a neat booklet entitled "The Power of an Ideal." It tells in an interesting way about the growth of this company since its start in 1900. In the rear of the pamphlet is given a price list of the various works published by the company.

CONTRIBUTIONS

Double-Header Mileage and Repair Bills.

Baltimore, Md., Aug. 26, 1905.

To the Editor of the Railroad Gazette:

My observation is that a good many transportation men give little consideration to the influence of double-header mileage on locomotive repair bills and that the protests of mechanical engineers on the subject are treated somewhat light-heartedly. I suggest that it will be profitable if you ask answers from your readers on the following question, viz.: Supposing two passenger engines were coupled and run constantly in double-header service on a road ballasted with gravel, how much sooner would the second engine have to go into shop for repairs than the leading engine?

ENQUIRER.

Record Production and Delivery of Flour.

St. Louis, Mo., Aug. 25, 1905.

To the Editor of the Railroad Gazette:

The Kehlor Flour Mills Company, of St. Louis and East St. Louis, on Thursday, August 17, bought two carloads of wheat then on track at East St. Louis and ordered them to its mills immediately. These cars were delivered there that night. The wheat was ground into flour on Friday, the 18th, sacked and loaded into cars that afternoon and forwarded via the Continental line from East St. Louis on the Baltimore & Ohio Southwestern, train No. 98, leaving at 7.10 p.m. The cars arrived in New York Tuesday morning, August 22, were delivered alongside the White Star steamship "Baltic" at noon, and the vessel sailed Wednesday morning, August 23d, and it is due to arrive at Liverpool on Wednesday, August 30. The flour, therefore, will be on the Liverpool market within two weeks of the time the wheat was delivered to the mill at East St. Louis. I believe this is the quickest time on record for this performance.

EDWARD HART, JR.

How to Divert City Passenger Traffic.

New York, Aug. 26, 1905.

To the Editor of the Railroad Gazette:

In a city paper of yesterday or the day before there is a suggestive item to the effect that—

> The plans inaugurated by the Brooklyn Rapid Transit Co. on Aug. 14, to divert traffic to South Ferry and thus relieve somewhat the congestion on the Brooklyn Bridge, have not met with much success. The loss to the company by running cars on several of the leading lines direct to South Ferry, it is said, has been $300 a day, and if this continues the service will probably be discontinued before the end of the month. It was mainly at the urgent request of the Transportation Reform League that the South Ferry service was started, and the railroad officials, after ten days' experiment, are pretty well satisfied that it will be difficult if not impossible to devise any scheme to lessen the tide of traffic on the bridge.

"Difficult if not impossible" is the phrase to which I wish to call your attention. What is the matter with a reduction of 20 per cent. in fares? Would not a saving of a cent a ride attract a good many passengers, and do away with this "difficulty"? I mean the fare through to Manhattan, of course. Such a reduction might necessitate an unequal division of profits with the ferry boat, but would not the street railroad make money, nevertheless? If the new route should take from the bridge only such number of passengers as ought to be taken from it the carrier would lose nothing on the bridge line, for he would still be using that line to its full capacity; and the traffic on the ferry line would be clear gain. Do you see any flaw in this reasoning? Why should not the city compel a reduction? Will the street railroad publicly claim that it would be unjust for the city to deprive it of the profits which it makes from passengers who ride across the bridge on strap-hangers? If the city government has not the courage to do what I have suggested, let us turn the question around for a moment. Advance the fares over the bridge. Is not the city bound to stop the disgraceful and dangerous crowding of passengers at the bridge terminal? Would not an increase in fares accomplish this? When the other bridges and the tunnel are ready, the low fares could be restored.

S. G.

Under-Running Third-Rail for the New York Central.

The accompanying illustrations show the details of the under-running type of third-rail with which the New York Central has been experimenting with a view to using in the electric zone around New York. The design originated with Mr. W. J. Wilgus, Vice-President of the New York Central in charge of the terminal improvements, and Mr. F. J. Sprague, and was perfected in the office of Mr. Edwin B. Katte, Electrical Engineer to the Electric Commission.

A number of advantages as regards safety, economy and reliability of operation are claimed for this type of third rail over the prevailing form of top contact rail, such as is used in the New York Subway, and it has received endorsement only after a careful consideration of the difficult operating conditions to be met and the relative merits of both types to meet these conditions. The drawing, Fig. 1, shows the details of the third-rail support and insulation. The rail is a special bull-head section, 70 lbs. to the yard, rolled in lengths of 33 ft. from steel having a composition which gives it high electrical conductivity. It is supported from brackets bolted to the ends of extension ties spaced 11 ft. apart. The brackets are of cast-iron, strongly ribbed, and are made of such shape as to give ample clearance to the end of the contact shoe. The insulator is U-shaped, and fits loosely over the top flange of the rail and the web so as to allow for some vertical play and to permit the rail to move freely in a longitudinal direction under expansion or contraction due to temperature changes. The sides of the insulator are slotted near the bottom edges, and a projecting sheif or lug on the face of the supporting bracket fits into the slot on the back while the bottom of the clamp fits into the slot on the outside face. This clamp fits around the side and top of the insulator, and is bolted to the top of the bracket. It will be seen that this is a simple device of few parts, each support consisting of three lag screws, one bracket, two insulators and one clamp with nut. Insulators made of a number of different materials have been tried, but glazed vitrified clay seems to answer the purpose as well as any, and is cheaper.

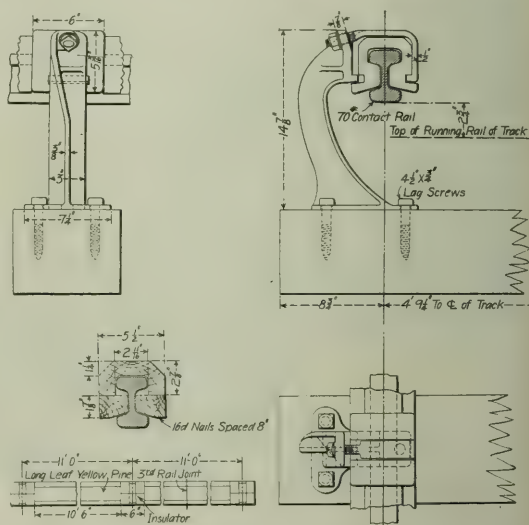


Fig. 1—Detail of Supporting Brackets and Wood Protection, New York Central Type of Third-Rail.

The wood covering between supports consists of three pieces, which completely cover the top and both sides down to within ⅞ in. of the bottom of the rail. The top piece is cut from long leaf yellow pine, 5½ in. x 2⅞ in. It is champfered 1¼ in. on each of the top corners, and is slotted $2^{11}/_{16}$ in. wide by $1^{17}/_{32}$ in. deep on the under side to fit snugly over the top flange of the rail. The two bottom pieces fit in above the bottom flange of the rail close up to the web, and are toe-nailed to the top piece with 16d nails. This forms a smooth covering without bolts or supporting brackets, which if used might become electrified and cause death or injury if touched. The only possible way to come in contact with the rail is to reach in under the board covering.

The joints in the third rail are equally simple, consisting of two flat splice bars with two bolts and flexible bonds soldered to the ends of each rail. These joints are placed midway between supports, as shown in the sketch.

In mounting the third rail on a four-track line the arrangement and dimensions shown in Fig. 2 will be preserved. The third rails for tracks 1 and 2 will be mounted between the tracks, leaving the space on the outside and between the center tracks clear. At breaks at cross-overs and switches an under-contact incline will be used, which will be supported and protected in the same manner as the remainder of the rail. Fig. 3 shows a section of the experimental track at Hoffmans, N. Y., equipped with this type of third rail, where exhaustive experiments with a number of types have been carried on during the last year.

Fig. 4 shows the relative location and appearance of the Sub-

way or Long Island Railroad type of third-rail installation, and of the New York Central type.

For the same clearances the New York Central type requires a location of from ½ to ¾ in. farther out than the Long Island type, but in order to amply clear steam railroad equipment it is proposed on the New York Central to place the rail 1½ in. farther out than

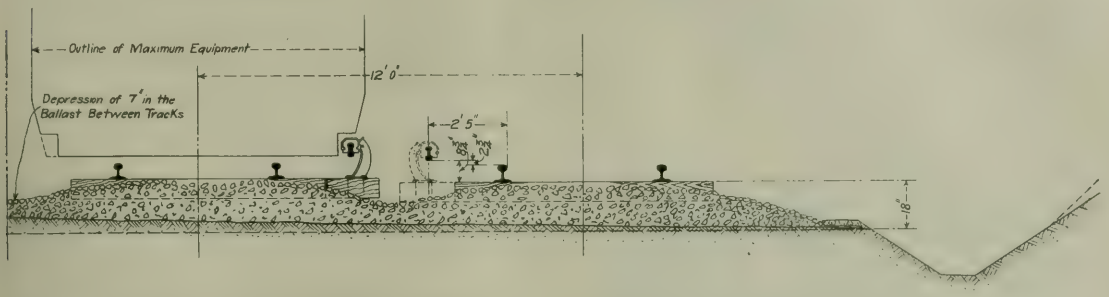


Fig. 2—Half Cross-Section of Standard Four-Track Roadbed Showing Location of Third-Rail.

on the Long Island Railroad, or a total of 29 in. This difference of 1½ in. is such as not to preclude interchange of equipment with a suitable shoe, which can be arranged so as to automatically pass from under-contact to top-contact, and vice versa. Experiments are now being carried out with a type of contact shoe which will work equally well with top or bottom contact. This is essential because the New York, New Haven & Hartford will, in the near future, require equipment which will interchange with the New York Central and the Pennsylvania and Long Island Railroads.

The following are the principal advantages claimed for the New York Central type of rail over the top-contact rail as determined largely from the experience gained on the experimental track.

First Cost.—The top-contact type of third rail omits the use of boards on the side of the rail, except at crossings, but for the purposes of this estimate the complete protection with side-boards is figured.

Top-contact type	$4,325 per mile.
New York Central type	4,100 per mile.
Saving in favor of New York Central type	$225 per mile.

Maintenance.—The New York Central under-contact type will cost much less than the top-contact type for annual maintenance for the reason that it has but 7,600 parts per mile as against 24,500 parts per mile for the top-contact type. Experience so far with the New York Central type has disclosed no breakages whatever in the clay insulators, whereas on top contact types it has been noted that a large proportion of the clay insulators are already broken and the indications are that the breakages will increase. The board protection on the New York Central type has a continuous support so arranged that it cannot crack and warp, whereas the board protection on the top-contact rail is supported at intervals. Much of it is very thin board, and consequently cracks and warps under exposure to weather, and the cost of renewals will be heavy. The vertical posts holding the protection boards on the top-contact rail, resting loosely on the insulators, will easily move and not affect the latter. However, observation shows that the rail rests on the metal caps and in moving tilts the insulators and ties. The danger of the top-contact third-rail causes the trackmen to work with hesitation and caution, with consequent loss of time and expense to the company, whereas the New York Central type is so well protected that the trackmen may work with freedom and thus use their time to the best advantage of the company.

Fig. 3—Under-Running Third-Rail Installed on the New York Central's Experimental Track at Hoffmans, N. Y.

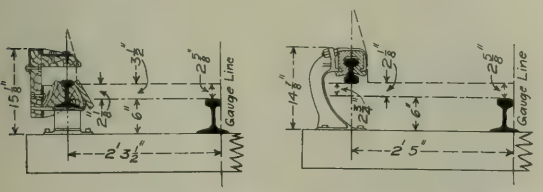


Fig. 4—Comparison of Clearances of Top-Contact and Bottom-Contact Third-Rail Installations.

Operation.—The top-contact type of third rail is open to the action of sleet, whereas the under-contact type is thoroughly protected from sleet. The former has a space between the top of the rail and the underside of the protection board, which catches snow and can be cleaned out with difficulty, whereas the under-contact type will not catch the snow, and a simple projection on the ordinary snowplow will clear away the snow and keep the rail clear by the action of gravity. The top-contact type has the rail base within 5½ in. of the ground at the top of the tie, whereas the lowest part of the New York Central type is 8¾ in. above the same level, and consequently further removed from snow, ice and rubbish. The construction of the New York Central type is such as to require the maintenance of a clear space between the live third rail and the ground, whereas with the top-contact type the accumulation of snow, ice and rubbish may continue without disturbance. This condition permits a considerable leakage of current, especially during the winter months, and consequently a loss of money in operation.

Safety.—The principal feature to be considered in the adoption of the third rail is that of safety. The top-contact type permits the edge of the rail to project nearly an inch beyond the edge of the protection board, so that in the absence of the board on the edge

of the rail a man walking near the third rail or accidentally dropping a tool is liable to injury. Moreover, a man stumbling or falling so as to come in contact with the third rail is very liable to touch the live portion; also the lower bolt for fastening the protection posts on the top-contact type are alive with current, and project so as to cause a short-circuit in case a man touches them. On the other hand, the New York Central type is thoroughly protected against accidental contact of any kind, and, in fact, the live portion cannot be touched unless there is an intention to do so, as will be plainly seen from the drawings.

Performance of an Allfree-Hubbell Locomotive on the Pittsburg & Lake Erie.

The Pittsburg & Lake Erie was among the first of the roads now having Allfree-Hubbell locomotives in service to equip an engine with this valve gear for trial purposes. Since doing so the motive power department of the road has been conducting various tests and keeping careful record of the locomotive's performance. Among other things these tests developed water economies of from 10 to 15 per cent. Following is a report of the performance of this locomotive in competition with a companion locomotive similar in all respects except that it had the usual valve gear. The information is from Superintendent of Motive Power L. H. Turner, who says:

The following figures show the results of a carefully conducted comparative test between Pittsburg & Lake Erie locomotive No. 275 equipped with the Allfree-Hubbell system of steam distribution, and locomotive No. 124, the same in all respects except being equipped with an American balanced slide valve. The test was conducted with the locomotives engaged in through freight service and all observations were taken on the same piece of track going in the same direction. Every effort was made to obtain strictly average service conditions in the way of changes in enginemen, varying temperatures, different weights of trains, etc.

The test covered a space of time of about three months; the following report, however, shows the results of one year's performance and all assumptions as to miles run, tons hauled, and rate per ton are based upon actual facts and extracts from past annual reports. Charges and credits were made and given both engines alike for tons hauled, water consumption and speed made.

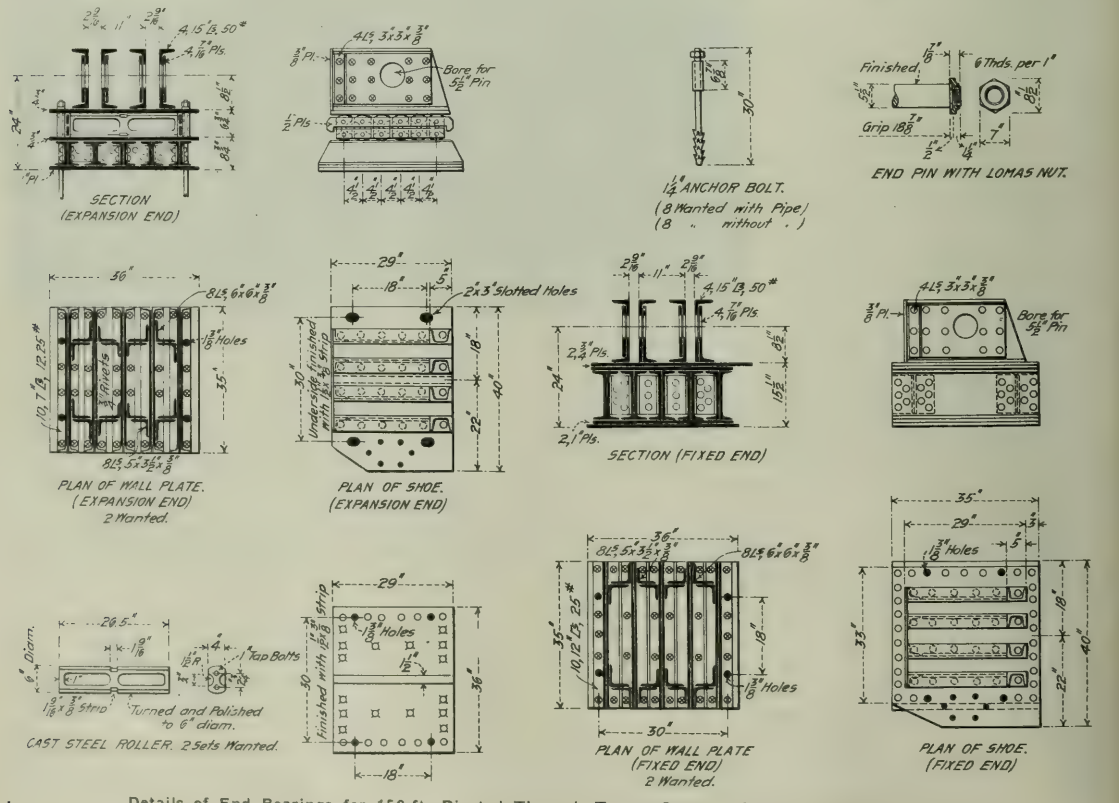
General Assumptions.	
Miles run per year	30,000
Revenue tons per train	1,800
Average haul in miles per ton	62½
Revenue per ton-mile	$0.006
Actual Performance.	
Tons per train No. 275	2,486
Tons per train No. 124	2,440
Difference	46
Speed, miles per hour, No. 275	14.36
Speed, miles per hour, No. 124	13.89
Difference	0.47
Coal consumption per 100 ton miles, No. 275, lbs.	13.01
Coal consumption per 100 ton miles, No. 124, lbs.	13.68
Difference, lbs.	0.67
Credits to No. 275.	
Increased revenue due to saving of coal	$152.40
Increased revenue due to increased load	2,889.13
Increased revenue due to increased speed	1,125.00
Total increase in revenue for the year	$4,166.53

The Pittsburg & Lake Erie also now has a passenger locomotive equipped with the Allfree-Hubbell gear, which was placed in service in June. Results from its performance are not yet available.

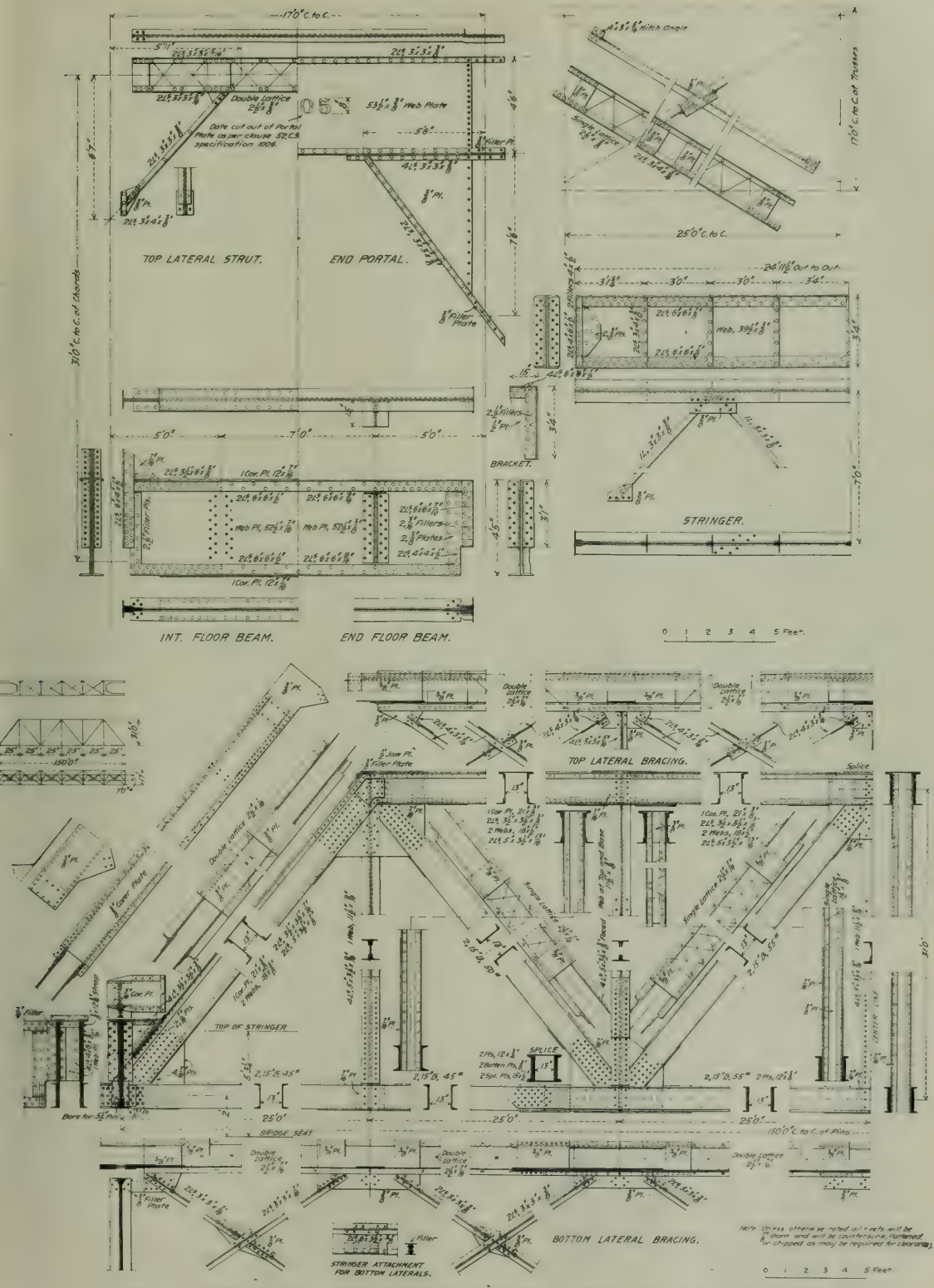
Standard Bridges on the Harriman Lines.*

The drawings this week show the details of the Harriman Lines' standard 150-ft. riveted through truss, the longest riveted span in use. For greater spans pin-connected trusses are used and the standard designs for this type of bridge will be shown in a later series of articles. The 150-ft. span is essentially the same in all of its details as the 140-ft. span shown last week. Heavier sections have been used for some of the important members, but the method of fabrication has not been altered. Some changes have been made, however, in the design of the end bearings. The bearing shoes for both the expansion and fixed ends are built up of four 15-in., 50-lb. channels with $^{7}/_{16}$-in. batten plates riveted to the webs. The wall plates are made correspondingly heavier and stronger. The estimated weight of one span is 311,000 lbs.

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, August 11, 18 and 25.


SECTION (EXPANSION END)
1¼" ANCHOR BOLT. (8 Wanted with Pipe) (8 " without ")
END PIN WITH LOMAS NUT.
PLAN OF WALL PLATE. (EXPANSION END) 2 Wanted.
PLAN OF SHOE. (EXPANSION END)
SECTION (FIXED END)
CAST STEEL ROLLER. 2 Sets Wanted.
PLAN OF WALL PLATE (FIXED END) 2 Wanted.
PLAN OF SHOE. (FIXED END)

Details of End Bearings for 150-ft. Riveted Through Truss—Common Standard, Harriman Lines.



Details of Trusses and Floor of 150-ft. Riveted Through Span—Common Standard, Harriman Lines.

The Grain Crops.

Current western estimates of the wheat crop in the United ates range from 624,000,000 to 700,000,000 bushels. The Ames-ooks Co. has just issued a circular which argues for the higher ure, in addition to 80,000,000 bushels from northwestern Canada, d says that in wheat, after a year of absolute independence of reign outlet for our product, we have undoubtedly raised a crop nich means an exportable surplus and a price to conform with foreign basis less the cost of delivering it in foreign markets. om all appearances this means an exportable surplus of 200,000,-0 bushels of wheat this coming year. This means that export siness must become a matter of almost daily occurrence and in ood volume both of wheat and flour to move this quantity during e crop year. As to how much this will be modified by the ability inclination of the American farmer to hold back his crop is a atter of conjecture, but it should not be forgotten that an 80 cent heat price in primary markets is, after all, a very fair price and profitable one on such a yield as America has secured this year. is also true that it is yet to be demonstrated as to the stimula-n which will be given our domestic consumption by a price basis 80 cents instead of the present basis of $1, at which even now e first arrivals of new wheat are selling in Minneapolis. Reports om Russia are very contradictory, but it appears fairly safe to as-me that their crop this year is not entirely satisfactory. It also fairly demonstrated that the heavy shipments from Russia the st year would have been even heavier had their inland transporta-n facilities been equal to the task of moving the grain. It is also rtain that the need for actual money by Russia will force every shel of merchantable grain that can be moved and marketed into reign markets as fast as their facilities can handle it.

As we (the Ames-Brooks Co.) see it, this is the situation. After o years of very low ocean grain freights there is a promise this fall a large movement of grain (wheat, flax, corn, oats and barley), in of which America has an apparent exportable surplus. The antici-tion of this movement has already advanced ocean freights very arply for the later fall months. It is reasonable to expect that will cost in November 5 cents to 10 cents per bushel more to ach a foreign market from an American primary market than it es to-day on the present low lake, rail and ocean freights, all of nich are certain to advance sharply. Now, if August wheat in icago at 80 cents is not on an export basis, what will be done th December wheat at 82 cents, and an increased cost of at least cents per bushel to the foreign markets? There is only one an-er. If America has the surplus wheat to sell and if the farmer sists on marketing it, either American prices must decline to eet this condition as it materializes or foreign prices must ad-nce.

In flaxseed.—It seems almost certain that America has grown rhaps the largest crop of flax she has ever raised. Yields in the rthwest are universally exceeding the estimates, and the crop so far along that very little damage can now be feared. It seems rtain that this article also must reach an export basis, and here e foreign price basis is more in doubt. Some Duluth seed was ld for export when Duluth October was $1.25 per bushel. Since at time the foreigner has declined steadily with our declines and oided making further purchases. With the market now 20 cents wer the foreigner shows less inclination to buy American seed an he did 60 days ago.

In rye.—Foreign requirements will undoubtedly be larger than fore as there is no doubt of a shortage in the rye crops abroad. this article, however, it is still interesting to note that in the erman markets Russia is selling her new crop rye, which is sup-osed to be very short of the normal, at prices less than American e can be delivered from our new crop.

Oats and barley.—Some export business is working in these ery day, and with the foreign demand for feed stuffs promising be a material factor in the price all this year, we think these rticles will continue for export. The higher cost of reaching for-gn markets as ocean freights advance with the wheat movement ay operate against the American price in these articles.

In corn.—Foreign markets are still steadily taking old crop merican corn at a price of around 65 cents in foreign markets. hey are also willing to contract our new crop at 5 cents to 10 cents scount under this basis, so that there promises to be a steady arket at good prices for what promises to be one of the largest rops of corn America has raised.

Summing up the grain situation in America there is everything hat should please our business interests. We appear to have a ood exportable surplus of all grains, for price basis is very satis-ctory to the farmer and promises to draw from foreign markets o America an amount of money value which cannot help but have favorable effect on American business this coming year.

A press despatch from Odessa, Southern Russia, says that the xport grain trade is paralyzed by lack of cars due to the drafting f cars and engines by the government for military uses.

Railroad Statistics for Year Ending June 30.

The following table compares certain statistics of the railroads in the United States for a series of years, as if they were worked as a single property. It is open to criticism on the ground that it contains some reduplication, but the comparison afforded is sufficiently accurate to be valuable. More extended comment on these Interstate Commerce Commission statistics was printed in the *Railroad Gazette* last week.

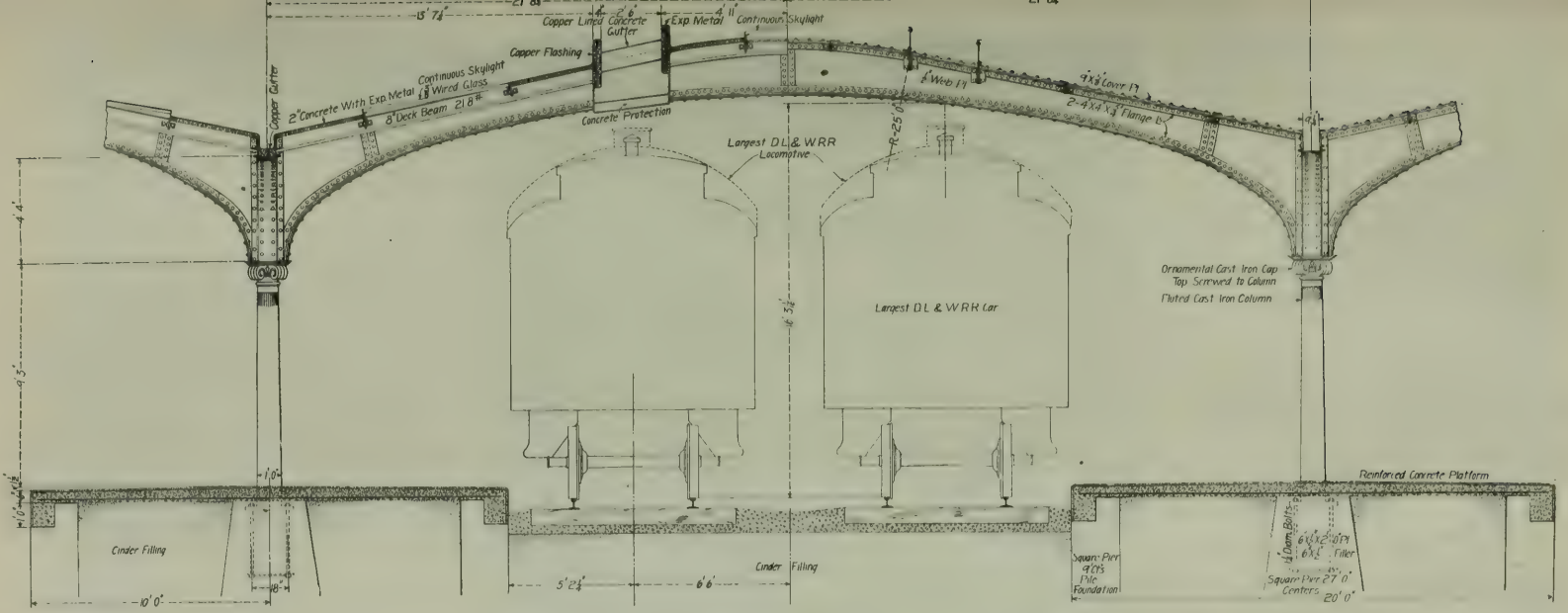
Railroad Statistics for Year Ending June 30.

	1904.	1903.	1902.	1901.	1900.
Miles road completed.	213,904	207,977	202,472	197,237	193,346
Increase, 12 mos.....	5,927	5,505	5,234	3,892	4,051
Mileage in hnds rcvrs	1,323	1,185	1,475	2,497	4,178
Locomotives, No. ...	46,743	43,871	41,228	39,584	37,663
Cars owned, pass'gr..	39,752	38,140	36,991	35,969	34,713
Cars owned, freight..1,692,194		1,653,782	1,546,132	1,464,328	1,365,531
Cars owned, total....1,798,561		1,753,389	1,640,220	1,550,833	1,450,838
Employees 1,296,121		1,312,537	1,189,315	1,071,169	1,017,652
Per 100 miles road	611	639	594	548	529
Total stock and funded debt, millions..	$13,213.1	$12,600.0	$12,134.2	$11,688.2	$11,491.0
Stock and debt per mile of road	64,265.0	63,186.0	62,301.0	61,528.0	59,676.0
Gross earn'gs.millions	1,975.1	1,900.1	1,726.4	1,588.5	1,487.0
Average per mile....	9,306.0	9,258.0	8,625.0	8,125.0	7,722.9
Pass. carried, millions	713.4	694.9	649.9	607.3	576.8
Same, 1 mile, millions	21,923.2	20,915.8	19,690.0	17,353.6	16,039.0
Freight carried,million tons.	1,309.9	1,304.4	1,200.3	1,089.2	1,101.7
Same, 1 mile	174,522.1	173,221.3	157,289.4	147,077.1	141,590.2
Average rate per ton-mile (mills)	7.8	7.6	7.6	7.5	7.3
Average pass. fare per mile (cts.)	2.0	2.0	2.0	2.0	2.0

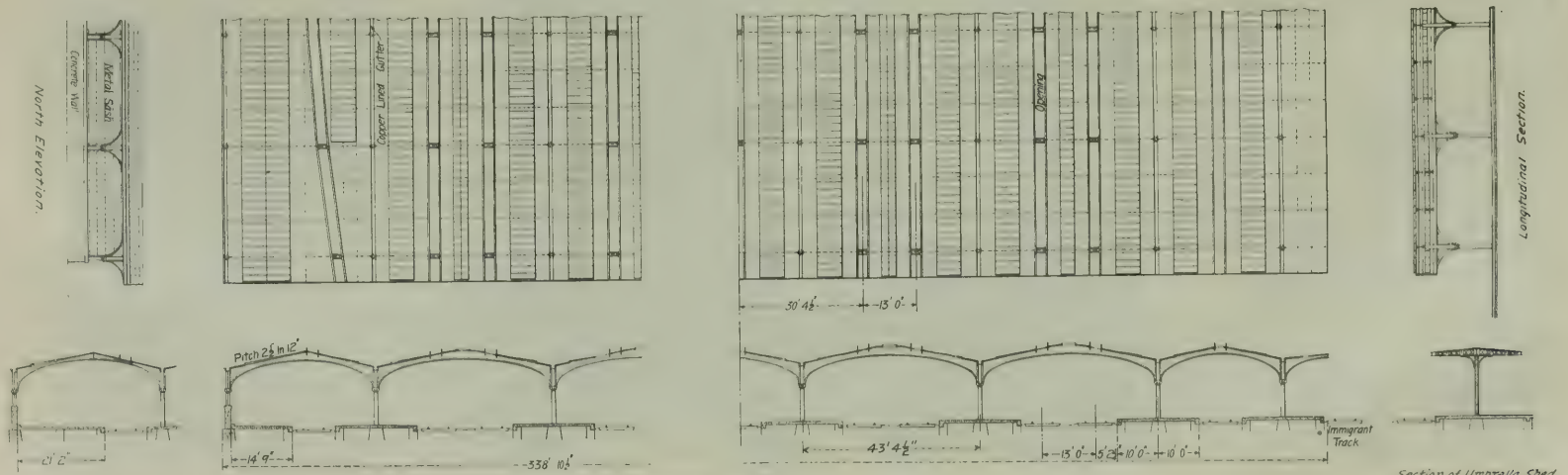
A Novel Train-Shed for the New Hoboken Terminal of the Lackawanna.

The accompanying illustrations show a novel train-shed, which was designed by Lincoln Bush, Chief Engineer of the Delaware, Lackawanna & Western, for the company's new terminal at Hoboken. It is an entirely new departure in train-shed design and the advantages claimed for it over the ordinary type of shed, with single long truss spans of steel, are: First, that its first cost, or cost of construction, is cheaper—probably 30 to 40 per cent. less; second, the cost of maintenance will be less; third, it will be lighter, and, fourth, it will be less gaseous and not so noisy. The proposed shed, as shown, consists of a number of longitudinal sections built up of structural steel, reinforced concrete and wire glass. In all cases where the steel would be subjected to the locomotive gases it is protected by concrete and by copper. The roof is supported by longitudinal rows of columns, placed 27 ft. between centers, and the maximum height of the roof spans is about 16½ ft. from the top of rail. Transverse built-up roof girders are placed between the columns and resting on these are longitudinal purlins which directly support the reinforced concrete roof slab and the skylights in it. The longitudinal opening over the locomotive stacks, shown in the cross-section, extends the entire length of the train-shed, and with the exception of the crossing of the roof girders it is entirely open. The tops of the locomotive stacks will come within 6 in. or 8 in. of this opening, and it is thought that practically all of the exhaust from them will be discharged directly through and outside of the shed. The girders and purlins directly over the smoke stack are to be encased in concrete to protect them from the gases. To protect the platform from rain and snow and to direct the gases in their passage from the stacks, a built-up section encased in a concrete slab 4 in. thick by 2 ft. 1 in. high is placed on edge on either side of the opening, as shown in the illustration.

Three continuous skylights, of wire glass, each 6 ft. wide, will be placed longitudinally in the roof of each section. The one in the middle of the section and at the peak of the roof will admit light directly to the inside windows of the cars on the track below, and the remaining two rows of skylights placed over the platform will admit ample light to the outside windows of the cars. The proximity of the skylights to the car windows will no doubt tend to produce a better light in the cars than is usually found in cars in the majority of large train-sheds. In addition to the transverse pitch which is given to the roof in both directions from the center it also has a slight longitudinal pitch between the columns. A copper gutter running longitudinally is placed over each row of columns. This is connected with a down spout, which is placed in each of the hollow vertical cast-iron columns. The majority of the ground on which the terminal is built is made ground, and to avoid any trouble from settlement the footings for the concrete platforms and the platforms themselves have been designed to avoid all difficulty from this source. Three rows of piles are to be driven under each platform, one row under each outer edge and one row down the middle. Small square piers, spaced at 9-ft. centers, will be built on the outer rows of piles and similar piers will be built on the center row of piles for the columns supporting the train-shed. The concrete platforms will be reinforced with expanded metal and will be supported by both rows of small piers as well as by the column piers. As proposed at first, and as described in the *Railroad Gazette* of March 24, 1905, the original plans of the Lackawanna terminal called for 16 tracks under the train-shed. As shown



Typical Cross Section.



Proposed Train Shed for the New Hoboken Terminal of the Lackawanna.

in the accompanying plan, the new design embodies only 14 tracks. After careful consideration, it was thought better to reduce the number of tracks and to have wider platforms, rather than to have a large number of tracks and narrow platforms. This is for the reason that the number of trains which can be operated in a terminal at one time depends largely upon the rapidity in which they can be loaded and unloaded, and the wider platforms will naturally tend to a more rapid movement of passengers.

The New "Alton Limited."

The Chicago & Alton placed in service August 20 entire new trains for its "Alton Limited" runs between Chicago & St. Louis. No one who sees these splendid trains will be inclined to dispute the Alton passenger department's claim that they set the "high mark" in passenger equipment. The trains are in day service and are made up of six cars, comprising a mail, a composite smoking and baggage, a chair car, a dining car, and two parlor cars, one of which has an observation platform. The trains were built by the Pullman Company and embody many new ideas. In general construction they are modeled on the lines of the Pullman equipment exhibited at the World's Fair at St. Louis last year. One of the most notable differences from usual practice is in the lines of the deck, which is square instead of the conventional arched form. The effect is decidedly pleasing, giving an impression of roominess.

The composite baggage and smoking car is 73½ ft. long. The baggage compartment is trimmed in ash and the smoking compartment in quarter-sawed oak, inlaid with ebony and whitewood. In this car the eye is instantly attracted to the seats, which are unique in form and were designed specially for this equipment. The object was to obtain a distinctive design which would combine comfort, roominess and a suggestion of the home. They are made of natural wood and upholstered in green Spanish leather. There is ample room beneath them for hand baggage. The toilet room for the car is placed at the forward end of the smoking compartment, between it and the baggage section, instead of at the rear. The space at the back end where the toilet room is usually found is occupied by a leather-upholstered settee, there being one on each side of the car; also one at the forward end of the compartment.

The chair car is 72½ ft. long and seats 64 persons. It is finished in Mexican mahogany, an orange-colored wood. The square-decked ceiling has figured veneer panels done in two shades of light green. The aisle carpet is a soft-toned body brussels. This car, also, has a new design of seat. Unlike the usual reclining chairs, these seats stand on four legs and therefore have the same advantage as those in the smoking car, namely, abundance of room beneath for hand baggage. Hat and coat hooks have been entirely omitted from both smoking and chair cars, the idea being that with the ample provision for hand baggage on the floor, the overhead racks will take care of all hats, coats and umbrellas. The appearance of the car will undoubtedly be more sightly in the absence of coats and hats swinging from the walls. The chair car seats are not reclining chairs. They have the Richards panel back, but instead of a moving adjustable panel within a rigid frame, the entire back moves, being pivoted at the bottom and fitted with stiff springs, so that it adjusts itself to any posture the occupant may assume within the limits of its travel of several inches. These seats are not reversible, of course. They are upholstered in green Spanish leather.

The dining car, 62½ ft. long, is finished in "vermilion," an East Indian mahogany. It is polished to a high luster, giving a rich and elegant effect. The tables are rounded at their outer ends, affording a great improvement in appearance, besides producing the effect of greater aisle width and therefore of more room. Another novelty is the wall lights, which are set in shield-shaped sconces between the windows, there being three lamps in each enclosure. The chairs have the green leather upholstery, and the carpet is a green-shaded Wilton. The cars have accommodations for 30 persons. The kitchen is arranged to permit both front windows to be used for serving during rush periods. Ordinarily, one is for the receipt of used dishes and tableware, which slide from the window down an incline into sinks for washing. All appointments of the kitchen represent the very latest practice. An electric fan contributes to the comfort of the occupants.

Interior of Dining Car, "Alton Limited."

The engravings convey an excellent idea of the interior finish and ornamentation of the parlor cars. Vermilion mahogany is used for a paneled and inlaid wainscot high enough to enclose wide observation windows with French scroll panels roundabout and above them orange-opal glass. Above the window panels is white buckram stenciled with a frieze of poppies and edged with green and gold. The ceiling contains recessed panels of the white buckram stenciled in green and gold, the clear-story panels being separated by white enameled cross-beams. The chairs are a golden brown velour and the carpet green Wilton. One of the cars, the observation-parlor, is intended more especially for men and has a large smoking room with seats for ten and a buffet adjoining. The broad observation platform at the rear end gives the proper finish to this sumptuous train.

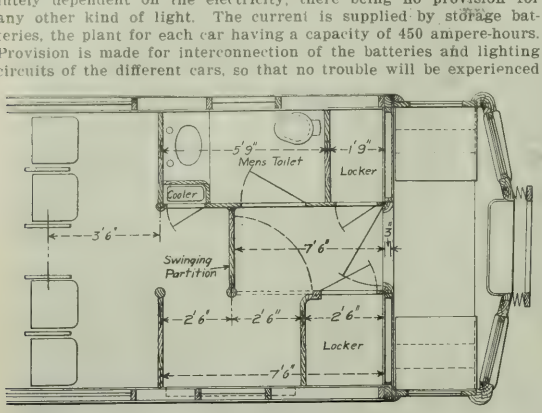
Another new feature, shown for the first time on the World's Fair exhibit equipment, is the swinging partition in the entrance passageways of the chair cars to protect the occupants of these cars from objectionable drafts and screen from view the entrances to the toilet rooms. A floor plan of the end of one of these cars herewith illustrates the arrangement. The partition is shown in what

Interior of Combination Smoking Car, "Alton Limited."

Interior of Chair Car, "Alton Limited."

might be termed the "running" position, crosswise of the passageway. To give a direct passage, when passengers are being received, for instance, the partition is swung around at right angles to its present position, as indicated by the broken lines. It is held at either point by a latch, and may be locked in position if desired. This is the first train in service with this feature.

The train is lighted throughout with electricity and the lighting fixtures are of a unique and special design. The train is absolutely dependent on the electricity, there being no provision for any other kind of light. The current is supplied by storage batteries, the plant for each car having a capacity of 450 ampere-hours. Provision is made for interconnection of the batteries and lighting circuits of the different cars, so that no trouble will be experienced



Plan of End of Chair Car Showing Swinging Partition.

in the event of the failure of the batteries on one or more cars. The entire train can be lighted from the plant on one car. All cars are supplied with electric fans.

The new equipment was given the same exterior colors as the old, which consist of three shades of maroon stenciled in gold. The total weight of the six cars is 293 tons. Each train is equipped throughout with the Forsyth automatic air and steam coupler.

The old "Alton Limited" equipment has been placed in service between St. Louis and Kansas City, and will be known as the "Alton-Burlington Limited." It will be remembered that these two roads have a joint arrangement for a combination short route between these two cities.

Proper Methods in Conducting Painting Tests.*

BY GUSTAVE W. THOMPSON.

A number of years ago the President of our society, Dr. Dudley, wrote a series of papers treating of the characteristics of paint, and, we believe, for the first time in the history of the art, attempting some scientific understanding of paint problems. Not merely were these papers the first, in our opinion, that treated of the subject of paints scientifically, but, it may be said, that since that time practically no progress has been made along this line. It is to be deeply regretted that Dr. Dudley has not had time to enlighten the public further in this direction; for, we are confident, had he been able to do so, the science of painting and paint manufacture would have been very much simplified. The situation, as it is presented to-day, is this: New paint materials are offered to the consumer, from time to time, these paint materials having more or less value, but in regard to which the manufacturers, as a rule, claim a somewhat more universal merit than these paints in actual use would warrant. It is natural for the paint manufacturer to advocate the use of his product or products for every condition under the sun, because he hopes by this broad advocacy to increase their sale. If there is one principle, however, on which the members of this society are pretty well agreed, it is that there is no complete paint which is suitable for all conditions of exposure; that is, every paint must, at least, have its various components put together in different proportions according to the conditions of exposure to which it is to be subjected.

We believe that it is the business of the engineer to design the paint which he is going to use under any given conditions. We believe that the paint manufacturers are only too anxious to supply what the engineer may demand. If the engineer starts out to select a paint, his proper attitude is not to take any one of the prepared paints on the market and specify that, because the manufacturer tells him it is the best for the purpose in question; but it is his duty to make such experiments as are practical for the purpose of finding out what paint is the best for the conditions to which the paint surface is to be exposed. To examine a paint on a large scale is, of course, the most satisfactory way provided the paint turns out well. We are unquestionably of the opinion that the surest proof of a paint is its use, just as we are confident that the best way to detect a poison is to take it internally. The unfortunate part of the matter is, however, that the use of the paint in order to find its value may leave the user firmly convinced that this value is a negative quantity. Supposing that he is able to try a paint in a limited way on full-sized structures, and the result, while not a minus result is really very nearly that—that is to say, suppose the result leaves him somewhat in doubt, how is he going to tell whether the fault lay in the paint or its method of application? How can he be sure that the relative failure of the paint may not have been due to inherent destructive conditions external to the paint itself but peculiar to the structure painted? A painting test of this kind, properly called a "field test," is of inestimable value when accompanied by tests conducted under conditions all of which are known. These are what may be called "laboratory tests," and, if conducted with care and parallel to field tests, they act as a check upon the results obtained by these field tests and give a better basis on which to rest scientific conclusions. These laboratory painting tests, made with the intent of exposure under service conditions, should be supplemented by other laboratory tests which should parallel information enabling the engineer or paint chemist to determine the relative value of a given paint in advance of the results which are obtained by field or laboratory tests under service conditions. We must not reverse this order, however, and attempt to substitute purely chemical tests for exposure tests under service conditions until the laboratory tests have demonstrated their value.

By the term "painting tests" in our title, we have intended to include those tests which can be conducted with scientific accuracy, but which, at the same time, are as close as possible to ordinary practice so long as this accuracy is not impaired. Unfortunately, tests supposedly of this kind are in most cases without value. So much is this the case that laboratory painting tests are often spoken of in words of derision, as though they could be made to produce any result desired by the skillful manipulator of the brush. In most cases these painting tests are made by persons interested in exploiting certain products, whereas they should be conducted principally by the consumer. The primary cause for the lack of value which these painting tests usually show is that they are not conducted with sufficient accuracy. Tests of this kind should be conducted under the supervision of a competent engineer or chemist and with as much care as if a chemical analysis were being made.

Committee E has outlined a method of conducting painting tests for protective coatings, this method demanding proper attention to all those details which are essential to the obtainment of accurate results. These tests, when carried out by the sub-committee having them in charge, should prove of inestimable value. There are other paints, however, which, though "protective," are used for the purpose of producing a desired finish of appearance. Most paints are of this kind, and I propose, with your permission, to say a few words about painting tests made, using this class of paints:

Let us, to start with, take the question of the relative "covering power" of paints. To my mind, the term "covering power" has only one proper meaning; that is, the power to hide the surface painted. It is, as Dr. Dudley has pointed out, a function, first, of the light-destroying or absorbing power of the constituents of a paint, and, second, of the difference in refractive index between the pigment and vehicle. Whatever it may be caused by, however, we are more interested in the actual facts of the case than the reasons therefor. In comparing two paints for covering power, it is generally understood that these two paints should have practically the same color and be very nearly alike in tone, for the eye is not able to note accurately the difference in covering which exists between paints of different colors or tones. When we compare two paints of the same color and tone for covering power, our work is somewhat simplified when it is borne in mind that very few paints are homogeneous as regards pigment. Most paints contain several pigments, the principal one being a white pigment of some kind. Only with straight white or dark colors is the pigment likely to be homogeneous. Furthermore, with the colored paints consisting largely of white pigment, the tinting material is so fine that only a very small amount is usually needed to give the tint desired. In this case the actual covering power of the paint is principally dependent upon the white pigment present. Our greatest interest, therefore, centers around the covering power of white paints; for, when we wish to design a paint of a certain color, we usually select a given white paint and add to it such coloring materials as have the highest possible tinting power and of which, consequently, we have to add the least amount possible. The result is that, practically speaking, tests for covering power are demanded for white paints only, and it is of these that I desire to speak.

On the threshold of our inquiry, we are confronted by two difficulties: The first of these has to do with the amount of vehicle we are to use to get the "consistency proper for painting." In the present state of the art, there is apparently no method for determining this consistency; the consistency proper for painting is simply a matter of rule of thumb. There is nothing standard about this consistency; it may be one thing in winter, another in summer;

*From a paper read before the American Society for Testing Materials Atlantic City, June 30, 1905.

one thing with a flat brush, another with a round brush, and still another with the squirt gun. We have a refuge, however; and that, it seems to me, is the only safe one. When we have mixed our paint to a "consistency proper," in our opinion, "for painting," let us record the formula on which we prepared the paint and let our report state this formula in full detail. If the paint was a prepared or ready-mixed paint, then the analysis of the paint should also be reported in as nearly formula form as possible. In other words, we may have difficulty in determining what is the consistency proper for painting, but we need have no difficulty in recording the composition of the mixture which was used in making a given test for covering power; and this, in the present state of the art is all that we can ask. The second difficulty which presents itself is in the adoption of a spreading rate per gallon of paint. There can in practice, of course, be no standard spreading rate; and yet we have found that any white paint which has, according to our experience, a consistency proper for painting can be readily brushed out so as to cover 1,200 sq. ft. to the gallon of paint when applied to a fairly smooth surface; and, in most cases, if it is not spread out at that rate the paint will run. We solve this difficulty of the spreading rate at which the paint is to be applied in the same way that we solve the difficulty in connection with the consistency proper for painting; that is, we simply make the spreading rate followed a matter of record. To illustrate, let us suppose that we have received two paints which we desire to compare for covering power; these paints we will say are prepared paints—that is, they have been thinned to "consistency proper," in the manufacturer's opinion, "for general painting." We would, first of all, analyze these paints to determine the formulæ on which they were prepared. Inasmuch as the pigments in the two paints may vary in composition and, consequently, in specific gravity we make a determination of the weight per gallon of paint as received; and, knowing the percentage by weight of the vehicle present, we calculate the percentages by volume of vehicle and pigment present, which gives us a somewhat better conception as to the nature of the paints. All the information we have thus obtained is recorded. Our next step would be to compare these two paints as to the relative ease with which they can be spread over the same area, without any particular regard to their covering power. If we find that they can be spread over the same amount of surface, without, as is usual, great difficulty, we adopt a standard spreading rate for the two paints—say, 1,200 sq. ft. to the gallon, one coat—and apply the paints to standard prepared surfaces at that rate; and, when we are through, we compare the paints for their covering power, or power to hide the surfaces painted. Now let us compare this method of making a painting test for the covering power of white paints with the method usually followed: Jones has a paint that he wants tested. He takes it to his friend Brown, the painter, and wants his opinion. Brown reports in a few days that the paint he received from Jones covered better than any paint he had ever used. Now, Brown may have been perfectly honest in making this report to Jones; but, unless the formula on which the paint was mixed and the rate at which it was spread is given, Brown's opinion is worse than useless.

We describe here more in detail our method of comparing white paints for covering power:

Use white pine boards, 30 in. long x 10 in. wide and, approximately, 1 in. thick. Each end of the board is provided with a cleat having a tongue fitting into a groove on the end of the board and securely nailed on. The entire board, including the cleats, to be finished to the size given above. Three of these boards are primed with, we will say, the following paint mixtures: White lead paste, 100 lbs.; linseed oil, one-third boiled, 75 lbs. No attempt is made to secure a definite amount of priming paint to the unit of surface; this, for the reason that the boards may vary considerably in their absorptive power. When this priming coat is dry, each board receives a diagonal stripe of lampblack in japan about 1 in. wide on one or both sides of the board, as may be desired. When this black stripe is dry, it is given a second coat of paint mixed to a consistency proper for painting, the formula being recorded. The weight per gallon of the paint so mixed is then obtained by finding its specific gravity and multiplying by 8.33, which gives the weight per gallon. Inasmuch as the board which we are using has a total surface of 680 sq. in., all we have to do is to find what the ratio is between 680 sq. in. and the spreading rate at which we desire to apply the paint in order to find the fraction of the gallon which we wish to apply to each board. If the rate adopted is 1,200 sq. ft. to the gallon, then we get the formula: 680 sq. in. : 1,200 sq. ft. :: 1 .. x, the reciprocal of "x" being the fraction of a gallon of paint to be applied to each board, one coat. Having the weight of the paint per gallon we easily get the amount of paint by weight to apply to each board, one coat on all sides. When this second coat of paint is thoroughly dry a similar coat is applied; and, when dry, the boards can be compared for the covering power of the paints on them. We mention the painting of three boards with each paint to be compared. The purpose of this is that variation in results are obtained between boards which are apparently painted in an identical manner. These variations are not great, but it is thought best to eliminate them, to a certain extent, by painting three boards and selecting the one giving medium results for comparison with boards painted with other paints.

Tests conducted along these lines, we believe, will give valuable and scientific results and will enable the intelligent person to draw safe conclusions.

Let me state here, by way of illustration of the usefulness of this method, one of the results obtained by tests comparing pure white lead and linseed oil with a mixture of white lead and a small amount of barytes with linseed oil. The pure white lead was mixed on the formula of 100 lbs. of white lead paste to 30 lbs. of linseed oil; two mixtures containing barytes were made on the same formula as the white lead and pure linseed oil, except that to the pure white lead was added an amount of barytes corresponding to 10 per cent. by volume of the white lead present and the amount of oil was also increased 10 per cent., so that the mixed paint contained in each case the same percentage of pigment by volume and the same amount of oil by volume. Another mixture was made, adding 20 per cent. by volume of barytes to the sample of white lead paint and a corresponding amount of oil. These three paints were then compared by the above method for covering power and spread at the uniform rate of 1,200 sq. ft. to the gallon. The result was that both paints containing barytes showed a very perceptible diminution in covering power. Now, this illustration has not for its purpose the saying of anything in favor of white lead and against barytes, but simply to show that if the statement is made that a small percentage of barytes can be added to white lead without impairing its covering power, some explanation must be made as to the method by which such a result is obtained. If in any painter's hands the result has been found that the addition of a small percentage of barytes did not impair the covering power of the white lead, it must have been due either to the fact that less oil was used or that less surface was covered per gallon of the paint containing barytes than by the straight white lead.

Perhaps the most important test that can be applied to paints is a durability test—that is, a test as to the permanency of the paint film itself. Boards painted, as in the making of the covering power tests described above, can be exposed to the weather and the durability of the paint films observed. Durability tests, to be of value, should be conducted with the same care as the covering power tests. The formulæ on which the paints were mixed should be recorded, also the rate per gallon at which they were spread.

Quite recently, painting tests with a view to observing the durability of various paints were reported on to the International Association of Master Painters and Decorators and the results obtained were published generally in the paint journals. Undoubtedly, these tests were conducted conscientiously and the conclusions reported give honest opinions about the results obtained. We feel, however, compelled to question these results for several reasons which appear to me to be very important. In the first place, single boards only were painted with each paint and exposed. At least three boards should have been painted and exposed alongside of each other, and the board which showed results about the average of the three should have been selected for comparison with other paints similarly selected. Very frequently it will be found that two boards painted apparently in the same manner and with the same paint will show differences in results due to differences in the boards themselves. In the second place, the formulæ on which the paints were mixed are not stated with sufficient detail. In the third place, there is no information given as to the spreading rate at which the respective paints were applied. Considering any two of the boards, the paint on one board may have been twice as thick as on the other, for all we know to the contrary. We have very little doubt that the thicker the paint film, the greater its durability. This emphasizes the importance of having painting tests conducted under the supervision of the engineer or chemist. The ordinary master painter is, we believe, thoroughly competent to interpret results and to conduct field tests on full-sized structures; but, when it comes to preparing boards for exposure, special training is required, such as the chemist or engineer only can be said to have.

To conclude, no matter what the painting test may be, whether it be of colored paints or white paints, whether it be with homogeneous or mixed pigments, whether it be for covering power or durability, the essential features that we should insist upon are that the formula of the paint should be stated fully; that the thickness of the film—or what is the same thing, the rate at which the paint is spread—should also be stated. These two requisites of proper painting tests should also be demanded in all tests for the permeability of paint films or their permanency, no matter how these tests may be applied. If we wish to compare two paint films for their permeability by the dextrine test, we should know, to start with, that these two films have approximately the same thickness. It is a safe assumption that the thicker the paint film, the less its permeability. If we desire to compare two paint films for their permanency, we should know that these two paint films are of the same thickness, as the elasticity and general life of the film are proportionate to its power of resistance to oxidizing influences, and the thicker the film, the more permanent are its inner parts.

Time Freight on the Chicago & North Western.*

The Chicago & North-Western under date of August 1, 1905, issued a new pamphlet covering the movement of time freight. The general system used corresponds to that of the Red and Green Ball freight on the St. Louis & San Francisco, Missouri Pacific, etc., described in our issue of August 18. The Chicago & North-Western, however, has only one class of time freight. This class is considerably more comprehensive than that of the Red Ball freight classification on the St. Louis & San Francisco and rather less comprehensive than the Green Ball freight classification. It includes in all 161 articles of a valuable, perishable, or otherwise urgent nature. A point of difference with several time freight systems in common use, which was also noted in the case of the St. Louis & San Francisco, is that the manifest envelope is done away with. The waybills are of a distinctive color, which is all that is considered necessary. The coding system of designating stations is managed in about the same way as with the other lines previously reported. Certain stations are designated coding stations and assigned certain letters and set of numbers supposed to last long enough to take all of their freight to destination, so that there will not be any duplicate codes out at one time. For example, Chicago (40th street) is code "W" and has 999 numbers. When No. 999 has been reached it reverts to one again. The time freight is thereafter reported at each succeeding terminal by its code instead of the car number and initial. This saves very largely in the wire work. What is known as the "15" report shows on what train the freight is forwarded, together with the destination, etc. This blank, also known as the "consist" report, is in all its essential details precisely the same as the consist report shown in the description of the St. Louis & San Francisco system, page 161, form 106-A. The yard master or agent at the terminal then makes a "17," or passing report of these cars. This is also substantially the same as the Frisco system's passing report 52, except that the Frisco report devotes several lines as a blank asking explanation of delays which may have occurred. In the event that a car is set out, a "19" set-out report is made (see Frisco set-out report 21). When the car is set out of a train the conductor leaves this report with the telegraph operator at the point where the cars are set out and the operator immediately wires the information given thereon to the car service agent and to the chief train despatcher. Should the freight be transferred to another car, the necessary information is entered on the waybill in the place provided therefor, but no change is permitted in the original code letter and number, which must identify the shipment to its destination. The delayed cars forwarded report No. 21, which is shown herewith as characteristic of the system,

*For previous time freight articles see August 25, Atchison, Topeka & Santa Fe; August 25, Boston & Maine; August 18, St. Louis & San Francisco.

Form 54 A.

Chicago & North Western Railway Co.

TIME FREIGHT CARD WAY-BILL

No. 137601

Code Letter WO Number

For Car No.

THIS CAR MUST NOT BE DELAYED

From WOOD ST., CHICAGO

To

Via

Date 190

Consignee

Final Destination

Contents

Weigh at

Weighed at — WEIGHT OF CAR AND CONTENTS IN TONS

Gross

Tare

Net

TRANSFERRED INTO

Car No.

At 190

To be filled in by Conductor leaving car at destination

Date 190

Train No.

Time

AGENT AT DESTINATION WILL STAMP HEREIN THE DATE RECEIVED.

☞ SEE INSTRUCTIONS ON OTHER SIDE.

Time Freight Card Way-Bill.

RECORD OF TIME FREIGHT CARD WAY-BILL.

The following is a record of a time freight card way-bill used in lieu of way-bills giving full particulars.

No. 137601

Code Letter WO Number

For Car No

From WOOD ST., CHICAGO

To

Via

Date 190

Consignee

Final Destination

Contents

Weigh at

Weighed at — WEIGHT OF CAR AND CONTENTS IN TONS

Gross

Tare

Net

Way-bills giving full particulars for all the freight in this car have been made and sent forward by train mail. They are numbered as follows:

Record of Way-Bill.

55A SYMBOL { Letter / Number

Chicago & North Western Railway Co.

FOREIGN CAR, Home Route and Record Card.

(This Space to be used for the Movement of an Empty Foreign Car.)

FROM

TO

(Empty Movement Authorized by)

Car Initials Car No.

PENALTY

Will begin 190

Received from R. R.

At Station

Date 190

SEND HOME

To R. R.

At Station

REMARKS.

INSTRUCTIONS.

A card of this form must be completely filled in by Agent for each Foreign Car received, loaded or empty, from other roads, which the Agent will deliver to Conductor who moves car from his station. If a loaded car, the card must be attached to and put with the way-bills covering same, and the card must accompany car, loaded or empty, until it passes off this line.

When a car is delivered to connecting line Agent will take up this card.

When a car is received in "return" movement, the Agent will make a new card, showing the date (30 days after date of receipt) when Penalty will begin; the R. R. from which it is returned, station and date and must ascertain from his record and fill in under the head of "Send Home" the original "Home Route" as was shown by the old card, giving the R. R. and station from which it was originally received.

Conductors will not move a Foreign Car, loaded or empty, unless accompanied by this card, except in handling Foreign Cars to or from Non-Agency stations, in which case they must deliver to or receive from the Agent who makes billing for such Non-Agency station, a card of this form to cover.

A Foreign Car belonging to a road with which we have direct connection should be returned to that road at nearest junction point, provided such routing does not involve additional mileage.

THIS CARD DOES NOT AUTHORIZE EMPTY MOVEMENT. SUCH MOVEMENT WILL BE DIRECTED BY THE SUPERINTENDENT, CHIEF TRAIN DISPATCHER OR CAR SERVICE AGENT.

Note.—These rules will not apply to such Refrigerators and other cars as are assigned to this Company from time to time, due notice of which will be given.

E. E. BETTS, Car Service Agent.

Record Card, Foreign Cars.

Form 217. 6-29-05. 30M

Chicago and North-Western Railway Co.

21 DELAYED CARS FORWARDED REPORT.

The following cars, way-billed TIME FREIGHT, which have been delayed, were forwarded from

_____ *Station,* _____ *190*_

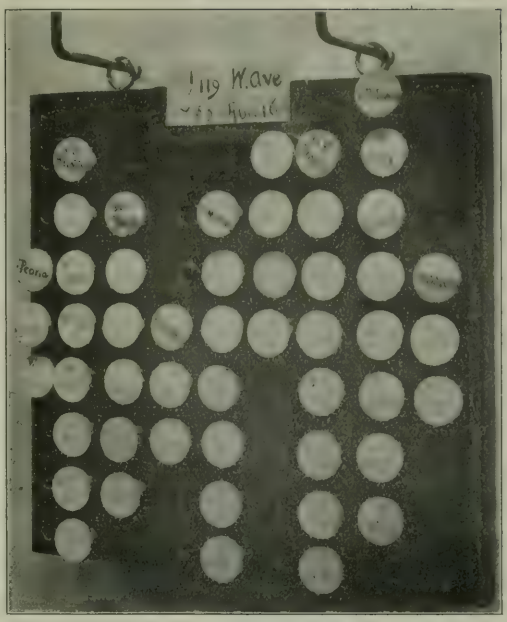
CODE LETTER AND NUMBERS			TIME FORWARDED	TRAIN NUMBER
Code Letter.	From Lowest Number	To Highest Number		
B	C	D	F	G
			M.	
			M.	
			M.	
			M.	
			M.	
			M.	
			M.	
			M.	

(A) _____ *Yardmaster.*

(B) _____ *Agent.*

This form will be used by Agents and Yardmasters to report to Car Service Agent the forwarding of cars loaded with Time Freight, which have been delayed for whatever cause, **when not sent out in proper train.**

Delayed Car Report.

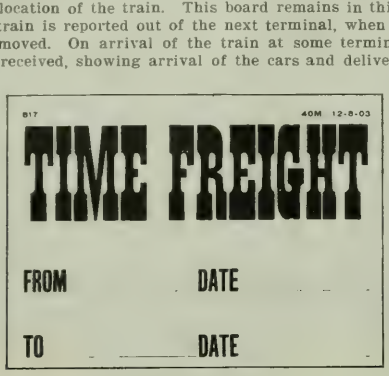


Enlarged View of Train Board.

Graphic Method of Keeping Track of Time Freight, Chicago & North-Western.

does not differ in any material particular from the St. Louis & San Francisco report covering the same thing, except in this alone, that an effort has been made to print each of the Frisco reports on a different colored paper as an additional means of glance identification. This is not done on the North-Western, except that the time freight card waybill is red and the foreign car home route and record card is green.

Perhaps the most characteristic and interesting part of the Chicago & North-Western method is the neat and graphic time freight car and train record, which is illustrated in the accompanying photographs. On receipt of the "15," or consist, report in the car service agent's office, showing the forwarding of time freight in a certain train, a train is made up on a board, 7 in. x 7¼ in., which is bored full of holes to contain the plugs which are marked with the code letter and number corresponding to the code letter and number assigned to each coding station. After this train is made up it is hung on the board between the terminals, in accordance with the location of the train. This board remains in this location until its train is reported out of the next terminal, when the board is again moved. On arrival of the train at some terminal a "17" report is received, showing arrival of the cars and delivery to con-



Time Freight Card.

necting lines, when the board is taken off and the codes distributed in cases provided for this purposes. If a car is set out between terminals, or fails to go forward from a terminal in its proper train for any reason whatever, a "19" set-out report is made and this report is plugged, together with the code letter, number and destination in the board at the point where the car is set out and remains there until a report is received showing forwarding. A car of time freight which has started must appear somewhere on the board, either in a train, in a terminal yard, or set out at some intermediate station. After the "15" and "17" reports are checked with the board they are filed in the drawers shown, for reference. The accompanying forms show the time freight card waybill and the record of it; two forms which are quite simple and complete in the North-Western system. The foreign car home route and record card, which is also shown, is a rather uncommon form. This card, as stated, is green.

For particulars of this system we are indebted to the courtesy of Mr. R. H. Aishton, Assistant General Manager, and Mr. E. E. Betts, Car Service Agent.

National Railroad Commissioners' Convention.

The seventeenth annual convention of the National Association of Railroad Commissioners was held at Deadwood, S. Dak., August 16 and 17. Twenty-three states were represented by about 50 commissioners, assistants and secretaries. According to one of the speakers, no member of the Interstate Commerce Commission was present. Addresses were made by Governor Elrod, of South Dakota; President Ira D. Mills, of the Association, and others. The first report presented was one suggesting improvements in the annual statistical forms for reporting expenditures on maintenance of way and maintenance of equipment. The proposed changes were in the line of simplification and of including items sometimes treated as doubtful. For example, in M. W. it is proposed to include replacement of all buildings, including cost of additional buildings necessary to operation of property; in maintenance of equipment, replacement of shop tools, including tools necessary to maintain all equipment up to the general standard of efficiency. Objection was made on the ground that this would make it too easy for railroads to use income for permanent betterments. No definite action was taken.

A proposition was made to ask Congress to give precedence in Federal courts to cases looking to the enforcement of state railroad commissioners' orders and orders of the Interstate Commerce Commission in which the government is not a party. After considerable objection the resolution was carried.

There was a long discussion on railroad taxation and plans for ascertaining the value of railroad property; and, as usual, a great variety of facts and views were brought out. No action was taken, the subject being referred back to the committee (which, however, will not consist of the same men as last year) with instructions to report, if possible, a plan for a uniform system of railroad taxation.

What powers should be granted to railroad commissioners was again discussed, but naturally no agreement was reached, as representatives of the "strong" and of the "weak" commissions cannot agree with each other. Uniform classification was again thrashed over, the committee varying its repeated recommendations by proposing a plan to divide the country into 12 sections, each to have an equal railroad mileage, each to have a representative on a committee which should prepare a classification in two years, then allow one year for objections, then another year to consider the objections, and then—presto, the thing is done.

Interstate Commerce Commissioner Clements made a report summarizing the laws which have been passed on railroad topics by the several states within the past two years, and the recommendations for legislation which have been made by state railroad commissions. The committee on the Interstate Commerce law recommended nine amendments to the present law, embracing the usual propositions to give authority to establish rates, to regulate private car lines, etc.

The President of the Association for the ensuing year is Commissioner W. G. Smith, of South Dakota, and the next meeting is to be held at Washington, D. C., April 2, 1906. At that time it is proposed to devote four days to business sessions.

Railroad Shop Tools.

(Continued.)

LATHES.

The accompanying illustration, Fig. 1, shows the latest design of 40-in. x 40-in. planer made by the New Haven Mfg. Co., New Haven, Conn. These machines are made in two sizes, which plane 10-ft. and 12-ft. inside of the pockets respectively. They are designed for the heaviest class of work. The beds are very deep and wide and are strongly braced; the table is wide and thick and has deep ribs; the three T slots are planed out, and holes are drilled. The driving motion is by two belts, one on each side of the machine, thus giving a very steady motion; the gearing is contained entirely within the bed and is mounted on short steel shafts of large diameter, running in cap boxes. The cross bars are very deep, are strongly braced, and can be quickly raised or lowered by power by friction clutch from the main driving shaft, as shown in the cut. The cross-feed screws are cut with double threads giving rapid adjustment, and the bronze cross-feed nuts can be taken out when necessary to renew them without removing the saddle from the cross bar. The heads are provided with vertical, cross and angular

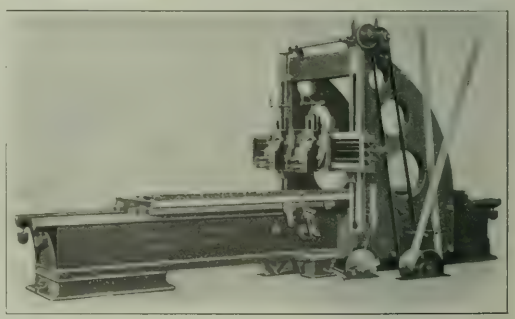


Fig. 1—The New Haven 40-in. Planer.

automatic power feeds. They are under full control of the operator from either side of the machine, and can be adjusted in any direction without disturbing the feed pawl. The table can be run back to examine the work without changing the position of the dogs, and the feed can be instantly changed from nothing to the coarsest without stopping the machine. All gears and racks are cut from the solid stock, and shafts and screws are of steel, with nuts case-hardened. The table has four wipers attached which lubricate the V's and keep them clean; the waste oil is caught in detachable cups on the bed, and can be again used in the wipers. Three sets of friction rolls are also provided running in oil pockets in the bed. When desired, cross-bars of suitable length for double heads can be furnished, so that the extra head can be run aside and the remaining head plane the full width of the machine. Heads with

automatic power feeds for one or both uprights can also be furnished, if desired. The driving pulleys on the counter-shaft are 16 in. in diameter by 4¼ in. face, and should be run at 14¼ r.p.m. to give a cutting speed of 1 ft. per minute.

Fig. 2 shows a 36-in. x 12-in. frog and switch planer, made by the Putnam Machine Co., Fitchburg, Mass. This machine is especially adapted to planing frogs and switches. The bed is deep and is reinforced by a heavy base which extends entirely around the machine. The side walls are tied with box girders and between the housings and supporting the bull wheel the bed has double walls. The ways have a sectional bearing of 6¾ in., an angle of 45 deg., and a spread of 27¼ in. Ample oil reservoirs and automatic disc oilers are provided for lubricating the tracks and side gibs. The platen is 32¾ in. wide and 7 in. deep, and is provided

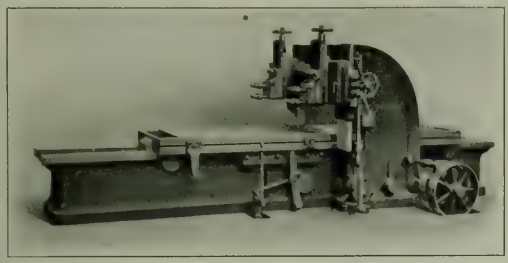


Fig. 2—The Putnam 36-in. Frog and Switch Planer.

with adjustable gibs which receive the pressure of side cuts and prevent the table from lifting. The racks are 9 in. wide, are cut from the solid, and are secured to the platen by bolts and dowels. The driving mechanism consists of forged steel shafts, 34 in. driving pulleys, 2¾ in. face, and a train of steel gearing powered 150 to 1. The main driving shaft is supported by four massive bearings fitted with phosphor bronze bushings. The driving and reversing pulleys have anti-friction, self-oiling bushings. The pulley shaft pinion has spiral cut cogs, which impart a quiet, smooth and even motion to the platen. The table has quick return and can be operated from both sides of the machine. The cross-rail is 15½ in. deep and is stiffened by two heavy ribs between the housings. It is fitted to each housing on four sides and secured to the same by lock gibs and six large steel housing bolts, which locate

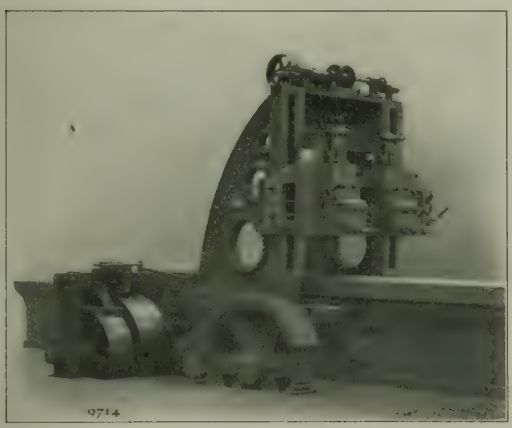


Fig. 3—The Nile-Bement-Pond 36-in. Frog and Switch Planer.

the cross-rail 9 in., 12 in. and 14 in. in height from surface of table. The cross-rail is extra long, so that one head may be run entirely out of working range. The heads are specially designed to meet the enormous strain incident to this class of work. The saddles are arranged to permit the heads to come into close proximity. Each head has a vertical traverse of 10 in., either by hand or power; also hand or automatic independent horizontal movements across the beam. The feed mechanism can be operated while the machine is in motion and will operate at either end of the stroke. The housings have an 8½ in. face and are of web-box form. The weight of the planer, fitted with a 12-ft. platen is 28,000 lbs. The machines are also made for platens with lengths of 14, 16 and 18 ft.

The 36-in. x 36-in. frog and switch planer shown in Fig. 3 is made by the Niles-Bement-Pond Co., New York. This machine stands at right angles to the line shaft, and the power is transmitted by a heavy train of spur gearing which is all cut from the solid. The cutting power is about equal to that of the usual 8-ft. planing machine and all parts are proportionately heavy. The table is gibbed down to the bed so that lifting or side movement is impossible. The machine can be handled from both sides. The housings, cross-rail and heads are all extra wide and heavy. The saddles are also wide, but are made right and left to allow the tools to come close together. The tool-slides have power, cross and down feeds, but no angular setting. The tool-boxes have small angular setting to clear tools. The cross-rail is provided with power elevating gears, but if desired the elevating mechanism on the crossrail can be omitted and the housings made shorter; in which case the machine will plane only 12 in. high, as the cross-rail is then bolted to the housings.

(To be continued.)

All-Electric Interlocking.

The General Railway Signal Company has, during the present year, erected 30 "all-electric" interlocking plants (or has furnished the material for such plants, to be put up by the railroad companies), and an officer of the company has given us the following list of these plants with the sizes of the machines. Following this list is one of 26 places for which the company's all-electric apparatus has been ordered, but is not yet fully installed:

Plants Installed During 1905.

Place.	Road.	No. spaces in machine.
Lynchburg, Va.	Norfolk & Western	56
Centreville, Ill.	Terminal R. R. Assn. of St. Louis	72
Champaign, Ill.	Illinois Central	32
Gilbertsville, Ky.	Illinois Central	16
Harriman Junction, Tenn.	Cincinnati, N. O. & T. P.	24
Hinton, Va.	Chesapeake & Ohio	12
Coalburg, Va.	Chesapeake & Ohio	24
Fourth Ave., Saginaw, Mich.	Pere Marquette	64
Washington Ave., Saginaw, Mich.	Pere Marquette	44
Fort St., Detroit, Mich.	Pere Marquette	32
Eldorado, Kan.	Atchison, Topeka & Santa Fe	24
Algoa, Texas	Atchison, Topeka & Santa Fe	48
Bakerstown, Pa.	Baltimore & Ohio	16
West Columbus, Ohio.	Baltimore & Ohio	56
Bellaire, Ohio.	Baltimore & Ohio	28
Wilders, Ind.	Erie	36
Morton Grove, Minn.	Chicago, Milwaukee & St. Paul	44
Lake, Wis.	Chicago, Milwaukee & St. Paul	40
Franksville, Wis.	Chicago, Milwaukee & St. Paul	40
Ranney, Wis.	Chicago, Milwaukee & St. Paul	56
Atlanta, Ga.	Atlanta Terminal Co.	184
Pana, Ill.	Cleveland, Cin., Chi. & St. Louis	112
Lawrenceburg, Ind.	Cleveland, Cin., Chi. & St. Louis	28
Ashmore, Ill.	Cleveland, Cin., Chi. & St. Louis	12
Kedzie Ave., Chicago, Ill.	Chicago & North-Western	104
Melrose Park, Ill.	Chicago & North-Western	28
Florence, Ala.	Southern	20
Marion Ave., Allegheny, Pa.	Pennsylvania Lines	72
Willows, Ill.	Pennsylvania Lines	112
Indiana Harbor, Ind.	Indiana Harbor	120
		1,556

Ordered, but Not Installed.

Place.	Road.	No. spaces in machine.
Portage, N. Y.	Erie	32
Bridgeport, Chicago, Ill.	Chicago & Alton	80
Crawfordsville, Ind.	Cleveland, Cin., Chi. & St. Louis	44
Superior Junction, Wis.	Chic., St. Paul, M. & O.	28
Hawthorne, Ill.	Chicago, Bur. & Quincy	56
Barboursville, Va.	Chesapeake & Ohio	28
Newport News, Va.	Chesapeake & Ohio	24
Wadsworth, Ill.	Chicago, Mil. & St. Paul	40
Deerfield, Ill.	Chicago, Mil. & St. Paul	40
Ada St., Chicago, Ill.	Chicago & North-Western	32
Greene St., Chicago, Ill.	Chicago & North-Western	28
De Kalb, Ill.	Chicago & North-Western	48
Garth St., Hamilton, Ont.	Toronto, H. & B.	88
Cumminsville, Ohio.	Baltimore & Ohio	48
Youngstown, Ohio.	Baltimore & Ohio	48
Shoemaker, Ohio.	Toledo Ry. & Terminal Co.	20
West Penn Junction, Pa.	Pennsylvania Lines	80
Rochester, Pa.	Pennsylvania Lines	56
Ford St., Chicago, Ill.	Pennsylvania Lines	104
Baden, Pa.	Pennsylvania Lines	56
Freedom, Pa.	Pennsylvania Lines	44
Bellevue, Pa.	Pennsylvania Lines	52
Ashtabula, Ohio.	Lake Shore & Mich. Southern	120
East Toledo, Ohio.	Lake Shore & Mich. Southern	100
Erie, Pa.	Lake Shore & Mich. Southern	56
Broad St., Columbus, Ohio.	Toledo & Ohio Central	72
		1,424

Repairing Worn Coupler Knuckles.

At the recent meeting of the Master Blacksmiths' Association, Mr. D. B. Swinton, Canadian Pacific, described a method of repairing worn-out coupler knuckles which has been successfully used on more than 1,000 knuckles on that road. The method applies to the repair of old knuckles having the link slot and coupling-pin hole. When a knuckle wears away on the pulling face to within ¼ in. of the coupling pin hole it begins to flatten out and becomes unfit for use. To restore the proper contour the wearing face of the knuckle is heated in a forge around the coupling pin hole while the knuckle pin hole and the tail of the knuckle are kept cold. When heated to a moderate red heat a piece of 1¾-in.

round iron, about ⅝ in. longer than the depth of the knuckle is driven through the coupling pin hole. It is then put back in the fire and reheated, when it is again removed and the ends of the round iron riveted down. The knuckle is then placed under a steam hammer, with the wearing face resting on a forming die in the bottom block. A few light blows will close up the knuckle and restore the proper contour at the gage points. It is then tried with a standard gage in a new coupler and also tested with a new knuckle to make sure that it will lock with other couplers. A blacksmith and helper can repair from 25 to 30 knuckles a day in this manner, and when so repaired the wearing face will last as long as the other parts.

Economic Depth of Bridge Trusses and Depth for Greatest Stiffness.*

BY MANSFIELD MERRIMAN.

The fact that there is a certain depth for a bridge truss which renders the quantity of material a minimum has long been known, and the marked increase in the depth of bridge trusses which has occurred during the past quarter of a century is due to the efforts of manufacturers to use the least possible amount of material. It has generally been supposed that the vertical deflection of a bridge under a moving load decreases with the depth, and this is true for plate girders. For a truss, however, investigations made by the author show that the least deflection and hence the greatest stiffness increases up to a certain limit, as the depth increases, and then decreases, so that there is a depth which gives the truss its greatest vertical stiffness.

The following are the results obtained by the author for the type known as the deck Pratt truss. Let l be the span, d the depth, p the panel length, and n the number of panels, so that $l = np$. The economic depth was obtained by forming an algebraic expression for the amount of material in the truss in terms of its dimensions, given loads and allowable unit-stresses, and then finding the value of $\frac{d}{p}$ which renders that expression a minimum. There were found, for

n	=	4	8	12	20	30
$\frac{d}{p}$	=	1.29	1.73	2.08	2.65	3.21
$\frac{d}{l}$	=	0.32	0.22	0.17	0.13	0.11

which shows that $\frac{d}{p}$ increases with length of span while $\frac{d}{l}$ decreases with length of span. To determine the depth that gives greatest stiffness, an algebraic expression for the stored energy in the truss due to the deformation of its members was formed and this equated to the deflection due to the given loads. Then the values of $\frac{d}{p}$ that render this expression a minimum were deduced for different values of n, as follows:

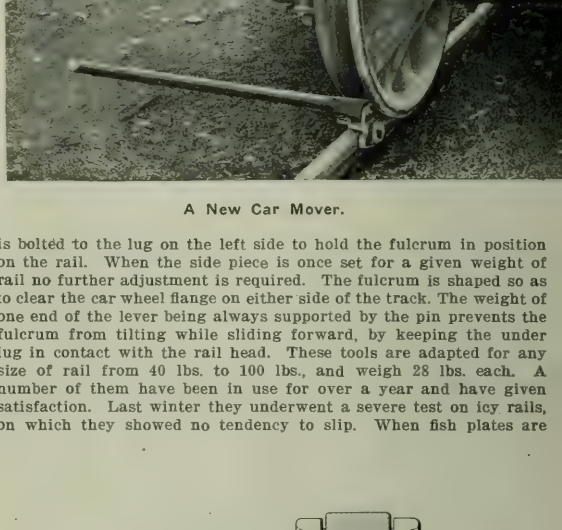
For n	=	4	8	12	20	30
$\frac{d}{p}$	=	1.29	1.63	1.92	2.38	2.85
$\frac{d}{l}$	=	0.32	0.20	0.16	0.12	0.09

which give laws similar to those of the economic depth, and which show that the depth which gives the greatest stiffness is slightly less than the economic depth. It hence appears that no additional stiffness can be imparted to a bridge by giving to the truss a depth greater than the economic depth.

*Reprinted from *Proceedings* American Philosophical Society, Vol. XLIV., 1905.

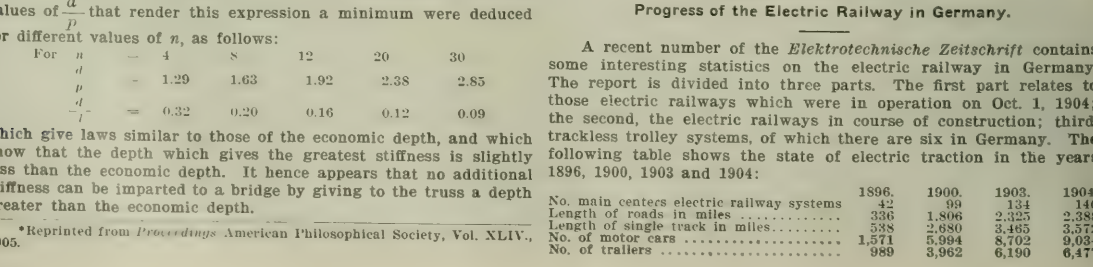
A New Car Mover.

Car movers are apt quickly to become useless, as they depend solely upon direct pressure on a sharp piece of steel which soon becomes worn and dull. The device shown in the accompanying detailed illustrations, made by Harvey J. Gehr, Waynesboro, Pa., has a clamp or locking action on the rail head. This action is not affected by wear and is always greater than the backward pressure on the bar, thus making it impossible for it to slip. The pinch bar is of steel and is attached to the fulcrum by a steel pin. The fulcrum is of malleable iron with steel bearing plate inserted at the point where it rests on the top of the rail, and an adjustable side piece



A New Car Mover.

is bolted to the lug on the left side to hold the fulcrum in position on the rail. When the side piece is once set for a given weight of rail no further adjustment is required. The fulcrum is shaped so as to clear the car wheel flange on either side of the track. The weight of one end of the lever being always supported by the pin prevents the fulcrum from tilting while sliding forward, by keeping the under lug in contact with the rail head. These tools are adapted for any size of rail from 40 lbs. to 100 lbs., and weigh 28 lbs. each. A number of them have been in use for over a year and have given satisfaction. Last winter they underwent a severe test on icy rails, on which they showed no tendency to slip. When fish plates are


33" diam. Wheel
Steel Lever
Top of Rail
This line shows the "hook-over" movement used in placing the car mover in position on the rail

Side and End Elevations of Gehr Car Mover.

encountered by this type of mover, it has to be moved from one side of the track to the other, but this can be done easily and quickly.

Progress of the Electric Railway in Germany.

A recent number of the *Elektrotechnische Zeitschrift* contains some interesting statistics on the electric railway in Germany. The report is divided into three parts. The first part relates to those electric railways which were in operation on Oct. 1, 1904; the second, the electric railways in course of construction; third, trackless trolley systems, of which there are six in Germany. The following table shows the state of electric traction in the years 1896, 1900, 1903 and 1904:

	1896.	1900.	1903.	1904.
No. main centers electric railway systems	42	99	134	140
Length of roads in miles	336	1,806	2,325	2,388
Length of single track in miles	538	2,680	3,465	3,572
No. of motor cars	1,571	5,994	8,702	9,034
No. of trailers	989	3,962	6,190	6,477

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay. EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.

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VOL. XXXIX. No. 10. FRIDAY, SEPTEMBER 8, 1905.

The special committee of the Railway Signal Association which was appointed last May to take a letter ballot on certain points in semaphore design has sent out its circular, and, in addition to the subjects committed to it, asks the members, informally, to give their opinions for or against the use of the upward inclination of the semaphore blade to indicate all-right or "proceed." With a three-position signal this would necessitate the use of a combination something like Fig. 1.* If we may judge by the attitude in the past of the American Railway Association and other bodies of railroad officers, this proposition will be rejected by sheer force of conservatism. The downward inclination has been practically universal in America for many years, and it seems so much more natural that

Fig. 1.

Fig. 2.

Fig. 3.

operating officers and enginemen will be loath to vote against it. It is true that arms turned 45 degrees upward have been used for 10 or 15 years on the Atchison and the Erie, to indicate caution, but the advantage of the arrangement does not seem to be great enough to have found favor on other roads, even theoretically. Advocates of the simple downward inclination which is now so familiar in this country, must also recognize the fact that variations from it have been used a good deal in England, not to mention numerous other designs founded in Germany and France, most of which are looked upon by Americans as "freaks." Moreover, the "semaphore" as described in the 1864 edition of Webster's dictionary has five positions (Fig. 3), so that the American railroad semaphore can make no claim to correctness or pre-eminence by reason of purity of origin. The main reason for preferring the upward inclination is that no counterweight is needed to change the signal to the normal and safe indication (stop) when a connection breaks or the arm is weighed down by sleet. But there ought to be a decided preponderance one way or the other in the iron casting, to provide for the return of a disconnected signal to the stop position at night, if the arm should break off, so it is not clear how much reduction it would be safe to make in the weight of the iron. With the arm in any position except vertical, the different designs probably have no advantage over each other in visibility, except what may be due to custom or habit or prejudice; but for the vertical position the arrangement shown in Fig. 1 would probably prove inferior to Mr. Grafton's well-known design. Whether or not the gentlemen of the committee, Messrs. Elliott, of the New York Central, Rudd, of the Pennsylvania, and Ames, of the Lake Shore, propose to recommend this change to their own managers, we are not informed (though it is understood that individually they favor it); but if they do intend to thus recommend they ought to have no difficulty in starting a very warm discussion in the next association meeting, for their respective managers control, collectively, probably 20,000 miles of road. The practice of that large mileage must powerfully influence the practice on many other roads.

Whatever may become of this proposition to change all at once 20 or 30 thousand semaphore signals, regardless of cost, the mere fact that the proposition is offered, with some show of formality, is a matter of interest to the railroad world, for it indicates a strong movement toward uniform methods and designs, and toward definite and intelligent discussion of signaling problems. These three men would not put forth this idea unless they were pretty well agreed upon it; nor unless they felt pretty sure of their ground with their respective fellow officers. There has been some criticism of American railroad officers for allowing the signal companies to do too much of their thinking, and of signal engineers for not doing enough thinking—for each other. Discussions looking to united action by the two largest railroad systems of the country serve to answer this criticism. In giving too free a hand to the manufacturers the railroads have by no means produced wholly unfavorable results, for it is chiefly to the manufacturers that we are indebted for many features of American signal practice which are superior to the practice of Europe. This softens the criticism just mentioned. But the only way to soften the criticism of the signal engineers is to again criticise the managements—for not giving the signal engineers enough authority and money. Not having any signal department at all, or having one and keeping it unreasonably subordinated, is the just charge against some companies. The chief drawback in

*See also page 223.

this beautiful prospect for united action is the danger, the same that is so familiar in the field of politics, of going too fast. A few strong men among the signal engineers may, indeed, decide on a scheme of signal practice in every way suitable for all the railroads of the country; but railroad operating officers, like functionaries in a city or national government, have notions of their own, and the ideas of other men concerning their duties cannot be at once transplanted into their minds except by perfectly organized authority; and even then the authority may need instruction. It is doubtful wisdom for a signal engineer to induce his general manager or chief engineer to adopt a practice of which the chief has not himself become a thoroughly intelligent and hearty advocate; and on even the best organized roads many branches of authority are, in this sense, still far from perfect, because the systems of roads have grown so rapidly. And when it comes to dealing with fifty or a hundred division superintendents, each of whom must, in the nature of things, be allowed more or less individual judgment and authority, the problem of uniformity may become very perplexing. A lot of these division superintendents ought to be brought into the Railway Signal Association, where they could more conveniently and profitably exchange ideas with the engineering department.

THE GROWTH OF TRAFFIC.

The report of the total traffic of the railroads of the United States for the fiscal year ending with June, 1904, makes it possible to measure the effect of the depression in business which may be said to have begun with that year. As we have often shown, in a rapidly growing country like this, an arrest of growth is equivalent in its effects on business and transportation to a positive decline in production in an older and more stationary community. We have had experience of a positive decline in this country, however, and a violent one, as after the fiscal year ending with June, 1893, which came after what may be called for this country a period of normal progress. This is shown by the following record of railroad freight transportation in successive years, in *millions* of ton-miles:

1890	76,207	1892	88,241	1894	80,335
1891	81,074	1893	93,588		

Here we have a growth of traffic amounting to 23 per cent. from 1890 to 1893, an average of 7 per cent. yearly, in a country whose increase in population was something less than 2 per cent. yearly. This is followed by the astonishing decrease of 13 per cent. in the single year from 1893 to 1894, the effect of which was nearly as great as a decrease of 20 per cent. would have been in a stationary community.

The recovery from this extreme depression was rapid, but substantially there was no resumption of the normal growth interrupted in 1893-94 until 1898, as the records of millions of ton-miles below show:

1894	80,335	1896	95,328	1898	114,078
1895	85,228	1897	95,139		

Thus there was about the same amount of traffic in 1897 as in 1893; then a sudden increase of 20 per cent. the next year, as if to make up for lost time.

This rapid growth continued, though at not quite such a rate, until 1903, the millions of ton-miles yearly having been:

1899	123,667	1901	147,077	1903	173,221
1900	141,599	1902	157,289		

This shows what is doubtless the great development of production and transportation on a large scale in economic history, the increase from 1897 to 1903 having been 82 per cent., and the mere increase in these six years being double the total freight traffic of France, Germany, and Austria combined.

The effect of the depression following 1902-03 is shown by the following comparison of the millions of ton-miles in that and the following year:

1904.	1903.	Increase.	Per cent.
174,522	173,221	1,301	0.6

That is, the freight business in the bad year for trade was just about the same as in the previous year, which was the best of all years. That it was a bad year needs not at this day to be pointed out by referring to the statistics of iron production, etc. And this shows, what we have said before, but what is not sufficiently appreciated, that in a country like this an arrest of growth is an industrial disaster. When a country has had to provide for an average growth of 12 per cent. yearly for six years in production and transportation, a sudden reduction of this growth to less than 1 per cent., like that from 1903 to 1904, means that an important part of the machinery for production and transportation will find no employment for the time. If there had been no more of such machinery in 1904 than in 1903, there would have been equally full employment for it; but there was more, and in some branches of business a great deal more, and consequently much of it could not be worked to its full capacity. That the arrest in growth was much less serious than the large actual decline from 1893 to 1894 is, of course, true, and that the depression extended over a much shorter period, the present condition of industrial production and transportation has already demonstrated. Further evidence that the great mass of the population suffered comparatively little by the depression of 1903 is shown by the statistics of passenger transportation. This fell off 14 per cent. from 1893-94 to 1894-95, and it was not till 1899 that it equaled the travel of 1893. But in 1903-04 the travel was nearly 5 per cent. greater than in the previous year, the amount, in *millions* of passenger-miles, since it began to grow in 1899, having been:

1899	14,591	1901	17,354	1903	20,916
1900	16,039	1902	19,690	1904	21,923

The increase from 1899 to 1904 has thus been just about 50 per cent., or at an average rate of a little less than 9 per cent. yearly, the yearly increase in population meanwhile (swelled by exceptionally heavy immigration) being probably a little more than 2 per cent. In the earlier years of this period there was a rapid increase of trolley mileage and travel and a considerable one in every year, so that the increase of steam railroad travel does not indicate the whole. Now travel is a pretty good index to the condition of the mass of the population. A very large part of it is avoidable, and will be avoided when people find it hard to pay for food, clothes and rent. In the last year reported it was swelled somewhat, doubtless by the St. Louis World's Fair. The amount of *growth* in successive years has been, in *millions* of passenger-miles:

1899 to 1900	1,448	1901 to 1902	2,336	1903 to 1904	1,007
1900 to 1901	1,315	1902 to 1903	1,226		

Considering the effect of the St. Louis Fair, which was almost wholly in the last year, the decrease in the amount of growth is considerable; but after all, the increase must have been as rapid as the increase in population, and the average man traveled as much in the last year as in any previous year.

The growth of traffic from 1897 to 1903 was certainly abnormally great. We must not expect again an increase of 82 per cent. in freight traffic in six years. It was only possible because of the sudden and great expansion of the mineral industries, especially iron manufacturing. At such a time of large profits and growing business, men are eager to increase the capacity of their productive plants, and they usually overdo it. If the increase exceeds the growth of the demand for several years, as has sometimes been the case, a prolonged period of depression results. It now appears that nearly all important industries are again pretty fully employed, and yet that there is not yet any great or general movement towards increasing the capacity of such industries. That means that there is not soon likely to be an overproduction, and that existing industries will remain busy. The railroads will have to provide for a growth in traffic, but not at the rate of 82 per cent. in six years, as from 1897 to 1903.

THE OVER-CAPITALIZATION OF STREET RAILWAYS.

The over-capitalization, taking the country through, of our street railways, is too familiar a general fact to need more than the most curt allusion. But the measure of that fact is a much more difficult proposition. We know that street railways are greatly over-capitalized, but we cannot say exactly how much in figures or in ratios. States vary and localities vary. If city railways could be grouped and compared with the "cross-country" lines, we should probably find variations in the hydrometer, and perhaps that the long-distance lines differ from both. The census figures for mileage-capital are crude, and the schedules prepared so long ago as to be already outlived. There are such intrinsic obscurities, also, as the fair recapitalization in shifting from the archæic horse car to the modern trolley. Even the test of "replacement value" shifts from year to year considerably with the cost of labor and material. And if, in the lack of absolute standards of mileage capitalization, we add the premeditated devices by which mist has been thrown on the street railway waters, the subject grows even more complex.

In seeking what we may call a water measure for the general street railroad capitalization in stock and bonds, there is, however, one rough standard unit accessible, and the State of Massachusetts supplies it. Practically alone, of the commonwealths of the Union, her State Railroad Commission has succeeded in keeping down capitalization to cost. But even to her standard of $49,158 per track mile there are one or two qualifications. In the early stage

of her street railway building her commission did not succeed in applying strictly its later rule. Again, with her 34 cities, her immense suburban population, and her subway and elevated lines in Boston, the actual and honest mileage capitalization of her lines probably exceeds the normal. We are borrowing from her a sounding line marked somewhat too long, with the result of undermeasuring the depth of water when the fathoms are read. But, even with that allowance, the tests are of interest. If we omit for Massachusetts thousands, raise her 49 plus to 50—where it probably about stands at the present time—and, to make the comparison at once more easy and graphic, raise also this measuring unit to 100, we obtain, in approximate figures for mileage capital, the table annexed, derived from the returns for 1904 lately compiled by the *Street Railway Journal*.

Massachusetts	100	Southern States	223
Rest of New England	139	Western States	174
Eastern States	297	United States (Mass. excluded)	217
Central States	206		

The eastern States in the table include New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Maryland, Virginia and West Virginia; the Central States, Michigan, Ohio, Indiana, Kentucky, Wisconsin, Illinois, Minnesota, Iowa and Missouri; the Southern States, the Carolinas, Georgia, Florida, Alabama, Mississippi, Tennessee, Louisiana and Arkansas; and the Western States, the Dakotas, Nebraska, Nevada, Kansas, Indian Territory, Oklahoma, Texas, Colorado, Montana, New Mexico, Idaho, Utah, Washington, Oregon, California and Arizona. It will be noticed that, by what we may characterize as the "Massachusetts standard," the Eastern States group stands capitalized in stocks and bonds at almost three to one—a return to be measurably looked for in a region containing New York City, Philadelphia, Baltimore, and several other cities rising into their hundreds of thousands of population. The Central States, with the cities of Chicago, St. Louis, Cleveland, Cincinnati and Detroit, are also at pretty high-water mark, with a ratio of more than two for one in capitalization. Much more surprising is the fact that the relatively thickly settled Southern group outstrips the great Middle West in mileage capitalization—perhaps to be accounted for by the fact that exploitation of street railways and the "bond and bonus" device struck the South after the system had been well learned at the North—and the same idea rings plausibly when the capitalization of the far West is contrasted with Massachusetts. The general average for the whole country, outside of Massachusetts, of more than two to one—217 to 100—and suggesting about 58.5 per cent. of street railway stock and bonds combined and now outstanding as dropsical, is probably not so very far from the real mark.

The causes of this imposing excess of capitalization are now becoming historical, but are not hard to find. They take us back to the later eighties, when the first trolley mechanism proved clumsy, noisy and unpopular, and was, on some lines, discarded; to the improving of them a few years later, when the trolleys leaped into popularity with a great bound, when speed, cleanliness, control and comparative noiselessness succeeded the odors, the stress and the dirt of the sluggish horsecar, and when the promoter and shrewd investor, far ahead of the public in their precision, carried through, in varied forms, their "bond and bonus" plans of recapitalization. We realize these things now with all the belated wisdom of hindsight. What we do not realize quite so well is that the great electric street railway "boom" of the nineties struck the country when legislation and the State Railroad Commissions were in a condition of Russian unpreparedness. In a good many states the commissions had no foreview of street railways at all; the body of legislation relating to them was scant and of the narrow "horse car" pattern, and totally unfitted for the new development; the universal cry for trolleys drowned in law-making bodies the subject of wise capitalization or carefully relegated it to the future, and the individual who wanted to see the electric line pass his door or tap his farm concerned himself little then with future rates of fare to pay dividends on watered stock. Everybody's business was, as often, nobody's business, and, in the *hiatus* the promoter, the speculator and the quick investor saw their chance and used it.

All this is rather trite, if impressive, history. But its result—if we accept the evidence of the Massachusetts standard—is that we have a system of street railways at once vast and vastly over-capitalized; and when we seek a remedy for the past, constructive criticism beats against the bars in vain. Something—indeed much—may be done in the future with the Massachusetts example as a precedent. But the stock waterings of the heretofore have already fallen into the old steam railroad category. They have been buried under successive strata of consolidations, are well-nigh untraceable, have passed largely from the original profit takers to innocent holders, to trustees, to savings banks, to conservative investors who ask, as to corporations, not whether stock was originally paid in as cash, but what are present pronts, and whether those profits will continue. It would be interesting if we had the figures to show the millions of street railway bonds marketed originally below 75; it would be equally interesting to know the large proportion of those same bonds that have risen to a 3.90 investment basis and in some states been opened to savings banks; and it would be much more interesting to discover what reply a State legislature, trying to root out the old evil, would make to the innocent bondholder who urges that the state, an original, if silent, partner in the transaction, must father its own sin of omission. Practically no remedy, certainly no radical remedy, for the great over-capitalization of the average American street railway is therefore in sight. But, if the subject for that reason becomes a bit theoretical and academic, its history, its results and its magnitudes are not less suggestive and picturesque.

Railroad Earnings in July.

The large increases in gross earnings for July over those reported for the corresponding period last year are due for the most part to the generally prosperous condition of industrials, which bring in their train all kinds of traffic. The iron and steel industry accounts for much of it, the large plants all running to their full capacity. The figures are especially large because of the great falling off in traffic a year ago when the majority of roads showed decreases as compared with 1903. The Atchison illustrates this with its increase of $942,077 over last year, when it reported a decrease of $643,757. On this road, the increase of July, 1905, over July, 1903, is $298,320, which gives a fairer idea of conditions. The increase on seven roads of the Southwestern group is $1,877,805, or 13 per cent., due apparently to increased shipment of live stock. Last year the beef strike was responsible for the great falling off in this traffic. In the middle and middle western group, the increase of 15 roads is $4,630,809; 9 per cent. This is due to the generally favorable conditions already spoken of, and in particular to the fact that the coal strike last year made a big decrease in the earnings of coal roads, the Reading, for example, showing a decrease of $1,157,642 at that time. The only roads in this group showing a substantial decrease this year are the Wabash and Illinois Central, and this is explainable by the increased passenger traffic occasioned last year by the World's Fair at St. Louis. Eight roads in the Northwestern and Northern Pacific group report an increase of $1,188,226; 5 per cent. Increases on these roads for August will be larger, as they will show the effect of the grain movement, which is, of course, much greater than last year. In the Southern group, the total increase of four roads is $792,940; 9 per cent. The cotton crop this year is large and there was also much of last year's crop to be moved during July, while the crop of 1903 was so small that there was but little of it left to be carried in July, 1904.

The accompanying table shows the gross earnings for July, 1905, and July, 1904, of 34 roads:

	July, '05.	July, '04.	Increase.
Atch., Top. & Santa Fe	$5,684,913	$4,742,836	$942,077
Baltimore & Ohio	5,768,830	5,274,542	494,288
Buffalo, Rochester & Pittsburg	766,487	649,195	117,292
Canadian Pacific	4,548,000	4,316,000	232,000
Central of Georgia	877,960	745,651	132,309
Central of New Jersey	2,071,756	1,921,655	150,101
Chesapeake & Ohio	1,775,614	1,671,503	104,111
Chicago & Alton	930,637	947,140	*16,503
Chicago Great Western	618,492	524,423	94,069
Chicago, Milwaukee & St. Paul	3,955,688	4,002,220	*46,532
Cleve., Cin., Chi. & St. Louis	1,890,912	1,764,084	126,828
Colorado & Southern	554,583	483,380	71,203
Chicago, Rock Island & Pacific	3,871,386	3,033,999	837,387
Denver & Rio Grande	1,469,400	1,287,900	181,500
Illinois Central	3,748,999	3,805,184	*56,185
Lehigh Valley	2,648,259	2,556,546	91,713
Louisville & Nashville	3,298,210	2,921,238	376,972
Missouri, Kansas & Texas	1,626,731	1,388,397	238,334
Missouri Pacific—Iron Mountain	3,360,000	3,223,000	137,000
Minn., St. Paul & Sault Ste. Marie	746,547	597,747	148,800
‡Montana Central	200,832	180,736	20,095
†New York Central & Hudson River	7,135,299	6,443,619	691,680
New York, Ontario & Western	708,523	646,806	61,717
Norfolk & Western	2,127,747	1,805,724	322,023
Northern Pacific	4,471,792	4,071,388	400,404
Pennsylvania Railroad	10,831,703	9,481,103	1,350,600
Philadelphia & Reading	3,098,279	2,661,438	436,841
St. Louis & San Francisco	3,156,844	2,783,504	373,340
Southern	4,022,954	3,716,117	306,837
St. Louis South-Western	670,181	641,981	28,200
‡St. Paul, M. & M.	3,694,329	3,491,979	202,350
Texas & Pacific	802,391	759,240	43,151
Wabash	2,001,080	2,082,164	*81,084
Y. & M. V.	497,666	520,844	*23,178

*Decrease. †And leased lines. ‡Great Northern.

Leather upholstery for the seats of the smoking and chair cars of the new "Alton Limited" trains described last week is a feature meriting special notice and commendation. The heavily carved woodwork, mouldings and other "gingerbread" work that was once

considered the most artistic finish for interiors of passenger cars, but which was principally effective to catch and hold dirt, has given way to the present smooth finish and use of highly polished woods, combining simplicity and quiet elegance. But aside from and more important than the esthetic considerations, is the sanitary advantage of the present practice. Yet American railroads still retain one relic of former practice which is more unsanitary than all the rest; the dust-retaining germ-holding plush covering of the seats. As long ago as 1893 the New York Board of Health issued an order requiring that upholstered seats in public places be covered with leather or some substitute having similar characteristics to prevent the retention and spread of disease germs. It was also suggested that similar precautions be taken with regard to seats for railroad and street cars, steamships, etc. The importance of frequent and thorough cleaning of the plush covered seats is by this time probably fully appreciated by all of the roads, though the methods used at a majority of the terminals are far from effective; in fact, there is but one really effective method and that is the vacuum process, which is also the most costly. A leather covering, of course, needs no such treatment. That passengers would find the change to leather agreeable there is little doubt, especially in the hot and dusty summer months. On the score of first cost there can be no objection since there is little if any difference between the leather and the plush. The wearing qualities of leather in this service in comparison with the plush are not yet definitely known, but it is thought that its life probably would not be so long, especially since the plush can be dyed and used again when faded and dirty. But the sanitary advantage should be the paramount consideration, and it is to be hoped that the practice inaugurated by the Alton will soon become general.

Cleveland, Cincinnati, Chicago & St. Louis.

The company has changed the date of its fiscal year from June 30 to December 31 to make it uniform with the other Vanderbilt properties, and as the last report was published as of June 30, 1904, the present very brief document covers six months only, for the period ending Dec. 31, 1904. For this period gross earnings were $12,141,288, operating expenses were $8,358,207, and net earnings $3,783,081. After deducting interest, rentals and taxes aggregating $1,847,370, a balance remained of $1,935,711. Two quarterly dividends of 1¼ per cent. each were paid on the preferred stock and one dividend of 2 per cent. on the common stock, requiring a total of $809,768. As a reserve fund for equipment renewals one million dollars was then set aside and a surplus of $94,951 was carried forward from the six months' operation. Ton miles increased 5.6 per cent. as compared with the corresponding six months of the preceding year. Freight revenue decreased six-tenths of one per cent., average ton-mile receipts decreasing from 6.77 mills to 6.38 mills. The average revenue train load increased from 336 to 342 tons, but freight train earnings were $2.21 a mile as against $2.31 in the last half of 1903. Passenger traffic shows tremendous increases, presumably due chiefly to the St. Louis Fair. Passenger miles increased 45½ per cent. and passenger revenue 31½ per cent., the average rate per passenger mile having decreased somewhat. Passenger train mileage increased 610,201 miles. Passenger earnings for the six months at hand constituted over 36 per cent. of the total earnings, while during the same six months in 1903 they amounted to about 31 per cent.

In spite of the heavy passenger train movement on account of the Fair the charge to conducting transportation showed a decrease over the corresponding six months in 1903. The specific item which is responsible for this decrease is the per diem balance, which was less than half as high in the 1904 period as in the 1903 period. The cost of fuel also decreased somewhat. Total operating expenses increased $174,090, to the figure given above; the increase coming chiefly under the head of maintenance of way and structures, and particularly in the items of tie, bridge and culvert renewal.

The freight ton mileage increased 43,328,062 ton miles, although the lower average rate occasioned a decrease in earnings. Part of the reason for this lower average rate is doubtless attributable to the large increase in tonnage of bituminous coal hauled. This commodity now amounts to about 28 per cent. of the total freight tonnage moved.

Principal operating statistics are as follows:

	Last half of	
	1904.	1903.
Average mileage worked	1,891	1,891
Freight earnings	$6,810,028	$6,848,385
Passenger earnings	4,480,037	3,405,778
Gross earnings	12,141,288	11,070,132
Maint. way and structure	1,452,871	1,274,587
Maint. of equipment	1,538,168	1,492,687
Conducting transportation	4,966,499	5,028,937
Total, operating expenses	8,189,895	8,015,804
Betterment charges additional.	168,313	129,807
Net earnings	3,783,081	2,924,521
Interest taxes and rentals	1,847,370	1,855,686
Balance to credit of income	1,935,711	1,068,835

TRADE CATALOGUES.

Ideal Power for August has as leading articles, "Economy of Surfacing Stone by the Aid of Compressed Air," "Steel Work in the New York 69th Regiment Armory," "Sinking Concrete-Filled Steel Piles Through Quicksands by the Aid of Compressed Air," "Scaling Condenser Pipes by the Aid of Pneumatic Hammers," and "Venting Cores," an interesting paper by Jas. A. Murphy read at the June meeting of the American Foundrymen's Association.

Superheated Steam.—The Power Specialty Co., New York, sends a pamphlet bearing the above title. It contains a full detailed description and illustrations of the Foster patent superheater which is made by this company. Copies of comparative tests on the use of saturated and superheated steam at the Spring Creek pumping station, Brooklyn, and the Central Park avenue pumping station, Chicago, are also given.

Traveling Hoists and Trolleys.—The Niles-Bement-Pond Co., New York, sends a handsomely illustrated catalogue, 9 in. x 12 in., of its electric traveling cranes and hoist. These run on a single I-beam and are especially useful for handling loads up to five tons. Brief descriptions and detailed illustrations of the various types are given, and full page illustrations show the devices in actual use.

Coal Handling Machinery.—The Sullivan Machinery Company, Chicago, sends an interesting catalogue descriptive of its automatic cross-over dump. This device is used for the rapid and economical handling and loading into railroad cars of coal, ore, rock, etc., from mines and quarries. The pamphlet is clearly written and is illustrated throughout.

Balanced Compound Locomotives.—The Baldwin Locomotive Works, Philadelphia, Pa., sends its "Record of Construction No. 53." It is handsomely gotten up and is illustrated throughout and contains valuable data and notes on the principles and performances of the balanced compound locomotive.

Concrete Mixing and Measuring Machine.—The Link-Belt Engineering Co., Philadelphia, Pa., sends an illustrated pamphlet descriptive of the Trump concrete mixing and measuring machine. The advantages derived from the use of this machine are clearly set forth.

Expansion Bolts.—The Steward & Romaine Mfg. Co., Philadelphia, Pa., sends an illustrated catalogue of its expansion bolts, toggle bolts, anchor bolts, pipe hooks and hangers, brass cap nuts, etc.

CONTRIBUTIONS

Street Car Ticket Lotteries in Mexico.

City of Mexico, Aug. 24, 1905.

To the Editor of the Railroad Gazette:

Your issue of August 18 contained mention of the ticket lottery scheme now in use on the street railways of Mexico City. That it has met with success is indicated by the published announcement of the company, that at the end of the first month it was in practice, the net receipts from fares had increased 29 per cent. A few days ago it was discovered that conductors had printed counterfeit tickets, receipts, to give passengers, but that was soon stopped, and nine of the conductors are now in the penitentiary. The entire public agrees that the system will prove a perfect success; and the company, from the start, removed all its patent indicators and four-fifths of its inspectors or "spotters."

J. MAC D. DE MUTH.
Editor of *The Mexican Railway Journal.*

Divisional vs. Departmental.

New York, Aug. 25, 1905.

To the Editor of the Railroad Gazette:

In your issue of Aug. 25 I notice a communication on the subject of "Railroad Organization" and your foot note inviting comments. I have some rather strong views on this subject of organization, which I shall take the liberty of briefly outlining to you as follows:

From an intimate connection with the departmental organization and a close study of the divisional organization on other railroads I have formed the conclusion that the divisional organization gives far better results, provided the superintendents in charge of the divisions are men who have had a detail training in maintenance of way and motive power as well as in the transportation service. In my opinion the secret of the success of the divisional system on the Pennsylvania Railroad is due to the system that was adopted many years ago by that company for the training

of their future officers in the technical departments. When the divisional organization is attempted with men whose experience has been confined to transportation problems I have noted that their lack of experience in mechanical and maintenance of way problems seriously detracts from their usefulness and is apt to result in a deterioration of track and equipment. On the other hand, if the experience of the superintendents has been confined to transportation matters I believe that the departmental organization is the better, as the motive power and maintenance of way departments are then controlled by men who have had special training in those directions. To summarize, in my opinion the best organization is effected by having superintendents who have had more or less detail training in maintenance of way and motive power problems and experience in transportation matters, with territory not too large to prevent their personal supervision of the work under their charge and coupled with an opportunity to keep in touch with industrial conditions along their line.

VICE-PRESIDENT.

Tests of Locomotive Valve Gears.

New York, Sept. 2, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of September 1, page 200, is a short account of the performance of a locomotive on the Pittsburg & Lake Erie equipped with the Allfree-Hubbell valve gear. The results show an apparent saving of about 5 per cent. in coal in favor of the locomotive fitted with this improved gear, when figured on the basis of coal consumption per 100 ton miles. However meritorious this valve gear may be, it nevertheless appears that the basis on which the coal consumption is calculated is by no means a safe one upon which to draw conclusions. While for statistical purposes the ton mile is well adapted as a basis upon which to make comparisons, it must be used with great caution in making accurate analyses of the value of any device which may be applied to the locomotive.

It is well known by those familiar with locomotive performance that two locomotives similar in design and workmanship and used in the same kind of service over the same division, may give results as to coal consumption widely at variance. Such differences in economy may be due to differences in the individual ability of the firemen, to differences in the climatic conditions, to leaky flues, to heavy side winds and to a variety of causes not easily determined or accounted for. The true measure of the work done by a locomotive is the drawbar pull which can only be accurately determined by the use of a dynamometer car or by placing the locomotive on a testing plant.

From these considerations, it has always seemed to the writer to be unsafe to judge the merits of a device such as a valve gear by the results of purely service tests. At best, an improved valve gear can only show economies within rather narrow limits, these limits, in most cases, being within the variations due to the skill of the firemen, etc. It is not my intention to enter into a discussion of the value of the Allfree-Hubbell gear, but in the interests of the promoters of this and other devices and of the railroads, it would be well to make thorough scientific tests in such a manner that all influencing elements can be measured and properly credited.

CHARLES DUCAS, M. E.

Competitive Signal Installations.

New York, Sept. 4, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Occupying now an independent position in regard to railroad and railroad signal companies, I feel that I may make a suggestion to you which I think will, if it meets with a successful issue, eliminate the possibility of doubt as to the fair distribution of contracts awarded upon a competitive basis.

My suggestion is that you use your columns for the purpose of urging upon railroad managers, in the interests of all competitors, the justice of—

First.—The preparation of carefully thought out and complete plans and specifications of the proposed works.

Second.—Date fixed for the opening of bids, of which all competitors shall be notified and invited to attend the function, to witness the opening of the bids. HENRY JOHNSON.

[Mr. Johnson's suggestion of the method to be pursued by a railroad company with a capable signaling department is not criticizable, but the managers of such companies need no urging from us. They are few in number and are already doing something like what is suggested. As to the others, the nine-hundred and ninety and nine, there seems to be but two rational courses: Employ an expert to study the conditions and prepare plans. Mr. Johnson, Mr. Sperry and others are competent. The other decent way is to pick out the signaling company, employ it and trust it. This can only be done with safety when there is absolute frankness on both sides. Shop costs, loading and profit and every item of information needed are in such cases the rightful property of the railroad company. This method is usual in England, where there is very little dishonesty in such matters, and it is not uncommon here.—EDITOR.]

Salaries on the Russian State Railroads.

From a table printed in the current Bulletin of the International Railway Congress, we have taken the following statement of the salaries paid Russian railroad officers in the year 1901. The system is divided into 22 parts. The highest administrative authority on each of these operating lines is the general manager. The highest salary paid a general manager is on the Southwestern system, where he receives $8,000 a year. The least salary paid a general manager is $2,700, on the Baskutchak system. The other general managers receive either $6,000 or $7,500 each. The salaries of the heads of the permanent way, rolling stock, locomotive, traffic, telegraph and stores departments range in the vicinity of $3,200. These officers, together with the general managers, are classified as administrative authorities. The next class, designated as executive authorities, includes the heads of sections of the permanent way, locomotive, traffic, telegraph and goods departments, and the station masters. The highest pay in this class goes to the heads of sections of the traffic department, who average from $1,200 to $1,900 per year. Heads of the permanent way department receive about $1,400; heads of the locomotive department about $1,000; heads of the telegraph department about $600, and heads of the goods department as a rule slightly less, although on some roads the goods department section head is paid more than the section head of the telegraph department. Station masters receive about $400, on the average, and in some cases considerably less. The accounting officers constitute the third general classification, and receive pay generally lower than the station masters. On a characteristic system, the Baltic & Pskov-Riga, there are 33 men classified in what is known as the Central Accountancy, and these receive about $432 each, annually.

Railroad Cases Decided in August.

The following abstracts cover cases decided by the United States Supreme and Federal Courts during the month of August:

Stopping trains at county seats.—Mississippi has a unique statute which authorizes the Railroad Commission of that state to require all passenger trains to stop at county seats. The Federal Circuit Court was recently called on to construe this act in a case where the Commission issued such an order against the limited trains of the Illinois Central Railroad. The court took the view that since the company furnished the particular county capital in question with three passenger trains each way per day that its legitimate wants were fully supplied and that a demand that through trains should likewise stop, when these trains were mainly for the transportation of interstate through business on a fast schedule to comply with a mail contract with the government, was unreasonable. Illinois Central R. R. Co. vs. Mississippi Railroad Commission, 138 Fed. Rep. 327.

Care in place of work for employees.—The care of a railroad company as to the safety of the place for work of its employees is defined as the ordinary care displayed by prudent intelligent men under like circumstances. A brakeman or other employee will be held to assume the risks of danger from conditions long maintained by the company and which are similar in character to those of other railroads in the vicinity, as for instance open culverts at points remote from stations. Southern Pacific Co. vs. Gloyd, 138 Fed. Rep. 388.

Alien beneficiaries in suits for death.—It is no defense to an action for wrongful death in New Jersey that the beneficiaries of the fund recovered are non-resident aliens. Hirschkovitz vs. Pennsylvania R. R. Co., 138 Fed. Rep. 438.

Wilful negligence at crossings.—South Carolina has a statute under which the failure to give the statutory signals at a railroad crossing creates a *prima facie* case of negligence against a railroad company if the omission in any manner contributed to the injury of a person on the crossing, unless the injured person was guilty of "gross or wilful negligence" himself. The statute was recently invoked in the Federal Court in that state and it was there decided that a traveler knowing of the existence of a railroad crossing who approached the crossing at night with the side curtains of his carriage drawn and drove on the crossing without listening or casting a glance in the direction of the track displayed such "gross and wilful negligence" as would prevent the recovery of any damages for his injuries. Southern Railway Co. vs. Carroll, 138 Fed. Rep. 638.

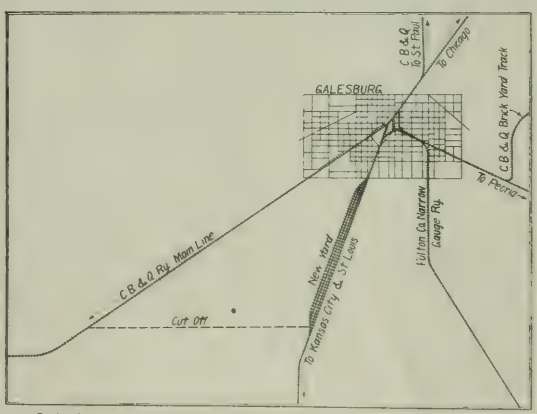
The Southeastern Freight Association.—Judge Speer, of the Federal Court for Georgia, speaking of the Southeastern Freight Association in an opinion reviewing the action of the Interstate Commerce Commission in regard to lumber rates in that jurisdiction, says: "In that territory, with all of its varied products, with an

area and population vaster than many empires of which we have an account, as regards every interest dependent upon the transportation of commodities, the action of the association is more authoritative than the firman of the Sultan or the ukase of the Czar." In this opinion the position is taken that the national courts should not discredit the conclusions of the Commission, as the Interstate Commerce Act itself creates a rule of presumption in favor of the reports of the Commission. In his view the Commission was intended to be an expert tribunal empowered by law to determine in the first instance the reasonable or unreasonable character of the rates for interstate commerce. Coming to the particular offense of the freight association, the case of an unreasonable increase is stated most strongly. To quote his own words: "Where a vast increase of lumber traffic had resulted in a large increase of net revenue to the carrier, the service was inexpensive; required neither rapidity of movement nor specially equipped cars, shippers were obliged to furnish and pay for equipment, railroads were neither to load nor unload, the commodity was neither fragile nor perishable, the industry affords a tonnage second in magnitude to no other transported by the carrier, an arbitrary increase to points of principal destination of two cents a hundred is unreasonable and unlawful. This is especially clear where the particular traffic is practically destroyed immediately after the advance is made." In regard to the association Judge Speer holds that it is none the less an unlawful combination by reason of a stipulation in its articles allowing any of the members to withdraw from the agreement at any time. Tift vs. Southern Railway Co., 138 Fed. Rep. 753.

Commerce Commission and private contracts.—The Interstate Commerce Act cannot be invoked to aid the enforcement of contracts between carriers and shippers. This rule is applied to a case where a shipper sought to charge a discrimination on the ground that the railroad company failed to furnish the number of cars called for under an express contract. It was held that the Interstate Commerce Commission was without jurisdiction. United States vs. Norfolk & Western Railway Co., 138 Fed. Rep. 849.

New Freight Yard of the Burlington at Galesburg.

Galesburg, Ill., is the most important point on the Burlington Lines East of the Missouri River for the interchange of freight between the different lines of the system. With the exception of the Chicago-Minneapolis line, through traffic for all of the lines traversing the State of Illinois must pass through this point. The map herewith shows the situation at Galesburg. The Chicago-Omaha and St. Louis-St. Paul lines cross there. The Kansas City line branches from the latter at Bushnell, 37 miles south of Galesburg, and the line to Centralia (the Jacksonville & St. Louis) runs

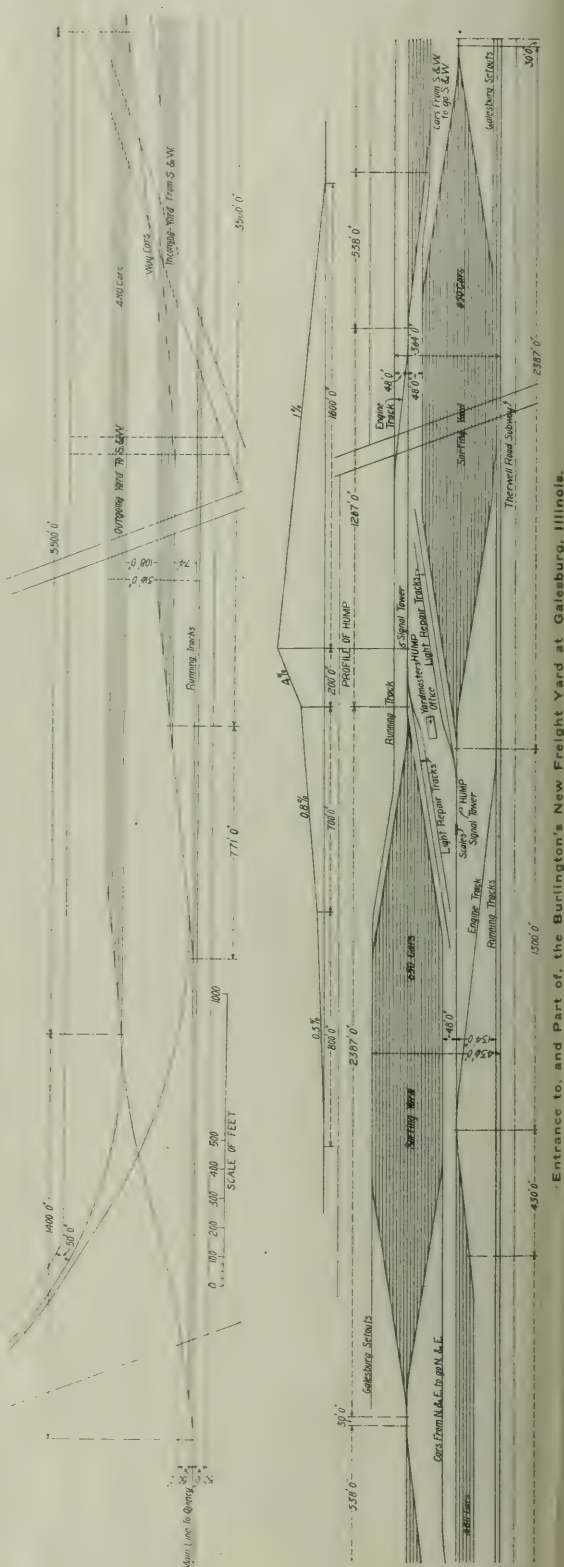


Galesburg, Ill., Showing Burlington Lines and New Yard.

southeast from Concord, 95 miles south of Galesburg. The Peoria branch runs southeast from Galesburg. The Centralia line, which already contributes an important coal traffic, is being extended 50 miles to Herrin, which will largely increase this traffic. Also the grades on this and the St. Louis-St. Paul line are being reduced to a minimum of $^{3}/_{10}$ of one per cent. northbound.

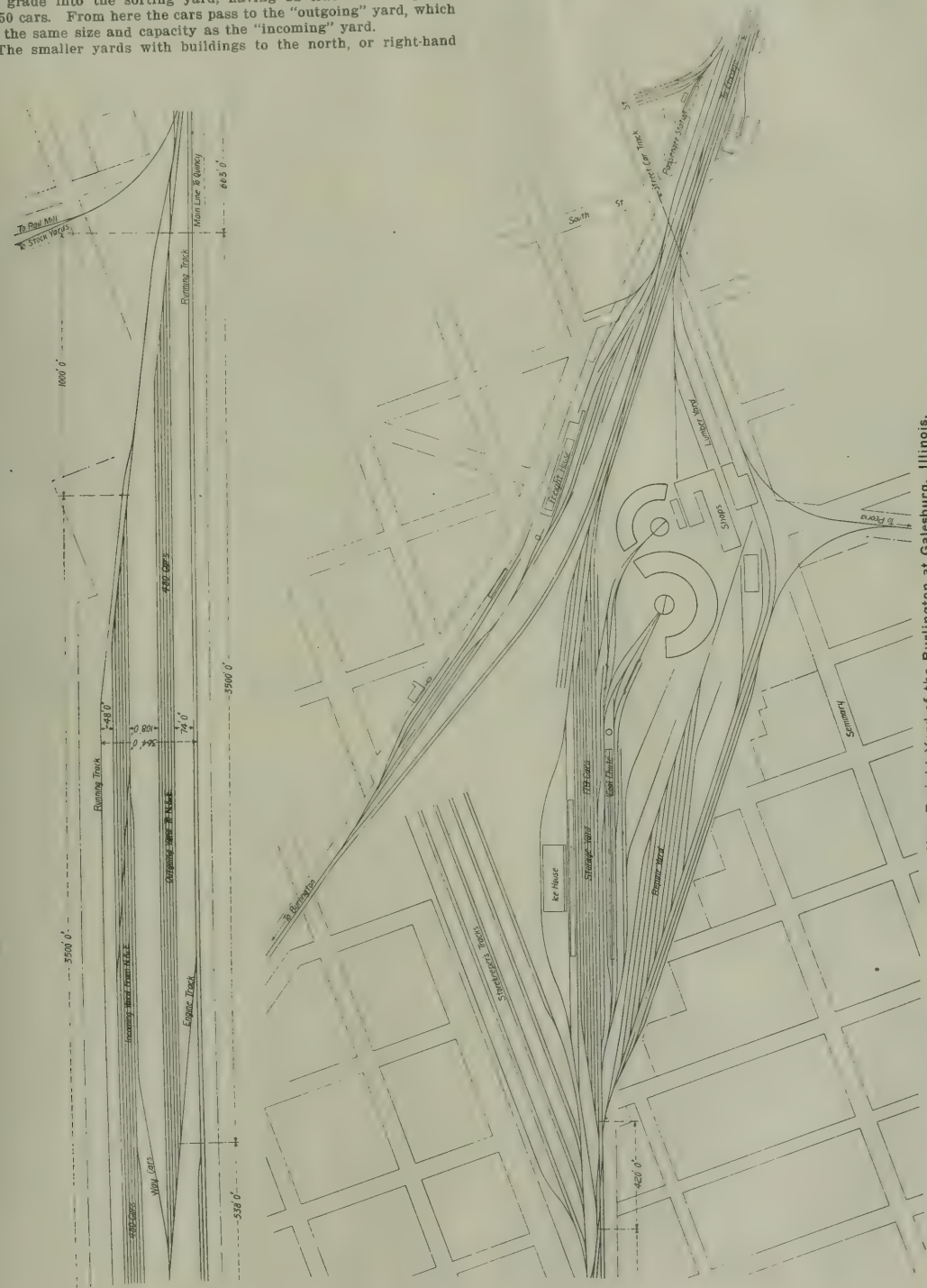
The facilities at Galesburg for some time have been inadequate properly to care for the heavy interchange of traffic at that point. The maximum length of yard track is 2,000 ft., which is too short for the 80-car and longer trains now common. The total amount of track room also is far too limited. The situation necessitated the building of an entire new yard and plans were prepared accordingly for a site immediately south of the present yard, adjacent to the line to St. Louis and Kansas City.. Work has begun and is being pushed as rapidly as conditions will permit.

The general plan of the yard is shown herewith. It is a double


Entrance to, and Part of, the Burlington's New Freight Yard at Galesburg, Illinois.
SCALE OF FEET
PROFILE OF HUMP
Running Tracks
Engine Track
Sorting Yard
Galesburg Sctn. Ts
Main Line to Quincy

hump yard almost three miles long and consists of duplicate halves, planned for movements in opposite directions; that is, one half is for the movements north and east and the other for the movements south and west. Each half is made up of an "incoming" yard having six tracks with capacity for 80 cars each; or 480 cars total. The outlet passes over a hump with a maximum approach grade of 4 per cent., from which the cars are directed down a 1 per cent. grade into the sorting yard, having 21 tracks and capacity for 650 cars. From here the cars pass to the "outgoing" yard, which is of the same size and capacity as the "incoming" yard.

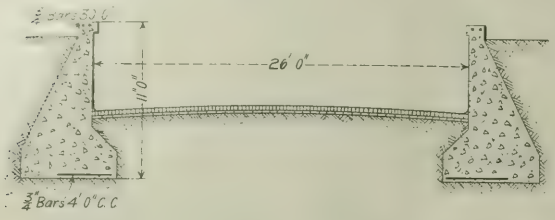
The smaller yards with buildings to the north, or right-hand end, of the new yard occupy the site of the present yard, which is to be remodeled as shown. There will be a storage yard for 179 cars, a repair yard, and an icing plant of 15,000 tons capacity for refrigerator cars. As shown by the map, a cut-off will be built from the Omaha line to the south end of the new yard, the convenience of which is obvious. It will be about four miles long. All movements will be in the direction of traffic except between



New Freight Yard of the Burlington at Galesburg, Illinois.

the Peoria line and the lines north and east where a reverse movement must occur. Trains from the Peoria line are, of course, received in the north-and-east "incoming" yard. Cars destined north or east are switched across to the north-and-east sorting yard and thence to the "outgoing" yard. Cars from the north and east for the Peoria line follow the same yard movement.

The yard will not be completed until next summer, although it is expected to have it half done before the bad weather of the fall stops the work, and the completed portion will be put into service at once. Operation will be from central towers adjacent to the humps, and when the yard is done it will be equipped for electric operation. Until that time the switches will be moved by



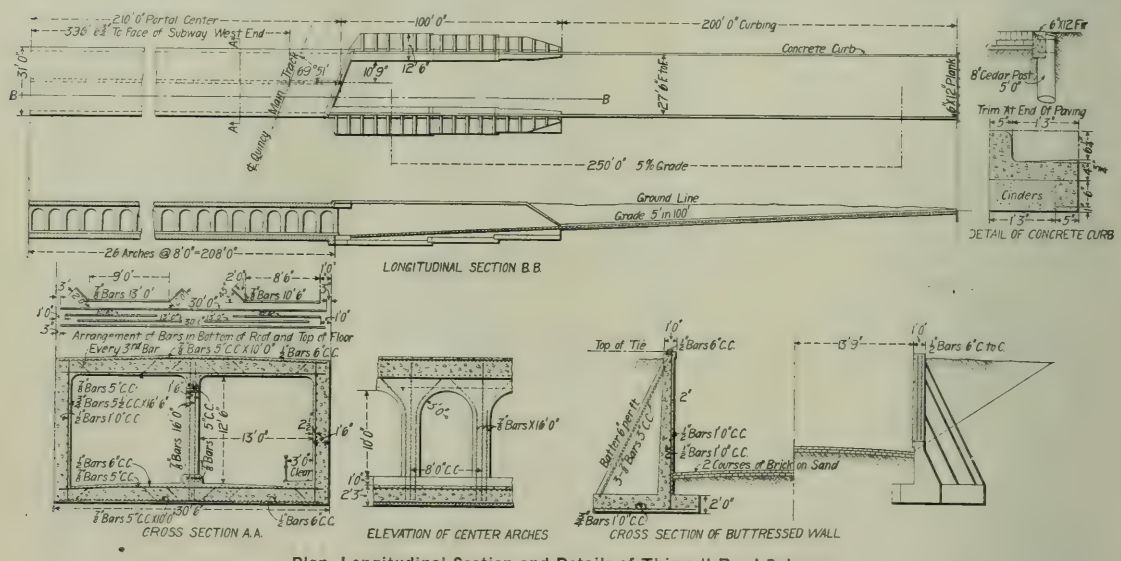
Cross-Section of Approach—Lemon's Corners Subway.

hand. The yard will contain about 30 miles of track and 200,000 cu. yds. of grading will need to be done. The total cost will be in excess of $400,000. One considerable item in the cost bill will be two reinforced concrete subways passing transversely under the yards at the points indicated on the plan. They will be built in response to and in conformity with the demands of the community, which insisted that underneath crossings be provided at the intersections of the yards and two existing highways. The total length of each subway, including approaches, will be 1,000 ft., of which 420 ft. is subway proper. Drawings of the design are shown herewith.

The cross-section shows the details quite fully. It is a double-roadway box design, 30 ft. 6 in. wide outside, 17 ft. high at the middle and 6 in. less than this at the sides. The inside clearance is 12 ft. 6 in. The partition wall between roadways is broken into arches 6 ft. wide, the distance c. to c. of columns being 8 ft. Johnson corrugated steel bars are used for reinforcing, ½ in., ¾ in. and ⅞ in. bars being used. Their arrangement is shown by the drawings. The clear width from side wall to partition is 13 ft. One side, however, contains a 3-ft. 6-in. sidewalk which reduces the clear roadway width. The sidewalk is protected by a gas-pipe railing 3 ft. high. The roadway will not be paved, and vehicles will run right on the concrete. The roadway is level at the center line and crowned 6 in. at the ends.

A buttressed design of retaining wall will be used for all of the approaches for the Thirwell Road subway, and possibly throughout in the Lemon's Corners subway, although drawings for the partial use of a solid design have been prepared. A cross-section of the roadway and this solid wall design is shown. The west approach to the Lemon's Corners subway is more elaborate than the others, as it extends both north and south parallel to the tracks. The total distance in each direction is 248 ft., or 496 ft. total. The estimated amount of concrete for both subways is something more than 8,000 yds.

The yard plan was prepared by Mr. J. D. Mason, formerly Chief Engineer of the Eastern Division of the Great Northern, and now engaged on special work for the Hill Lines. The subways were designed by the bridge department, Mr. C. H. Cartlidge, Bridge Engineer. All of the work is being done under the supervision of Mr. W. L. Breckenridge, Engineer of the Lines East of the Missouri River.


210' 0" Portal Center
336' 6" To Face of Subway West End
100' 0"
200' 0" Curbing
Concrete Curb
6"X12" Plank
8' Cedar Post 5' 0"
Trim At End Of Paving
Cinders
DETAIL OF CONCRETE CURB
51' 0"
Main Track
69° 51'
10' 9"
12' 6"
27' 6" Fill
250' 0" 5% Grade
Ground Line
Grade 5' in 100'
26 Arches @ 8' 0" = 208' 0"
LONGITUDINAL SECTION B B
Arrangement of Bars in Bottom of Roof and Top of Floor
Every 3rd Bar
Bars 5' C. C. X 10' 0"
Bars 6' C. C.
Bars 13' 0"
Bars 10' 6"
30' 0"
Bars 5' C. C.
Bars 5½ C. C. X 16' 6"
Bars 10' 0" C. C.
Bars 16' 0"
13' 0"
3' 6" Clear
Bars 6' C. C.
Bars 5' C. C.
Bars 5' C. C. X 10' 0"
CROSS SECTION A A.
Bars X 16' 0"
8' 0" C. C.
ELEVATION OF CENTER ARCHES
Top of Tie
Bars 6' C. C.
Bars 6' C. to C.
Batter 6" per ft.
3" Bars 5' C. C.
Bars 1' 0" C. C.
2 Courses of Brick on Sand
2' 0"
Bars 1' 0" C. C.
CROSS SECTION OF BUTTRESSED WALL

Plan, Longitudinal Section and Details of Thirwell Road Subway.

The Cost of Locomotive Operation.

XI.

BY GEORGE R. HENDERSON.

(*Continued from page 183.*)

MAINTENANCE.

General Repairs.—Probably no portion of our study is of greater interest than the question of repairs, yet it is one that defies every attempt to bring it to a scentific basis of comparison. We know in a general way that large engines are more costly to maintain than small ones, such as were used 20 years ago; that certain special types or designs are more troublesome to keep up than others; that labor and material are higher priced in the west than in the east; that certain sections of the country, on account of water, fuel, or physical conditions cause more frequent repairs; and that heavy trains (overloading) cause breakdowns and damage to the locomotives, but when we attempt to analyze these factors in detail and determine *how much effect* each has upon the general question of repairs, we find ourselves hopelessly stranded.

If we attempt to analyze statements and statistics regarding the cost of repairs, and wish to unravel the why and wherefore of each statement, we enter a labyrinth of detail and investigation that will be as unproductive as it is laborious. The enormous number of factors entering into this proposition is such that many of them cannot be assigned positive values, by which any close attempt to estimate beforehand the probable cost of repairs for any given locomotive in any specified locality will be fruitless. It often happens that two or more locomotives, exactly alike, are put on the same runs, and in the first year one of them will cost two or three times as much as the others. This is frequently laid to the carelessness of the men handling the unfortunate engine—it often happens that the blame should be divided between the engineers and the builders of the machine, who, perhaps, have slighted some of the workmanship, or supplied defective material. Some engines continually break frames or cylinders, while others, apparently identical in every way, give no trouble. Of course, there is a reason for all these things, and it is allowed that many of them should not be permitted to exist, but they *do exist*, and the best that we can do is to recognize them, and correct them as fast os possible.

However, as in the case of losses in fuel, all engines have some

troubles, but some usually do not have all, so that for a large division the matter is likely to equalize itself, and the average may remain fairly constant. Thus for the year 1899, the cost of repairs and supplies per engine mile on the Chicago & North-Western ran between 3 and 4 cents each month during the year, but did not touch either of those figures. Some roads think that a regular appropriation will suffice to cover the cost of repairs, but as wrecks and unforeseen contingencies are likely to arise, distorting the average for the particular month, it is not recommended. Our caption, general repairs, must not be taken in the strict sense in which it is ordinarily used by railroad shops, but for our purpose must include everything which cannot be properly considered running repairs. It is customary on some roads to consider all general repairs when the cost at any one time reaches a certain figure—sometimes $750. While this may be of some benefit in classifying the amount of work done, it is of little actual value, unless all the conditions are known, and also the mileage since the previous general repairs.

Some railroads regulate their shopping by the mileage which the engine has made since the last shopping. In this system the mileage made is posted each month on a card, and the additions of the previous month are made, and when the shopping mileage is reached, the engine is withdrawn from service. We believe the better way is to have the condition examined and reported each month, as the actual condition is at all times more important information than the bare mileage. For example, we would expect ordinarily that passenger locomotives should make 120,000 miles and freight engines 80,000 miles between general repairs, but even this is ambiguous, as a large portion of the mileage may be with light trains, or with very heavy ones, as the case may be. Then there may be a condition when the firebox needs renewal, from some sudden failure, the engine having made not over 30,000 or 40,000 miles since being overhauled, whereas the machinery may be good for six months further work.

In order to provide for these contingencies as well as to keep track of the work which the engine has done, the writer introduced the cards shown below, in addition, of course, to the monthly condition statements.

Engine No. ..... Class ..... on ..... Division.
In ..... service ..... miles since General Repairs
should go to ..... Shops ..... for
Boiler Repairs .....
Flue Repairs .....
Machinery Repairs .....
Tire Repairs .....
Wreck Repairs .....
Engine is now .....190.....
.....M. M.

(SIDE A.)

Engine No. ..... Class.....
Ordered to .....Shops.....190.....
Arrived at .....Shops.....190.....
Taken in .....Shops.....190.....
Ready for service .....190.....
Sent to .....Division.....190.....
Remarks .....
.....
.....
Cost of Repairs ..... $.....

(SIDE B.)

As the locomotive approached the condition where a shopping was needed, a card was filled out (see side A) by the Master Mechanic to whom the engine was assigned, giving the general details of repairs needed, the mileage made since last general repairs and present location of engine and shop to which, in his judgment, she should be sent, and this was mailed to the superintendent of motive power. These cars were to be sent in at least a month (if possible) before the engine should be withdrawn from service, and especially if the grade of repairs necessitated sending the locomotive to a large shop on another division. This afforded opportunity to properly regulate the class of work sent to the different shops, and to give special instructions regarding the repairs. It also called attention to the mileage made, and if this was small gave a chance to call for explanations as to the condition of the engine.

Side B was used while engine was being shopped, and when completed the time and cost of the work indicated whether the instructions had been complied with or not. These cards were filed in a "card index tray," and thus the last shopping of any engine, with cost and other general points, could be immediately ascertained, and when the next card arrived indicating that a shop period was needed, this and the previous card gave very valuable information regarding the engine. While $750 might have covered the cost of general repairs some years ago when locomotives were much smaller than they are now, and when labor and material were both lower in price than at present, comparatively little can be done for that sum at this time. From a statement before us, made in 1902, one of the best managed roads in the northwest shows $1,000 for general repairs for some 17 by 24 in. engines, which were supposed to represent average conditions. For 19 and 20 in. cylinders the repairs run higher—$1,200 to $1,500 per engine. When a new firebox is needed these figures are increased by from $500 to $1,000, depending largely upon the necessary boiler work accompanying the insertion of the new firebox, as at times it is found advisable to renew certain steel sheets which have deteriorated. In the southwest where labor is much higher paid and often not so effective, the cost is likely to run 10 or 20 per cent. greater.

The relative proportions of labor and material entering into the cost of repairs are, of course, not fixed, and vary usually from equal halves to two-thirds and one-third; that is, the cost of labor will ordinarily lie between .50 and 66 per cent. of the total cost of repairs. There are cases when it may be less, or more, but we think an assumption of 60 per cent. for labor and 40 per cent. for material will not be far from the general average. When locomotives are rebuilt, that is, receive new boilers and many parts of machinery, the cost may run up to 30 or 40 per cent. of the original price—in some cases more, depending entirely upon the nature and extent of the work done.

It has been generally recognized that the last few years have been extremely expensive ones for the railroads. In a communication to the Railroad Commissioners of Texas addressed by the International & Great Northern Railroad in 1903, the statement was made that during the past five years the average wages of employees had increased 15 per cent.; prices of material had increased 53 per cent.; prices of locomotives, 56 per cent., and prices of cars 26 per cent., yet in the same period the freight rates had *decreased* on an average of 21½ per cent. These increases have been a source of much anxiety to railroad officials, and the only method of offsetting these conditions is in the erection of modern shops and the purchase of up-to-date machinery. This means a large outlay, but it is well justified by the results if made with discretion.

Of course, the size of the engine must be considered, as a large locomotive cannot be overhauled for the same cost as a small one, and the repairs should be considered in connection with the work accomplished. The old method of basing repairs on the engine mileage is really of little value unless the size and power of the engine be also considered. On the other hand, the ton-mileage is not altogether satisfactory for two reasons: It does not cover light engine mileage, which certainly causes some wear to the parts, and it does not tell us whether the full power of the engine has been in use, or only a part of it.

If the general repairs of a locomotive cost $1,000 and cover a period of 100,000 miles, the rate for such repairs will be one cent a mile. (This does not include running or roundhouse repairs.) If the firebox must be renewed every 100,000 miles, which actually occurs under some adverse conditions, the rate will run 1½ cent or more per mile. In sandy sections and on heavy grades, the mileage may run only 50,000 or 60,000 miles between such repairs, increasing the cost to 2 or 3 cents a mile. In some bad water sections, flues have been renewed every 90 days, or say 10,000 miles; as this costs in the neighborhood of $300, the flue work alone will add 3 cents a mile to the repair charges. Of course, the obvious remedy is to treat the water so that the flue trouble will not exist, but then we may get into transportation difficulties even more troublesome. In fact, there is perhaps no locomotive account that depends upon the physical conditions of the road and the manner of loading and operating the engines as much as does the cost of repairs.

The method of treating the engine after it has been brought into the shop is also very important. It is well-known that the longer an engine remains in the shop the more it will cost, largely due to the fact that the ordinary mechanic has little interest in the accurate distribution of labor, and also to the tendency to "find work" to do as long as the locomotive remains in the shop. Remarkable improvements both in time and cost of doing work have been made by a system of scheduling the work beforehand, and providing each department with a date when the different important parts *must* be ready. This insures smooth and uniform progress of the engines through the shop, and avoids the delay due to waiting for materials from the different departments.

In one of our large shops in the northwest where this system has been in conscientious operation for four or five years, the time of general repairs has been reduced from one month to 13 days, and yet this shop is not provided with traveling cranes, nor is the work paid for by the piece. This is merely referred to in order to illustrate the importance of proper system and organization in all branches, if the best results are to be attained. Of course, modern machinery must be provided, and high speed tool steel, with the proper help for the foreman to see that all tools are constantly running at the correct speed, as no matter how ample the facilities, if an efficient *personnel* is lacking, the shop cannot be a success. Examples of this are seen at the present time, where in spite of the expenditure of large sums for improvements, the output of the new shop is very discouraging, and is a source of adverse criticism to the motive power department.

Complete co-operation is necessary between all the departments, and probably nothing inspires this quicker than regular meetings of the shop foremen, with the master mechanic, where improvements in the service and modern shop practices are freely discussed and trials of same encouraged. The manufacture of repair parts in large quantities reduces the unit cost, and makes necessary turret lathes and duplicating machinery. The scrap pile af-

fords a vast field for study and generally such investigations, if carefully made, will bear fruit. The judicious use of malleable iron instead of brass will often constitute quite a saving, and even some brass castings are made very much heavier than actually necessary.

It would be out of place here to attempt any lengthy discussion of shop methods, and the benefits resulting from up-to-date practices, but the important part which they bear to cost of repairs is readily recognized and will be appreciated.

(To be continued.)

The Great Northern Time Freight System.

The Great Northern time freight system, while similar in its general scheme to that of the Chicago & North-Western and the St. Louis & San Francisco, differs in its scope and in certain other important particulars. Only one class of time freight is carried, similar to the practice on the North-Western, and one train daily in each direction, originating respectively at St. Paul and Seattle (trains No. 401 and No. 402) carries this freight. But the class of goods which can move under the time freight symbol covers not only all perishable freight, including all freight liable to damage by freezing and all l. c. l. merchandize, but also all freight from eastern terminals destined to Montana and points west, including Helena, Butte, Anaconda, Spokane, Everett, Seattle and Vancouver, and points on connecting lines reached via these junctions, including all freight for export; likewise, all freight for Canadian Pacific and Canadian Northern points via Neche and St. Vincent, and all freight from eastern terminals destined to competitive points in Minnesota, Wisconsin, North Dakota, Iowa, South Dakota and Nebraska. In fact, all eastbound freight from points west of Havre is included in this classification, excepting only forest products and grain. Besides these general classifications, some 180 specific commodities are enumerated. Permission may also be obtained from the superintendent of car service to symbol and card as time freight other freight not shown in the

*For previous time freight articles see Sept. 1, Chicago & North-Western; Aug. 25, Atchison, Topeka & Santa Fe, and Boston & Maine; Aug. 18, St. Louis & San Francisco.

KEY TO TRAIN SYMBOLS

Train No. 401

Symbols		A	B	D	F	G	H	J	K	N	Q	S	U	V	W	Y	Z	A	B	D	F	G	H	J	K	N	Q	S	U	V	W	Z
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Como	Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Willmar	"	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Breckenridge	"	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1
Larimore	"	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1
Minot	"	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2
Williston	"	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2
Glasgow	"	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3
Havre	"	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3
Cut Bank	"	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3
Whitefish	"	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
Troy	"	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
Spokane	"	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5
Wilson C.	"	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5
Leavenworth	"	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6
Delta	"	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6

Key to Train Symbols

FORM 026.

If Delayed Attach Notice of Detention Here

Great Northern Railway Company

TIME FREIGHT

Initials ..... Car No. .....

Transferred to, Initials ..... Car No. .....

At ..... Date 190

From .....

To .....

In Train No. ..... Train Symbol ..... Date .....

Final Destination .....

Routing ..... R. R.

Contents .....

Consignee .....

If way bills are not enclosed show here station to which mailed .....

Weigh at .....

Stop Car at ..... For .....

WEIGHT

Weighed at .....

Gross .....

Tare .....

Net .....

Forwarding Station Symbol Letter ..... Number .....

INSTRUCTIONS

IMPORTANT **READ CAREFULLY**

This envelope will be used for each car of Time Freight, or for an empty car when handled as Time Freight. In the last case an empty car slip must be enclosed and if an empty foreign car, card form 345 must also be enclosed.

When authorized, agents will use this envelope as a card way bill for loaded cars, regular way bill to follow by mail. See Rule 15.

All of the way bills for each car of Time Freight will be contained in a red envelope and not more than one envelope may be used for one car.

If scale weight is obtained in transit it must, in addition to being shown on this envelope be placed on the regular way bill contained herein.

If a car of Time Freight is set out short of destination a notice of delay Form 1122 must be securely attached to the face of this envelope, a set out report telegraphed to Supt. of Car Service, St. Paul, and the car must thereafter be handled in preference to all other Time Freight of the same class.

Agent will enter on these lines any special instructions following car

Front of Waybill Envelope, Great Northern.

Time Freight Trains No. 401 originating at St. Paul and No. 402 at Seattle are known as symbol trains and carry according to date of departure the following symbol letters. See Rule 5, Time Freight Instructions.

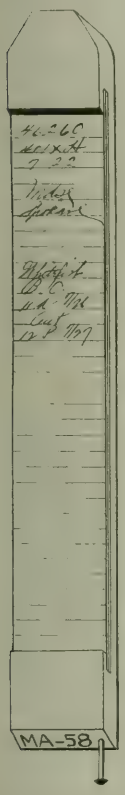
Key to Train Symbols																																
No. 402	Symbol	A	B	D	F	G	H	J	K	N	Q	S	U	V	W	Y	Z	A	B	D	F	G	H	J	K	N	Q	S	U	V	W	Z
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
No. 401	Symbol	A	B	D	F	G	H	J	K	N	Q	S	U	V	W	Y	Z	A	B	D	F	G	H	J	K	N	Q	S	U	V	W	Z
		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

RECORD OF MOVEMENT

TRAIN No.	TRAIN SYMBOL	STATION Taken From	STATION Left at	DATE	CONDUCTOR

classification, but the authority must in each instance be shown on the red time freight envelope.

It takes six days for one of these time freight trains to make the run from St. Paul to Seattle, and for convenience and identification of trains the company uses a code of symbols entirely distinct from the other symbols applied to the individual cars of time freight. One of these keys of train symbols is illustrated herewith. Train No. 401 leaving Willmar on the eighth day of any month would be reported as 401 K, and it would receive that same name at the other stations shown for that run, Breckenridge, Williston, Spokane, Delta, etc. Train No. 401 leaving Willmar on the twenty-first day of any month would be reported straight through its trip as 401 XG. A similar schedule is provided for train No. 402 eastbound, and the same letters are used to designate the same day in the month. In addition to this train designation two letters combined and a series of numbers are assigned to each symbol station and two symbol letters and one number are used for each car of time freight, similar to the practice on the other roads hitherto reported. For example, Barnesville, Minn., is B N and has the numbers 1 to 25. Minneapolis, Minn., is M A, and has numbers 1 to 750.



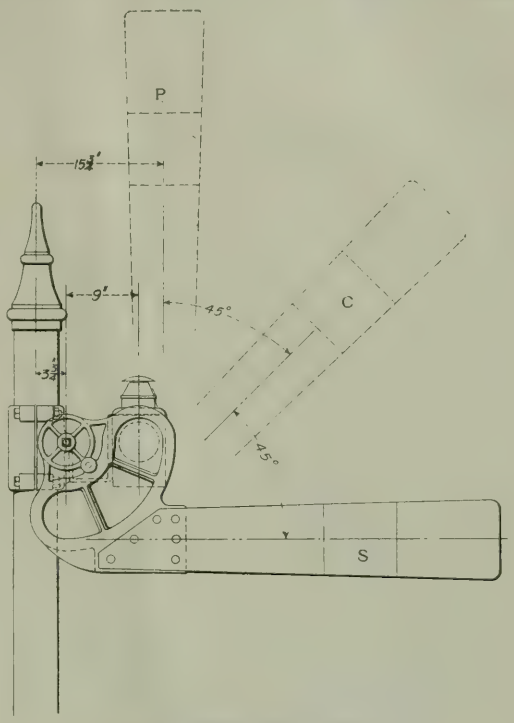
It is provided that time freight shall not be placed under symbol when it originates on and is destined to points on the same operating division or conductor's run. Agents at non-symbol stations originating time freight notify the division superintendent by telegraph and in the absence of special instructions forward the cars in local trains, notifying the agent at the nearest division terminal or junction symbol station through which the car will pass. An agent so notified applies symbols to these cars in the same manner as to cars originating at his station. A red time freight envelope which has been discarded by some of the other railroads whose systems have been described is used on the Great Northern, for each car, to contain waybills. It is provided that in no case shall the waybills for more than one car be placed in the same envelope.

The set-out report, passing report, notice of detention and consist report, which make up the principal working forms of the system, differ in no essential from those already shown, and consequently are not reproduced herewith. There is an interesting difference in practice, however, as regards the graphic method of tracing the train in the superintendent of car service's office. The train board in use by the Chicago & North-Western was shown last week. The Great Northern also makes use of a time freight board, which is about 16 ft. long and is divided into sections representing each operating district or division, the names of all the principal terminals being shown on it; but small iron rods run across the board and on these are carried boxes containing the car number, each box representing a train. The upper half of the board is used for eastbound trains and the lower half for westbound trains. The symbol numbers are placed on blocks instead of on small plugs, as is the usual custom. One of these blocks is illustrated herewith. The symbol number, which in this case is M A (Minneapolis) 58, is placed on the end of the block, and the block carries a number of paper slips, on the uppermost one of which is noted all necessary information, such as the car number, originating point, contents, destination and memorandum of delays. The company considers this plan much superior to the old method of using the small wooden plugs (see Chicago & North-Western last week), as all the necessary information is carried with the symbol number, and no time is lost in looking up information relative to delayed cars.

For particulars regarding this time freight system we are indebted to F. Bell, Superintendent of Car Service.

A Proposed Semaphore.

Committees of signal engineers of the New York Central lines, including roads west of Buffalo, and of the Pennsylvania lines, including roads west of Pittsburg, in joint conferences have recently been discussing improvements in signal practice and have considered, with a good deal of favor, a proposition to have all semaphores so changed in design that the all-clear indication shall be given by inclining the blade upward instead of downward, as is the case at present on all American railroads. With a two-position signal this scheme would provide for a horizontal blade to indicate stop and a blade inclined upward 60 or 70 degrees for all-clear. In a three-position signal the arrangement would be horizontal for stop; 45 degrees upward for the cautionary or distant indication and 90 degrees upward (vertical) for all-clear or "proceed." The inclination 45 degrees upward is in use for "caution" on the Erie and the Atchison, and has been thus used for 15 years or more. One of the three-position designs which has been considered by the committees is shown in outline herewith. The chief reason advanced for abandoning the downward and adopting an upward inclination is that with the latter a breakage or failure is more certain to throw the signal



A Proposed Semaphore.

S = stop. C = caution. P = proceed.

to the stop position without the aid of a counterweight. Accumulations of sleet, which under present practice tend to throw the signal to the all-clear position, would tend to throw it to the stop position.

Superannuation Fund on the New Zealand Government Railways.

The provisions of the Government Railways Superannuation Fund Act, which went into operation in New Zealand at the beginning of 1903, are unusually liberal, as will be seen from the following digest supplied us by Mr. T. Ronayne, General Manager of the New Zealand Railways, on the occasion of his recent visit to this country. The fund consists of contributions from persons employed by the department, of money now in the Railway Service fund; of fines and penalties which would hereafter be payable into this fund, except for the passing of the Act; and of interest accruing from investment. Every person who at the commencement of the Act was permanently employed in any capacity by the department was given the right at any time within the ensuing six months to become a contributor to the fund. Those who did not elect so to do are debarred from becoming a contributor to the fund at any future time, or from participating in its benefits. All persons permanently employed in any capacity by the department after the law went into effect, however, are required to contribute to the fund as a condition of their employment. The contribution from members is deducted at each monthly accounting period and is based on a percentage of pay received. This amounts to 3 per cent. if the age of the employed is not more than 30 years at the time when the first contribution becomes payable; to 4 per cent. if his age is between 30 and 35; to 5 per cent. if it is between 35 and 40 years, 6 per cent. between 40 and 45; 7 per cent. between 45 and 50, and 10 per cent. if above 50.

The fund thus acquired is administered by a board made up of nine members, including the Minister of Railways, the Solicitor General and the General Manager of Government Railways. Every contributor whose length of service in the department is 40 years or over, or whose age is 60 years or over, may at any time retire from the service of the department at the expiration of three

months' notice of his intention to do so, and is thereupon entitled to receive from the fund an annual allowance for the rest of his life. It is stipulated that for every year of service in the department he shall receive one-sixtieth part of his annual rate of pay, but in no case shall the total yearly allowance exceed two-thirds of such annual rate of pay. It is also provided that the board may extend the provisions of the superannuation to cases where the contributor's service is not less than 35 years but does not amount to 40 years. A contributor who retires with the consent or by the direction of the Minister on the ground of being physically unfit for further duty is entitled on his retirement to receive an allowance for the rest of his life as stipulated above. It is provided that if any contributor voluntarily retires from the service of the department before becoming entitled to a retiring allowance under the act, or if his services are dispensed with from any cause other than misconduct, he shall be entitled to a refund of the whole amount actually contributed by him to the fund, but without interest, together with any compensation to which he is entitled under the Government Railways act of 1887. Contributors dismissed or those whose services are otherwise dispensed with from misconduct are likewise entitled to a refund of the entire amount which they have actually contributed, computed without interest. In the event of the death of a contributor before retirement his legal representative receives the entire amount paid in without interest, in the same manner as with one who voluntarily retires prior to the expiration of his time. But if such contributor dies leaving a wife or children who survive him, then in place of such payment to his legal personal representative it is provided that there be paid to or for the benefit of the widow during her widowhood the annual sum of £18, with an additional sum of 5s. a week for each child until the child is 14 years old. These annual payments are to be made at the discretion of the board, but in no cases shall payments be at longer intervals than four weeks. The widow has the option, however, of receiving in a lump sum in place of this allowance such portion of the amount of contributions actually paid by the contributor to the fund and of the compensation to which the contributor was entitled under the provisions of the Government Railways Act as the board may determine.

If at any time the pay of a contributor is temporarily stopped by the department on the ground of ill health he is allowed to continue to contribute to the fund and his rights to the benefits provided are not affected by the stoppage. With regard to determining the annual rate of pay as mentioned in the previous paragraph, it is provided that this rate shall be taken as the rate the contributor was receiving at the time of his retirement, unless within the previous five years he had served in a lower grade. In that case, the average rate during the seven years next preceding his retirement is taken. But where a contributor's pay is temporarily reduced, or where through age or infirmity he is transferred to a subordinate position to that which he previously occupied, his retiring allowance is computed on the maximum rate of pay he received before such reduction or transfer.

At times when the fund is unable to meet the charges upon it, the board is instructed to set forth the fact to the Colonial Treasurer, stating the deficiency and the causes, and the Treasurer is authorized to make good the deficit without further authority. Retiring allowances and other money granted under the Act cannot be assigned or in any way alienated from the grantee and these grants are not subject to the Bankruptcy Act of 1892.

A servant girl riding in a third-class compartment in Hungary carried with her three gallons of alcohol in a demijohn which by some accident broke, so that the alcohol ran over the floor and also into the adjacent compartment. There a countryman touched it with a lighted match "just for fun," to see if it would burn. It did burn, and so did the car and the next one, and the poor girl and two other passengers.

Automatic Block Signals on the Erie.

The Hall Signal Company has taken an order from the Erie Railroad for equipping with automatic electric motor semaphore block signals its line from Bergen, N. J., two miles from the Jersey City terminal, westward to Middletown, N. Y., 66 miles. The contract covers 175 miles of track. There will be 82 single-arm and 33 two-arm signals. In blocks more than one mile long, the distant signals will be on separate posts, but between Bergen and Suffern the blocks are shorter and distant and home signals will be on the same post. The lengths of the blocks vary from three-fourths of a mile to 1¾ miles. This is the first important installation of automatic signals which has been made by the Erie, and the new signals will, for most of the distance, displace controlled manual block signals. The automatic block signals are to be worked by storage batteries charged by wire lines from generating stations at Rutherford, Ridgewood Junction, Suffern, Oxford and Middletown. A portion of this line is four-track, and on this portion bracket posts will be used. Parts of the line close to the eastern terminus have been four-tracked for many years, and the present signals are on bridges; these bridges will be retained. The Sykes lock and block apparatus, which is to be displaced, has been in use about 18 years, and much of it had reached the age at which it would soon need to be renewed.

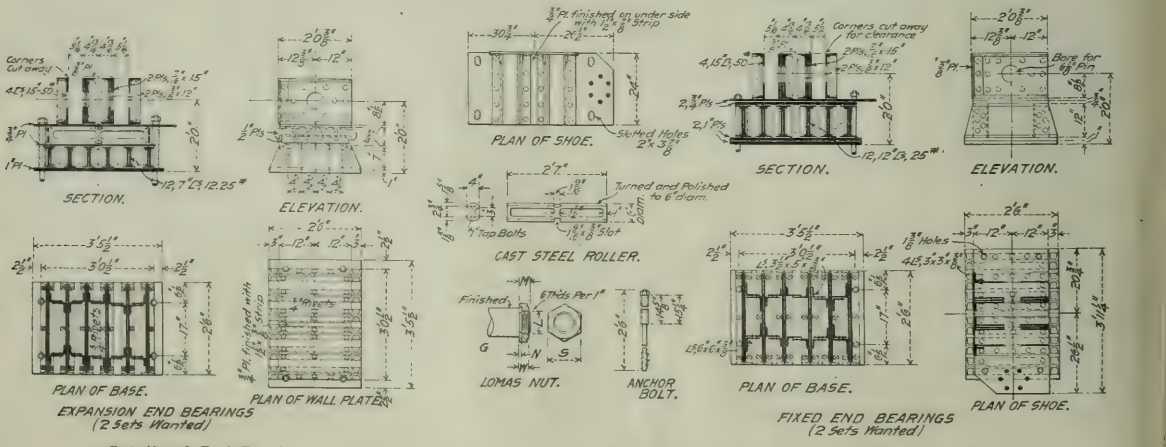
The five charging stations have each a 500 volt, three k.w. direct current generator operated by a gasolene engine. The charging lines will be No. 10 hard drawn copper wire. The contract also calls for 95 electro-mechanical slots for existing signals and 27 highway crossing bells.

The Hall company has also closed contracts recently with the Chicago & Alton, the Union Pacific and the Alabama Great Southern.

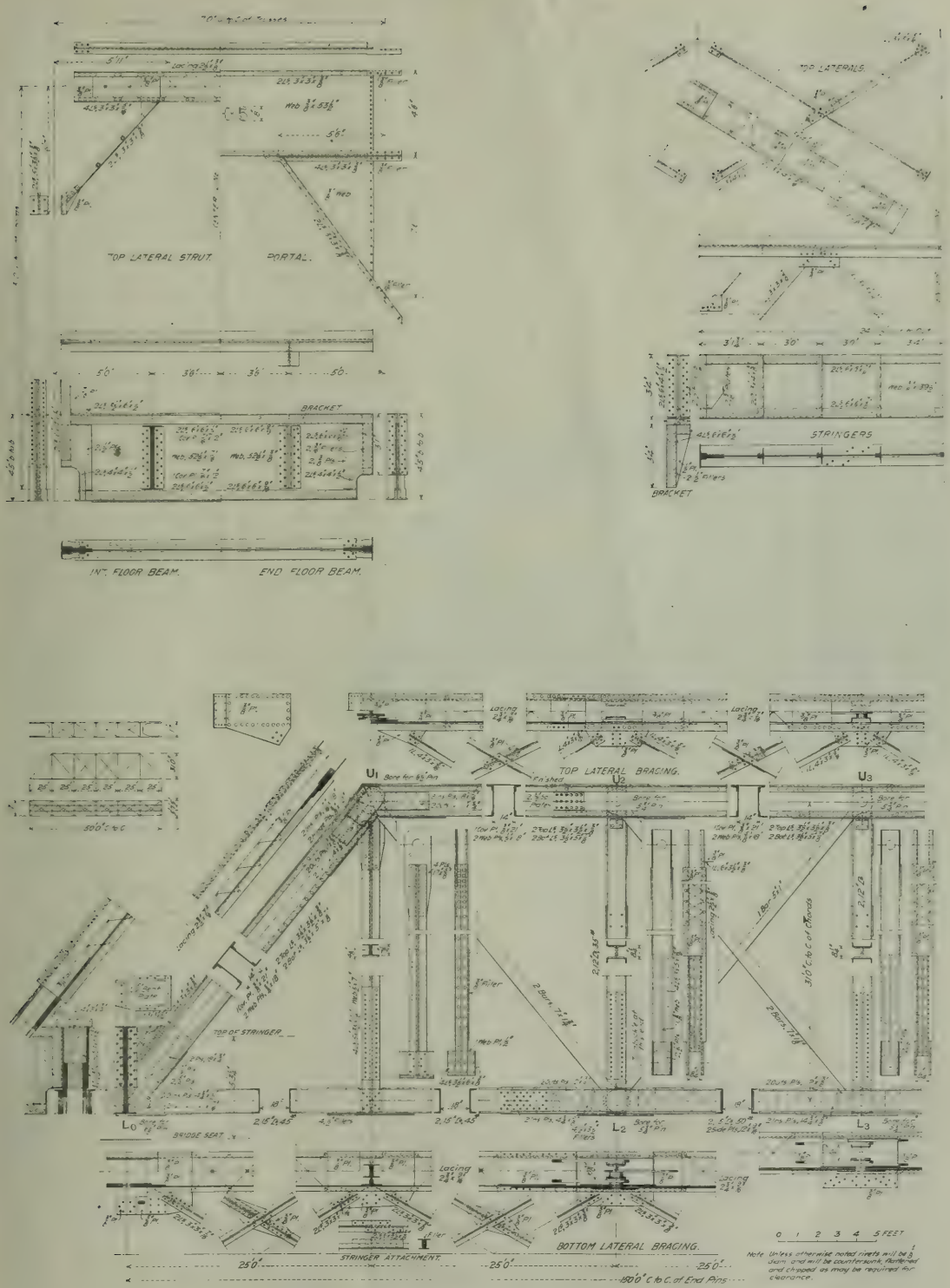
Standard Bridges on the Harriman Lines.*

The 150-ft. span through pin-connected truss bridge illustrated this week is the first of the Harriman Lines standard designs shown for this type of bridge. There are six panels, the two center panels have double diagonals, one of which consists of two bars 7 in. x 1⅛ in. and the other of a single bar 5 in. x 1 in. The intermediate panels have single diagonals each 7 in. x ¾ in. The top chord is built up of a cover plate 21 in. x ⅜ in.; two webs 18 in. x ½ in. spaced 14 in. apart; two top flange angles 3½ in. x 3½ in. x ⅜ in., and two bottom flange angles 3½ in. x 5 in. x ⅞ in. The end diagonals are fabricated in a similar manner to those shown in the 150-ft. riveted through truss bridge which was illustrated last week, the only difference being the distance between and in the thickness of the web plates, which are spaced 14 in. apart instead of 13 in. and are ¾ in. in thickness instead of ⅝ in. The bottom chord is made up of two 15-in. 45-lb. channels and two 12-in. x $^{9}/_{16}$-in. side plates. The estimated weight of one span complete is 304,000 lbs. as against 311,000 lbs. for the 150-ft. riveted through truss span shown last week.

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, Aug. 11, 18, 25, and Sept. 1.



Details of End Bearings for 150-ft. Through Pin-Connected Span—Common Standard, Harriman Lines.



Details of Trusses and Floor of 150-ft. Through Pin-Connected Span—Common Standard, Harriman Lines.

Raising a Bridge—A Quick Job.

F. H. Bainbridge, Principal Assistant Engineer of the Chicago & North-Western, sends the accompanying photograph to show the raising of a railroad bridge on the Galena division, south of Nelson, Ill. The bridge spans Five Mile Creek, and is a through plate girder 69 ft. long. It was raised with the ties and rails complete, weighing in this condition 113,450 lbs., to provide passage for a dredge increasing the waterway in the creek, and it was of course important that the delay to traffic should be as slight as possible. To raise the bridge quickly and economically, the gallows frame, bents and braces were built up of second-hand 8 in. x 16 in. bridge stringers. The height of the bents was 40 ft. and the total raise was 30 ft. The bridge was raised with four sets of blocks consisting of one 5-sheave block and one 4-sheave block, making a nine-part line. The hoisting lines were handled by two 7 in. x 10 in. double-cylinder double-drum engines, one at each end of the bridge. This equipment was taken from the ordinary bridge erecting derrick cars belonging to the Chicago & North-Western.

The track was cut at 9:02 a. m. on July 18 and the dredge

Lifting a Bridge to Pass a Dredge, Chicago & North-Western.

started at 9:12 a. m. The dredge had two breakdowns on passing through the bridge, but cleared the bridge, proceeding with its excavation at 5:25 p. m. The bridge was lowered again at 5:40 p. m. and the track was ready at 5:55. The work was done by the Engineering department of the Chicago & North-Western, Mr. Edward C. Carter, Chief Engineer. Mr. J. S. Robinson, Division Engineer of the Galena and Madison divisions, had charge of the work.

Railroad Valuations in State Reports.*

Generally speaking, the character of the information contained in state reports is determined by the law. When reports are fragmentary, and give only slight and unsubstantial data; when values of one part of the property are given in great detail, while those of another part are entirely ignored; when important steps in a system of valuation are omitted from the record, it is not, as a rule, the administrative officer to whom blame, if blame there be, should be attached, but the law. A word, then, must be said, by way of general introduction concerning the various systems of valuation provided for by the laws of the several states. These systems of valuation vary with the nature of the tax or taxes imposed.

Railroads are taxed either upon an ad valorem or upon a specific basis, or upon a combination of the two. The ad valorem taxes fall into two classes: First, taxes on the value of real and personal property; second, taxes on the value of stocks or bonds or on valuation based on earnings, dividends, or other results of operation. The specific taxes fall into three classes: First, taxes on stocks, bonds, loans, etc.; second, taxes on gross or net earnings, revenue, or dividends; third, taxes on traffic or some physical quality or property operated, or on privilege.

*Abstract of a report by Prof. Harold M. Bowman, made for *Bulletin No.* of the Census Bureau. This *Bulletin*, giving the total valuation of the railroads of the United States (eleven billion dollars) was noticed in the *Railroad Gazette* of Aug. 18 and 25.

How, then, do these various kinds of taxes affect the systems of valuation? The ad valorem tax *eo nomine* predicates an appraisement by administrative officers. The specific tax imports a legislative or anticipatory valuation. Legislatures obviously adopt this or that specific tax for no other reason than that it provides a relatively sufficient measure of value. The state constitution permitting, the legislature may adopt the par value of bonds and stocks as a basis; it may declare gross or net earnings the proper test; it may reject both and find in the number of cars owned, the number of miles operated, or the number of passengers carried, what it considers the true key to the value of the road.

This distinction should be thrown into clear relief, for it affords the basis for the criticism of railroad valuation in the states, and consequently, also, for a criticism of the administrative reports relating to valuation. If the tax is a specific tax, the responsibility for the value of railroad property is chiefly, if not entirely, legislative, except in so far as the classification of the railroad within the state rests with the administrative authorities. If the tax is ad valorem, the responsibility for the valuation is primarily administrative, for administrative authorities, being empowered to appraise property, may exercise discretion, and within the limits of that discretionary power they are responsible.

The Administrative Reports.—The statements of railroad valuation in the states, so far as published, are found in a variety of reports: Auditors' reports, reports of boards of assessors, of boards of equalization, of boards of public works, of comptrollers, corporation commissioners, governors, railroad commissioners, secretaries of state, treasurers of state, and tax commissioners. In some states all available information is contained in a single report, usually the auditor's. In other states the facts are found in two or more reports; but seldom, even in the entire range of reports of a given state, can full and adequate information of railroad values be found.

If the law calls for the ad valorem taxation of all the property, real and personal, of a railroad, there should be a record of that value somewhere. To be of any general use it should be found in state records and reports. It would be unreasonable to ask any one to seek his information first hand from county and city records.

And yet in many cases the investigator is put to exactly this inconvenience. It is not uncommon for state officers to reply: "We do not know the value of the railroads in our state"; or, "We cannot find out; we have not the means of ascertaining such value." These admissions may mean various things. In some cases they probably mean that administrative officers are indolent or incompetent. In some cases they mean that the state has been niggardly in its appropriations for a very important service. But as a rule, perhaps, they mean that the machinery of the law has not been adjusted to the conditions.

The reports of eight out of the fifty states and territories give no information as to the value of railroad properties. It is true that in most of these states the ad valorem tax is a secondary tax, but this does not excuse the absence of information. Even where secondary, the tax is of importance. In some cases it is of great importance; as in Maryland and Massachusetts, not to mention others. Five states and territories fail to give the values of railroads individually, but give the value of a part or all of the property of all railroads collectively. In Texas, however, the railroad commission has made some progress, taking up a part of the railroad individually each year and appraising their value. These values are reported.

The remaining states and territories, thirty-seven in number, give the values of a part or all of the property of each railroad individually. In many of these states the information is only partial information. In the great majority of them no information is given as to the property not used in operation, or the reports so combine it with other facts as to make the true contents of the report a matter of speculation. And in numerous instances the information is not labeled in such a fashion as to make its significance in the administrative process of valuation apparent.

Information is given by some reports with reference to the value of sleeping car and freight line and equipment companies. Out of eighteen states, which apparently impose a tax on the value of the real and personal property of such companies, ten states give partial or complete information as to the values, while eight states give no information at all.

Reports relating to the values of stocks and bonds are even more defective. Thirteen states impose such a tax either upon rail-

road or sleeping car and similar companies, or both; four of them give information as to the values on which the tax is based (though in one of them the information is given only for one class of companies, viz., the railroads, whereas the tax is on both railroads and sleeping car companies); nine of them give no such information.

These facts, in respect both to railroads and sleeping car and like companies, speak to a large degree for themselves. Of the states having ad valorem taxes on real and personal property of the companies in question, 16 per cent. give no information whatever as to railroad values, 26 per cent. give no information as to the values of individual railroads, while the 74 per cent. which do afford information as to individual roads give only a very imperfect and incomplete record. Add to this the fact that 43 per cent. of the states having ad valorem taxes on sleeping car and freight line and equipment companies give no information as to the values thereof, and the further fact that of the states having a tax on the value of stocks and bonds only 31 per cent. give such values, and the hopelessness of ascertaining the most essential facts regarding railroad valuation from administrative reports is apparent.

In the case of the specific tax on the par value of stocks and bonds we should expect to find such par value given. In the case of the specific tax on gross or net earnings one might reasonably expect to find information as to such gross or net earnings, and if the rate varied or were graduated, the facts which afforded the basis for such variation or graduation. In the case of the specific tax on physical quality or property operated, or privilege, one would expect to find facts concerning the amount of traffic, the physical character of the road, the cars run, and freight and passengers carried, or the nature of the privilege; but here, even more than in the case of the distinctly ad valorem tax, there is a dearth of information.

Five states impose the tax on the stocks or bonds, or both stocks and bonds, or railroads, etc., but not one of them gives any information, placed in authoritative relation to taxation, concerning their par value or the amount of stocks and bonds taxable.

Thirteen states impose the tax on gross or net earnings of railroads, or sleeping car and similar companies, or both, but only five give any information as to such earnings. And of these five, two give no information as to the earnings of sleeping car companies, though they tax the same. Three give information as to the facts which determine the rate for the individual roads. The remaining eight states give no information as to earnings. Seven states have the specific tax on traffic, physical quality, property operated, or privilege, but only one of the seven gives any information as to the facts representative of value on which such tax is assessed.

Summarizing these results in the language of per cents, we find that of the five states having the first specific tax, none gives information as to the valuation on which the tax is ascertained; of the 13 having the second specific tax, only 38 per cent. give information; and of the seven having the third specific tax, only 14 per cent. give information as to the facts representative of value.

Methods of valuing railroad property.—Though conspicuous defects still exist in the various systems of valuation, substantial progress has been made during the past score of years. Until recently railroads were valued according to what has been described as the "primitive" method. That is to say, railroads were not distinguished from other property. Thrown into the general mass, the right of way and the farmer's turnip patch were treated as homogeneous; railroad rolling stock and mechanics' tools as like property. All were appraised by the local assessor. There was no central state valuation of any part of the property. This system still persists in certain states. Wherever it is found the administrative reports of railroad valuation are, as a rule, hopeless, no satisfactory information as to railroad values being found in them.

The next step in advance, beyond which many of the states have not gone, was the provision for the valuation of a part of the property by a central state board or officer, the other property being valued by local officers. The principles for the division or distribution of property for local and central assessment are quite various, showing little or no fundamental consistency. Some states provide that all the rolling stock shall be appraised by a central board, all other property by a local board. Some provide that all property used in operation shall be appraised centrally, only the property not used in operation locally. In some cases the law makes a distinction between various classes of railroad realty and personalty, providing, let us say, that the roadbed, right of way, and rolling stock shall be appraised by central authority, while stations, machine shops, fixtures, furniture, etc., shall be assessed by the local officers. The weaknesses peculiar to this system of valuation arise very largely from the possibility of conflict and the dissipation of energy. So far as the appraisals are made by local assessors, this system presents all the evils of the primitive system. So far as the appraisals are withdrawn from local assessors, beneficial results seem to follow. If a great body of assessors, independent the one of the other, stretching over the length and breadth of the state, value different parts of the property, the results are inevitably inharmonious. The ratio of actual to assessed value varies in different sections of the state, and equalization does not redeem the case even when the equalization addresses itself to the railroad properties as a distinct group, which is an unusual thing. Moreover, the technical difficulties of distinguishing the several elements of railroad personality and real estate used in operation, where the law requires a distinction, are difficulties with which the local assessors cannot easily cope. All the economies of information, experience, and wise deliberation which centralization secures are wanting here. The state reports stand as a lasting monument to the errors and losses of this system of railroad valuation.

Some states have gone a step further, providing that all railroad property shall be valued by a central board or officer. Several states have endeavored to attain this end but have fallen somewhat short of it because constitutional provisions have stood in the way.

The most marked tendency in the development of the laws of railroad valuation has been centralization. Its advantages are apparent. It economizes effort, unites forces, focuses all the information accessible, makes possible expert investigation, fixes responsibility, and gives room for the development of scientific method. Let it has its defects. A small body may be more easily corrupted than a large one. A small body of assessors may become a cog in the political machine, whereas a large number of officers, varying in their political affiliations and allegiance, will maintain a comparative degree of independence. The composition of the central body is frequently open to objection. But experience indicates that the advantages of the centralized system greatly outweigh its disadvantages.

Defects in reports of valuation.—It is, as a rule, impossible to tell from the reports whether the railroads have been appraised at their actual value or not; and frequently the law itself will afford no assistance in this matter, for there are cases where the law has required that railroads should be assessed at their actual value when in fact they have been assessed at a much lower value. This is one of the greatest failings of the reports. It makes it impossible either to arrive at the true value of the road or to make any comparison with the values of other properties.

Almost without exception, no information is given as to whether the assessed value of railroad property bears the same relation to the true value, that the assessed value of other property bears to its true value. Sometimes the reports make it uncertain as to whether the railroad company itself or public officers have made the assessments, or whether self-assessment was resorted to.

Values for a part of a railroad—e.g., that part within given counties or cities—are sometimes given without any accompanying statements as to the value of the entire railroad property in the state. This often results in only a partial inventory of values. The reports uniformly fail to indicate the extent to which statements of values made to officials by railroad companies are overhauled by such officials.

Cases appear where the courts of a given state have held that even in the case of a distinctly ad valorem tax on real and personal property, the valuation might be based on the aggregate market value of stocks and bonds less debts due creditors within the state. And yet the reports fail to indicate to what extent this method of valuation is employed. It seems quite obvious that a certain part of the property, that denominated "real estate other than main stem," which the law requires to be assessed locally, could not well be valued in this way. And yet there is nothing in the reports to indicate that market value of stocks and bonds is not the measure for this item as well.

Reports may be found giving the values of "special franchises" without discrimination as to which of such franchises are represented by railroad privilege. Of course this makes the information absolutely useless from the standpoint of railroad valuation.

Defects in classification.—It is no unusual thing for a report to arrange the railroads in such a way as to show no relation between the branches and main line of a system. Branches are sometimes treated as co-ordinate with main lines. Sometimes the facts concerning the parts of a given road are entirely separated by intervening data, without any indication whatever as to the relation of the one to the other. Moreover, transportation companies are sometimes listed in a fashion so regardless of distinctions and differences that it is impossible without outside investigation to ascertain which of them are railroads, which surface car companies, which express companies, and which water transportation companies.

Weaknesses in distinctions are very common. For instance, reports frequently give only a general "track value," failing to indicate whether it is confined to main track, or includes side track, switches, etc., as well. Of course in such cases separate values of main track and other track are not given.

Again, in some cases the value of the property of sleeping car companies may or may not be included in the reports of assessing board or officer. In the case of omission, no reason is given there-

or in the report. Values of franchises are sometimes given without anything in the law or reports to make clear exactly what property is covered by such reports. The term "personal property" is at times used ambiguously. Values of separate items, such as "roadway," "roadbed," and "rails" are in some cases reported without any key to the exact distinction between them.

The tabulations are oftentimes crude, the arrangement of items being so confusing as to neutralize the effect of good distinctions. Take, for example, a case where the item "value per mile" is placed in such a position with relation to other items that it might be held to indicate either "main line" or "rolling stock." Oftentimes failure to give sufficient detail makes it uncertain just what property a rather general item includes. For instance, the description "valuation of main line" may, in certain cases, prove very misleading, for we find cases where it refers to roadbed, right of way, and track only, and other cases where all these items are included, and rolling stock, franchises, etc., as well. The case is quite as difficult where assessing bodies profess to state in great detail the values of the various elements, and do so for the most part, but entirely omit some important item, such, for example, as "rolling stock," without an intimation as to whether it is contained in any other item.

Defects in tax statements.—In some cases the determination of the tax to be paid and the statement of such taxes help materially in the solution of questions of valuation. For example, there may be cases when the capitalization of the tax will represent value with a fair degree of accuracy. But even in this branch of the reports there are frequent defects, obstructions, and obscurities. One of the most common criticisms to be offered is that of failure to indicate whether statements made are only of taxes paid or are of taxes payable. Sometimes taxes several years past due creep into reports that purport to be reports of taxes currently assessed and currently payable. We find states where certain subsidiary lines pay taxes and the main line does not; and yet no explanation of the peculiarity is offered. Some statements prove to be but partial statements of all the taxes payable by a railroad in the state, but to all appearances they are set forth as complete statements. For instance, it is not unusual for only the state or the local taxes to be given, and yet the statements indicate that both are covered. On the other hand, we have cases where the officers do not give and do not profess to give anything like a full statement of taxes payable or paid. For instance, in one state the only facts that bear on railroad taxes at all are those given to show the account of a railroad with a certain fund.

Failure of facts.—In many cases the error or defect takes the form of absolute failure of facts, as suggested incidentally in preceding statements. As stated elsewhere, a most common case is that of the failure to give any information as to the property not used in operation. This is a chronic failing. Again, it is the rule for reports to fail to note that sleeping car, parlor car, and fast freight line and equipment companies have any property other than rolling stock. Seldom or never is any attention given to those peculiar cases in which a railroad within a particular state is valued in some way or at some rate different from other railroads. Occasionally assessors have been so careless as to omit the statement of the year for which their valuation was made.

In some states laws provide that the railroad shall be taxed on the par value of the stock if the dividends reach a certain point, otherwise on the market value. But the reports in such cases fail to indicate whether the road was taxed on par or market value, or what the market values were. There are instances where the laws make peculiar provisions for the assessment of roads located in only one county. But in such cases the work of the administrative officers, so far as made public, fails to show what roads are and what are not located in a single county.

The failure to give facts is often accounted for by the great tendency toward generalization, the sacrifice of detail. The cases are few in which there is considerable minutiae in the reports. For instance, the value of tools and machinery is seldom given separately. As a rule there is little or no distinction between the various elements in the real or personal property. There is but one state report in the country, for instance, which analyzes the rolling stock values in any great detail. The state in question distinguishes 20 different classes of cars, without exhausting the possibilities of the case. The failure of the states in general to make any detailed analysis of this character indicates the degree to which the systems of ad valorem assessment now in vogue must be reformed in case the inventory system of valuation is to be introduced.

Defects of the law.—Finally a word may be said concerning the laws themselves. And, after all, it is the law which shapes the foundations of the reports. There are laws that attempt a rule for the assignment of values within and without the state, yet leave the meaning of that rule in doubt; laws that prescribe, let us say, a mileage basis of apportionment, yet do not indicate whether the miles are miles of main track or not; laws that are uncertain as to which officer shall appraise a given part of the railroad property; laws that are fraught with ambiguity, and laws that, although the work of legislative experts, yet fail in difficult situations to grasp the full meaning and significance of economic or financial principles. Such laws relating to railroad valuation could be cited without limit.

Conclusion.—To support the statements made regarding state reports a legion of facts are at hand and might be submitted. It is most evident that our systems of railroad valuation demand improvement. The steps toward uniformity that have been taken and are to be taken in the commercial law of our states should be urged in the administrative law. Not only should the administrative law as such be amplified and unified, but the unwritten custom of administrative officers, their ways and methods of reaching results and stating these results should be brought into harmony. One cannot study the laws of valuation and taxation and the work that has been done in the administration of them without feeling that there is something almost farcical in our present legislation and the practices and results to which it leads. The wastes and the inequalities violate principles of justice; the inefficiency of the laws is shameful. We should have more laws and fewer bargains in our statute books. And our laws once made should be administered, not manipulated. Both law and practice need improvement; the increase of administrative efficiency and the scientific betterment of the administrative law are both most necessary.

To pass from criticism and comment to the point more directly in hand, it is evident from the facts narrated why it was not possible to base a valuation of the railroad property of the United States upon the state report relative to the valuation and taxation of this class of property.

The Montreux-Oberland-Bernois Railroad.

BY FRANK C. PERKINS.

Bern, Freiburg and Waadt are among the most interesting cantons in Switzerland and many tourists visit the section. The electric mountain railroads are now in operation, and are all well patronized as the scenery is most beautiful.

Beginning at Montreux the Montreux-Les-Avants section of the Montreux-Oberland-Bernois road passes through a tunnel under the college and streets of the city, then mounts to the heights of the romantic castle Chatelard and passes through two tunnels to Les Avants, a distance of seven miles from Montreux. A magnificent view of Lake Leman and the surrounding country is to be had as the cars mount from 1,300 ft. above the sea at Montreux to 2,500 ft. at Chamby, and 3,200 ft. at Les Avants. One of the tunnels is 607 ft. in length and the other 453 ft.; and this section of the line has six viaducts and three iron bridges.

This electric line includes in its overhead construction steel poles 34 ft. long measuring 2 in. at the top and 3½ in. at the bottom, and weighing 53½ lbs. per meter. The overhead trolley wires are supplied with current at from 750 to 1,000 volts pressure from a sub-station located at Chamby. The lighting of the station and shops at Montreux is accomplished by five series of seven lamps each of 110 volts directly connected to the feeder conductors. The building is 118 ft. long and 49 ft. wide.

At Chamby a sub-station is provided with a machine room 1,500 sq. ft. floor space, and two storage battery rooms each having an area of 1,055 sq. ft.; also dwelling rooms for the engineer in charge. The electrical installation, including the transformers, transmission lines and trolley lines, as well as the electric cars and other rolling stock, was supplied by the Elektrizitats Gesellschaft Alioth of Munchenstein-Basel, Switzerland.

The line from Montreux to Montbovon is 14 miles long and the line from Montbovon to Zweisimmen is 25 miles long, making the distance from Montreux through to Zweisimmen 39 miles. The difference in elevation between Montreux and Zweisimmen is 1,800 ft. There are 26 stations and stops between these places.

For this railroad the electric power is generated at two power plants, the Elektricitatswerk Von Montbovon and the Hydro-Elektrische Zentrale von Hauterive. The Hauterive plant has a total capacity of 12,000 h.p. with a discharge of 777 cu. ft. of water and a fall of 16 ft. 5 in. The Montbovon power house has a net fall of 220 ft. with a water discharge of 212 cu. ft., developing 1,200 h.p. each with four units and 600 h.p. each with two units. The electrical generators are directly coupled to the turbines and are of the alternating type, supplying a pressure of 8,000 volts for the transmission line.

From Montbovon to the sub-station at Chamby the high tension transmission line is nine miles in length and consists of three conductors, each having a diameter of 6 mms. (about ¼ in.). At this sub-station there are three asynchronous Drehstrom motors, each having a capacity of 210 h.p., and operating at a speed of 430 r.p.m. directly from the 8,000-volt high tension current. To each of these three motors there is directly coupled a direct current dynamo of 140 k.w. capacity supplying from 140 to 187 amperes at a pressure of from 750 to 1,000 volts.

At a distance of 14 miles from Montreux the Montbovon sub-station is situated. It is equipped with three asynchronous three-

Tunnel on Montreux Railroad.

capacity of 368 ampere-hours, the accumulators being of the Pollak system. The sub-station is lighted by incandescent lamps supplied with current from 60 cells of storage battery, and each sub-station is provided with a traveling crane of a capacity of 11,000 lbs. for use in handling the heavy part of the machine during erection and repairs. The two trolley wires are of hard drawn copper 8 mm. (.31 in.) in diameter, mounted on high tension insulators. The height of the trolley wire above the track for most of the way is about 20 ft., though in some places it is as low as 13 ft.

Two different types of cars are employed, one having a baggage compartment and the other without, the former having a total capacity of 56 passengers and the latter 52 passengers. The car has a maximum outside width of 8 ft. 10 in.; length over all, 46 ft., and wheel base, 34 ft. The gage is one meter (39.4 in.). The car weighs 49,600 lbs. when empty. Four different schemes are provided for braking; the hand-brake and an automatic vacuum brake of the Hardy system; and on the new cars an electric short circuit braking system as well as an electro-magnetic track brake of the Schiemann system.

The four axles of the car are each provided with an electric motor of the d.c. type. The new motor cars are equipped with 65 h.p. motors, which operate at 750 volts, the gear being 1 to 4.33,

Montreux-Oberland-Bernois Railroad.

phase motors of 250 h.p. each. These motors also operate directly from the 8,000 volt line, and drive by direct connection three continuous current machines of 170 k.w. capacity at a speed of 430 r.p.m. These traction dynamos each supply a current of from 170 to 227 amperes at a pressure of 750 to 1,000 volts. The machines

Motor, Passenger Trailer and Freight Trailer—Montreux Railroad.

for the Montbovon sub-stations are of the four-pole type, the armatures measuring 850 mm. (33½ in.) in diameter. The conductors are wound in 120 slots. The commutator has 360 segments and a diameter of 510 mms. (20 in.). Its length is 260 mms. (10¼ in.).

An accumulator plant of 360 elements is provided having a

and the wheels having a diameter of 840 mms. (33 in.). The commutator has 185 segments and the current is collected by two sets of three carbon brushes. These motors weigh without gearing 1,360 kgs. (3,000 lbs.). At first the two pairs of motors are connected in series and the controller connections are such that then all four are operated in parallel. The Hardy vacuum brake utilizes an air pump driven by a 6 h.p. motor. The cars are lighted and heated by electric current, the energy used for heating being about 20 h.p. The motor cars are lighted by three series of seven incandescent lamps each.

For carrying passengers trailers are provided. These weigh 9.6 tons, with a total of 48 passengers, the weight being 441 lbs. per passenger. The freight trailer cars are 8 ft. 6 in. in width, and 24 ft. 6 in. in length. They weigh about eight tons. The line from Montreux to Montbovon cost about six million francs, and the cost from Montbovon to Zweisimmen was somewhat over seven million francs. The capital stock is 6,940,000 f.; bonds, 6,300,000 f.

From Montreux to Les Avants the trip is made in 40 minutes; from Les Avants to Montbovon 32 minutes, and from Montbovon to Zweisimmen 1 hr. 52 min. The total time required to make the entire trip is therefore 3 hr. 4 min.

The four sub-stations on this line are each equipped with motor generators and storage batteries having a capacity of from 520 kw. normal to 370 kw., while the overload capacity for each substation is much larger. The rolling stock includes 12 motor cars,

e trailers for passengers and 16 freight cars, with working cars a snow-plough. Two steam locomotives have also been provided a reserve for use in case of an emergency.

The Division Engineer in Railroad Work.*

In general, the division engineer is the engineer nearest in ch with the men—the employees. He has human nature to l with, and needs most to be human in nature. Said Stephen- , "The most important branch of engineering is the engineering men." The man who has men to handle need never be lonesome, l must sleep nights, and nights only. This human element, that largely enters the province of the division engineer will prevent t if squarely met, and will finally bring disaster if dodged. en, to theoretical engineering you add practical engineering, l to that add human engineering, you have the division engineer. d this defining sentence probably need not be restricted to rail- d work only.

The theory, in fundamentals, we learn pretty well in four rs in a technical school, but go on elaborating it more or less ough life. The theory gets homelike. The principles are as fa- iar as old friends—nothing new. And we learn practical engi- ering in the next ten years or more, or go far toward doing so. have precedents to follow. One bridge is, in the main, like other. One tunnel half like another, and the other half like a rd. Once in a while we meet novel conditions and they are wel- ne milestones in our lives. We fairly grow careless through mo- ony, on the whole. But the engineering of the humans we meet l have to deal with keeps our blood circulating, sharpens our s, turns our hair gray, and brings on that disease of civilization eurasthenia (nervous prostration). The human race is not mo- onous. No two are alike. Seldom is it that two even look alike; l, if one look like the other, that other will get even by acting the trary way.

The theoretical principles of engineering are as broad as the iverse; the practical principles may be followed all around the rld subject to the laws of climate and of commerce; but human gineering is racial, provincial or individual. This human engi- ering separates the assistant engineer from the division engineer. s the quality which bridges over the chasm between the assistant gineer and the roadmaster. As a qualification in engineering lity, it commands a higher salary than did the added qualifica- n, which in turn made us draftsmen, instrument men, or assistant gineers. Too much stress cannot be placed on the value of the dy of men when a man is an assistant engineer.

In my observation, it is the inexperienced and weak foreman o is most apt to have strikes. Since a strike may be considered e extreme of ill discipline and failure in management, we may ely say that lack of experience or of fitness on the part of those o handle men, brings on much of our labor troubles. In my ob- rvations, most labor troubles with gangs of men are not from a estion of wages. Bad treatment is a more frequent cause of uble. Most of the ill treatment comes from a want of knowl- ge of men on the part of some one in authority. Men very seldom come dissatisfied because worked too hard. A man who allows fing in the gangs is never liked by the men, and will soon have uble. Lack of knowledge of the work on the part of some one authority causes many of our strikes. Some one somewhere nks he knows the engineering of humans, when he is woe- ly ignorant of it. That causes the trouble, and the higher in au- rity that man is the larger the trouble, and the less willing that n is to listen to the opinion of others, before making up his n mind, the oftener the trouble will occur. Human nature is vincial. You may know the labor on one division, but if you go another division and feel too wise to listen there, you will find hase of human nature quite new to you, and you will early have uble. Egotism is cured by studying human nature. If you would ndle men successfully, you must keep your ear always close to e ground and your heart open to appeals from the men in kindly mpathy, and your mind open to new convictions day by day. The n who thinks he never made a mistake, the man who has things at," or the man who has a "system," is each unfit for authority er men. Such men, whatever their engineering ability, are not and will never be fit for division engineers. They lack in hu- n qualities.

Strikes are about as old as history, and for them there is no acea. Anarchy is an epidemic which may break out at any e. Intelligent handling of men and sanity of mind of employees e the present hope for peace.

For the purpose of this paper we will assume that the division gineer reports directly to the chief engineer and is reported to the assistant engineers, instrument men, rodmen and other engineering assistants. The clerks of the division office report to him. The roadmasters and master carpenters with their forces, report directly to the division engineer. What duties and what attitude does this require from the division engineer? Toward the chief engineer, his superior, he must have loyalty. This means more than obedience. It is obedience of the heart as well as of the head and hands. No circumstances can justify less. Disloyalty should be as repugnant to a division engineer as informing is repulsive to an Irishman. And when the organization you chance to be with, seems to expect you to be disloyal to the man you were explicitly told to report to, you quit. You are in a crazy organization, an impossible one, and you are wasting time.

Now loyalty means honesty. Therefore, when your superior asks for your opinion, give it to him. He is entitled to it. He has asked for it. Do not give him a reflection of what you think his opinion to be, just to make yourself "solid" with him. That is not honest. If he is competent, he will see through it all. You do not help him any. It is your duty to help hold up the hands of the chief engineer. Try to do that and despise trying to curry favor. Always be respectful to a superior. Your patience will be tried to the limit, but be patient. His clerks will write you letters over his signature, which, placed before a jury of chief engineers, would consign your superior to an asylum, but a division engineer should be above "getting even" with clerks or draftsmen. In that better land to which good division engineers go, there'll be no letters written by machinery.

The division engineer must be the master of his temper at all times. He must gratefully remember that his is the highest rank surrounded by men who have been specially trained in their specific work. His superior is not so fortunate and has greater trials than a division engineer. Long suffering is not pleasant, but it is, nevertheless, a part of professional training. You do not need to have trying times with but one office now. Promotion will make you worse off, possibly, and just to relieve the strain, you see to it that your clerk or your office boy does not write advice to roadmasters, or over your name seek wisdom from bridge men. You do not need to make an endless chain of it. You have time to go and see, and advise, and inquire, and decide without writing many letters or sending many telegrams. Or, if you have not, send some one to do it for you. Correspondence is essential and unavoidable to a chief engineer. It may be largely or altogether avoided by a division engineer in dealing with subordinates, for he is dependent of necessity upon that human element of which we have spoken. In my experience, the fewer letters a division engineer can write to foremen, roadmasters and master carpenters, the better. Some of us can perhaps do more through office supervision than I am able to do, but letters can never take the place of meeting a track man or a bridge man on the work and looking it over and talking it over there. If you are not the kind of a man to do that, I think you are not just the kind of a man for a division engineer. You may be able to do better work and of a higher grade, but that particular kind of work you can never do best. The gangs want to see the "old man" around pretty often. They want him to see how tough a job they have, or how well they are doing the work, or how hot it is there, or how cold it is. They will each man work the better for it, and they will not leave to go to another division, nor strike for more pay or overtime. All troops like to see their brigade leader. He means more to them than bulletin orders or messages by courier from the general in command of all the forces. Men follow best by sight and learn to love by sight alone. That "absence makes the heart grow fonder" never applied to a pile driver gang. Is it easy and nice driving? They want you to see how fast and how well they are driving the piling. Is it hard and unhandy driving? They want you to see how hard it is to get the piling down and how difficult to get at the piling to keep them in shape at all. Maybe you can suggest something to help. Maybe you can send them a better appliance. In any case, you can share the credit, the care and the responsibility, and that alone is a help. In this connection one scarcely need say that many letters of instruction to assistant engineers and the junior engineering assistants are not in place from a division engineer. If on maintenance, have as many of them as possible work from your own office, and tell them and show them; not write to them. You are the school teacher of the engineering organization. A correspondence school is better than none, but it is not the best. Teaching by personal contact is conceded to be better. You remember best the personal qualities of your best teachers; not their system nor their syllabus. You are training younger men to be engineers and men. The closer you are to them the more you can do with them.

Organization is one of the important problems of the division engineer. On construction work this is less difficult than on maintenance, for then he practically has but two classes of labor to deal with, viz., the engineering force and the contractor's organization. That engineering force can be organized, equipped and handled quite along the lines of the regular army, but much liberalized. The army furnishes the skeleton of a good organization, but must

*From a paper read before the Western Society of Engineers by Willard han, Assistant Engineer, Lake Shore & Michigan Southern.

have flesh and blood added to be used in civil life without revolt. Obedience and regard for rank we must have. Salutes are out of place, and an engineer organization needs to be a pure democracy. Toward contractors the engineer should show justice tempered with mercy. The division engineer should inculcate that idea in his assistants. An excellent chief engineer laid down this rule to a division engineer on railroad construction: "It is your duty to stand between the contractor and the company, and say what is right in equity." The general clauses of contracts give large powers to the engineer. These are to discipline bad contractors and protect the company from weak ones. They are not intended to be insisted upon always. Never make expenses for a contractor which in no way benefits the company. Make the company pay for mistakes of its own employees. Never keep a contractor waiting. Never accept better treatment from him as a division engineer than he gives a rodman. Consider, so far as you can, that all men on the right of way—engineers and contractors—are all under the division engineer, in a way, and make them each and all treat the others well. "Line up" the biggest contractors yourself whenever necessary. A division engineer on construction is boss of the right of way so long as he does not come between the contractors and his forces. He has a not difficult position from the standpoint of organization.

But, on maintenance, the division engineer has some trials with subordinates. Assistant engineers will get over into the province of master carpenters and roadmasters. Even instrumental men incline to the same fault. Time needed for checking levels and spans will be wasted "chumming" with a foreman and giving him advice. About the third year out of college we feel disposed to instruct the pile driver foreman. About the twenty-third year out of college we will be glad to let that pile driver foreman do the driving. Of course, bridge men and track men do not join well. There is by nature a neutral strip between a bridge and the track beyond, over which rolling stock is supposed to pass unguarded by either track men or bridge men. Out of which fund must this cost be met? Should track men "wait upon" bridge men and mow the lawns of agents, or is that last a transportation charge? Is a switch light rolling stock or right of way? Is working a coal shed track repairs or train expense? All these and some more are questions for a division engineer.

As a general proposition, the man to do the work is that man who can do it best for least money. Leave to others, systems of organization. Have no experiments to try yourself. Do not strain to make a record, but be content to let it follow you. From day to day assign duties to the man who can do the work cheapest and best, and leave the new ideas to theorists and the record to Providence. Divide the work along the lines of the different crafts and place the maintenance of a structure under that craftsman who can do the major part of its maintenance. Aid this craft where economical, with other or cheaper labor, but keep the responsibility undivided. It is better to have a gang of laborers in the bridge department than to call on section men to do such work for bridge men. It is better to have an axeman in an engineer party than to take a section man to drive stakes regularly. Give each man his own kind of work to do and keep him at it.

We have said that the division engineer is school teacher in his department. It is a graded school. Discourage a rodman who wants to do an instrument man's work before he is a first-rate rodman. Do not expect or allow the clerk to do things which an assistant engineer only is paid for knowing. It is not fair to expect a man to do work regularly which is beyond his grade. You are weak if you ask your clerk to be yourself when you are out on the road. You are silly when you have a pet whom you allow to do the work of a higher paid man who is there to do his own work. Observe not only rank but seniority, and if a man is not fit to keep up his own work get rid of him. Make men do the work they are paid to do or quit. Never have pets. If you dislike a man never let him know it. They are all your brother officers.

Never let an older and ranking man misuse another. Talk to him sharply and promptly. If he will not finally treat the younger engineer well, get rid of him. To be unfit for authority entirely unfits any engineer for taking charge of an engineer party. Make engineers of equal rank get on well together. Keep at it until they do. Never lose your own temper and never allow any one else in your professional service to do so without notice and remonstrance and final prevention.

Lay out field work on maintenance in trips to cover several pieces of work; each trip with least travel. When that trip is arranged, do not break into it with work that arises at the time. Anticipate work as much as you can. Let some work wait as it can until urgent work takes a party near there. This idea will save on large maintenance divisions about one hundred dollars per man per year for traveling expenses, and do more work and do it better. Never start men out so they cannot tell when they will get back. And if, as a division engineer on railroad work, you usually work the men nights or Sundays in addition to full week-days, you do not know your business. Another man can take your engineering force and do more work for the same money and please both the men and the chief engineer better. You are not working your head well. You do not plan well. You do not organize well. You have reduced the speed of your men—a sad fault.

Avoid divided responsibility where you can do so. If you can set apart one piece of work for one assistant engineer, have him do it and let no other man of equal rank go there. Assign work of their kind to instrument men and leave them alone responsible to you. Track and bridge men are divided by territory, and keep foreman so divided. Always be able to hold some one man logically and consistently responsible. Give him time and help to do the work. Let him follow his own devices all that you see you safely can. You see him start; visit the work with him quite often, and occasionally without him. Ask him about progress and cost just to check your own opinion from what you saw there and to keep him alive to the situation. If he gets into trouble, go out and shoulder the trouble with him, and if serious trouble, be ready to take all responsibility and be on hand for the emergency which you have foreseen or feared for some time. If he does ill, tell him quickly and prove what you say. If he does well, publish it among the men, and tell him, and write the chief engineer, commending him and citing the facts. If you cannot praise a man oftener than you blame him, let him go. And if you never praise him when he deserves it, the time will come when he is deaf to your criticism.

Never think aloud that you know as much about track as a trackman, or as much about bridges as a bridgeman. Listen to their practical opinion and leave them alone to their practical handling of their work. The company is not paying you to be a roadmaster now. If you have not more confidence in the judgment of the Superintendent of B & B who reports to you as to the fitness of a wooden stringer, than you have in your own judgment, then you are egotistical or need a new Superintendent of B & B. It is very hard for young division engineers to curb their knowledge. Just to help yourself to a more correct view, suppose you go to the chief engineer and say a certain bridge is unsafe. When he seems to hesitate to tell you what to do about it, just casually mention, in addition that the grayhaired Superintendent of B & B has also examined that bridge, and he, too, thinks it unsafe. Then observe with what alacrity and feeling of relief the chief engineer tells you to rebuild the bridge. No division engineer is sufficient unto himself. In his younger days it may be cured. In his riper years he is a hopeless failure. I respect the judgment of the roadmaster and bridge superintendent. I realize how dependent railroads are upon track and bridge foremen, and I trust that as a division engineer I will never lose my inclination to look up to them rather than to look down upon them. They know much that I have never had the time nor opportunity to learn. As engineers we can never increase our usefulness on maintenance without first having high appreciation of these foremen of maintenance gangs.

The last lesson in its order to be learned by a division engineer, is the relation of his position to that of other division officials. This relation varies with different roads. It may vary from year to year on the same road. It is unfortunate to our profession that so often we are in a transition state. It puts us in a bad light at times. It tests any organization to change front. The civil engineer is far more used on maintenance of railroads than he was a score of years ago. We are not all of us ready for the new duties and the new relations. A construction engineer is not wonted to maintenance administration. A maintenance man trained to one type of operative organization, finds it hard to adapt himself readily to a very different type when going from one road to another. Since the civil engineer is growing in favor on maintenance, he will suffer from jealousy. Prosperity breeds enmity, just as acquiring wealth brings hatred to our door. At this time, all our paths are not paths of pleasantness. As engineers we are coming to be useful if at all, just because we can put a dollar where it can earn more than where another man can put that dollar. If this is true, the corporate owners of our roads will give us the opportunity to do just that. It is not a question of type of organization—division, departmental or what not—but it is a question of administrative investment.

It is clearly the duty of the division engineer to work in perfect harmony with each and every division official so far as lies in his utmost power. Be agreeable always. Be a good mixer but no meddler. Never criticise other departments. Nobody wants to know your opinion on transportation, traffic or motive power. Only the fool knows too much—in this case. Help the other heads of departments of the division. Make your organization helpful to the whole division, and agreeable in every way. Hold up the hands of the superintendent of the division. Study to make your part of the work contribute all it can to the success of the administration of that superintendent. This is a principle holding true, whether or not you report to that superintendent.

Throughout this paper it must have been apparent that modifying conditions incident to various types of organization for individual roads could not be taken into account. The limits of a paper prevents this. General principles will apply, but there is no universal practice, and may never be. Traffic and climate and area

a system must modify. In a general way we have assumed for purposes of this paper an outline of one of the most common ms of organization. No paper of this kind can have general ap- cations save in principle. As division engineers, some of us ort to chief engineers and some to superintendents, but the re- ion to our subordinates and to our work remains the same in her case, and while the gift of prophecy would be needed to to whom the division engineer on maintenance of railroads will ort in the future it now seems likely that before very long he l have charge of maintenance of way of railroads. May we be dy. Engineers, we must trust we now are; track men, we may be soon must be, and, finally, we most imperatively must become road men. And the world has yet to see what may soon appear the American railroad man.

Report of the Commissioner of Bridges of New York City.

Bridge Commissioner George E. Best's report on the bridges the City of New York contains some very interesting data. ference is made to about 43 bridges, ranging in cost of con- uction, exclusive of land, from $1,500 to $12,000,000 each. Nat- lly the greater part of the report, which, in all, contains 308 es, is devoted to the bridges of the East river. The approxi- te cost and other data in regard to these is given in the fol- ing table:

Bridges Over the East River.

. Name.	Water crossing.	Terminals.	Height, above high water, ft.	Type.	Approx. cost, exclusive of land.
. Brooklyn Bridge.....	East River.	Park Row, Manhattan; Washington St., Brooklyn	135	Suspension.	$10,975,168
. Williamsburg Bridge....	East River.	Clinton and Delancey Sts., Manhattan; Driggs and Roebling Sts., Bklyn	135	Suspension.	10,981,575
. Manhattan Bridge.....	East River.	Canal St. and Bowery, Manhattan; Nassau and Bridge Sts., Brooklyn ..	135	Suspension.	*12,000,000
. Blackwell's Island Bridge	East River.	Second Ave. and 60th St., Manhattan; Crescent and Jane Sts., Queens	135	Cantilever.	*10,000,000

*Under construction.

In referring to these bridges the Commissioner says:

The Brooklyn Bridge has been kept under constant surveil- ce and careful inspection, and is now in first-class condition. e number of passengers crossing it has increased so that about 00 passengers now cross in the bridge trains in a single rush ır at night; this means that the cars, which seat about forty ple, actually carry three times that number during one rush ır, from 5.30 to 6.30 p. m. These passengers are crowded into cars and on the station platforms in a most disgraceful manner.

In 1890 careful estimates were made of the probable future vel on the bridge, and the number of passengers now carried in busiest hour of the day is 40 per cent. greater than the maxi- m capacity then believed to be practicable with the length of in and number of trains now run, and it was estimated that the nber of passengers now carried would not be reached until 1920. riously the growth of travel has increased beyond any figure n reasonably expected and it is hardly possible that the number passengers caried will be diminished; it must increase until Manhattan Bridge can be completed and put in operation to eve the pressure on this structure.

The completion of the subway, with its principal station di- tly in front of this bridge, will certainly increase the present in- erable conditions. Much time will be required to completely onstruct the Manhattan terminal and buid the large station y projected as a joint City Hall terminus for the Brooklyn and nhattan bridges, but it is certain that the extension of the lge tracks across Park Row and on the subway plaza will mit the use of a greater number of trains and the more rapid vement of these trains and nearly or quite double the platform as and the convenience of access thereto. This construction over k Row would be temporary, pending the completion of the large tion, and should be commenced at once and completed if possible ore the heavy travel of the summer begins. There is no good son for delaying this work, the plans for which have now been nged so as to avoid trespassing on the grass plots of the City l Park; failing to secure this measure of relief the conditions the Manhattan terminal must grow steadily worse, and they now so bad as to seem unbearable.

The extension over Park row must be temporary in any event, the larger station cannot be operated without its removal, and necessity for its existence will disappear, at latest, with the pletion and full use of the Manhattan Bridge. This extension l not be more unsightly than the present terminal, and the ef which it is certain to give would seem to justify fully the porary continuance of an unsightly structure at this point. fortunately the few interests which oppose its construction are se which never or rarely ever use the bridge, and have thus far weighed the interests, convenience, comfort and even safety of millions who must use the bridge. The Williamsburg Bridge s opened to public travel on the 19th of December, 1903, one road- then only being available for use.

On November 3, 1904, the Brooklyn Heights Company, the Coney Island Company and the Bridge Operating Company started the operation of trolley cars on the south tracks of the bridge.

Owing to the fact that the ground designated as a plaza on the Manhattan side of the Williamsburg Bridge had been given over to street purposes, it was not available for this Department. Adequate facilities for car service cannot be constructed on the Manhattan side, and the cars commenced operating and are operated on a very meagre and inadequate terminal. But, notwithstanding the condition of this terminal, more than 1,000 round trips per day have since been made by the trolley cars on the south tracks of the bridge, and something like 30,000 passengers per day are carried in these cars.

It is of the utmost importance that the ground designated as a plaza on the original maps of the bridge should be restored to the control of this department, in order that something like adequate accommodation may be afforded the cars and passengers at the Manhattan end of the bridge.

The travel on the roadways of the bridge has fully equaled the anticipations, and the receipts per month now aggregate about $5,000, against $6,000 on the Brooklyn Bridge. The Manhattan Bridge, in all probability, will be the most efficient of any of the large bridges now authorized over the East river. It is provided with a middle roadway, 35 ft. wide, and with eight railroad tracks, four for trolley cars and four for elevated railroad trains.

This bridge, with the Flatbush avenue (Brooklyn) extension, will form a wide avenue, virtually from Prospect Park (Brooklyn) to the junction of Canal street and the Bowery (New York), which may be continued through the wide avenue of Canal street to the North river. The bridge will form an important link, therefore, in a wide highway from the ocean to the North river through the central portion of the city.

The preparation of the plans for this bridge was first authorized on November 30, 1898. Early in 1902 the plans for the superstructure of a wire cable suspension bridge had been developed, and had these plans been adhered to contracts might have been let for this type of bridge before the close of the year 1902. It was, however, determined to change these plans and prepare plans for an eye-bar cable bridge, using nickel steel for the eye-bars.

Calculations show that there would be 10,000 tons more steel in the eye-bar type of bridge for this location than will be required for the wire cable construction, and notwithstanding the fact that statements diametrically opposed to this are made, I am convinced that the wire cable suspension bridge can be built in one-half the time, and at very much less cost, than the eye-bar bridge.

In the preparation of the plans for the eye-bar bridge none of the essential details were worked out on a practical basis, and while a contract could have been let on the plans prepared, it is certain that more than a year's time would have been rquired for the contractor to determine the details of construction before any work could be done.

The City of New York already owns two wire cable suspension bridges, both of them of spans exceeding that for the Manhattan Bridge by nearly 150 ft. The valuable work that these bridges have done, the ease and facility with which these bridges were constructed, the certainty of knowing within a reasonable time when the bridge would be completed and with close proximation what it would cost, the knowledge that the wire cable bridge would make a satisfactory bridge, and the experimental nature of the eye-bar bridge and the uncertainty as to its action under the traffic imposed, led me to reject the plans for this bridge, especially as I believed that they had not been legally approved by the City authorities, and to substitute therefor the wire cable bridge, which was anticipated in the original authorization, and which I believed would give the safest bridge at the least cost and in the least time.

The plans for the wire cable bridge were approved by the Art Commission in September last, and the preparation of detailed plans was at once commenced.

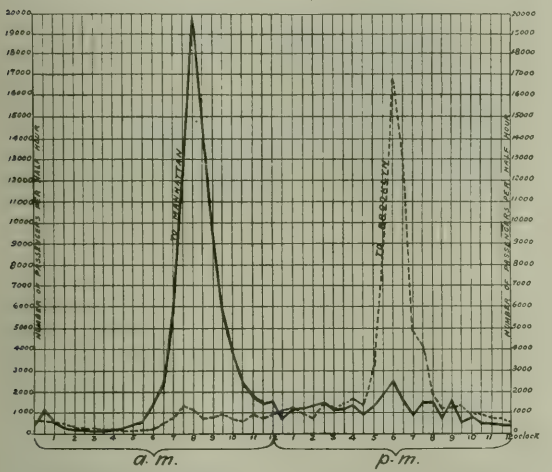
The methods of construction of this type of bridge are not in the least experimental, they are well understood and familiar to us all, and I believe that there is no good reason why the bridge on this plan should not be completed and opened for traffic early in the year 1908, while there is no experience to found an opinion on and no good reason to believe that the eye-bar bridge could be completed before the year 1910.

The Manhattan Bridge as designed will, I believe, be one of the handsomest bridges that has ever been built in the world, and I

believe that it will be built at less cost and in less time than any other structure of corresponding magnitude.

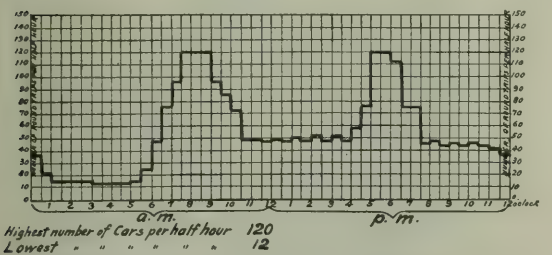
The wildest vagaries of vigorous imaginations and concentrated prejudices have led the uninformed to entertain and utter malevolent and iniquitous statements as to the motives for changing the plans for this bridge. These expressions, however, have not deterred me from the performance of what I believed to be the clear, clean duty of building this bridge on a recognized type of construction and removing it as far as possible from the realm of untried experiment.

The work on the erection of the steel superstructure of the Blackwell's Island Bridge has commenced and will reach an advanced stage during the coming year. More land must be taken on the Manhattan side to provide for terminals at that point, and these terminals must be studied with great care. On the Queens side we should have more width of land for the approaches, and although not now perhaps directly within the jurisdiction of this department, provision should be made for carrying a viaduct,



To Manhattan	114571	Maximum per half hour	
To Brooklyn	83910	To Manhattan	19889
Total both ways	198481	To Brooklyn	16766

Diagram Showing Passenger Travel by Half Hours on the Bridge Railway.



Highest number of Cars per half hour 120
Lowest " " " " " " 12

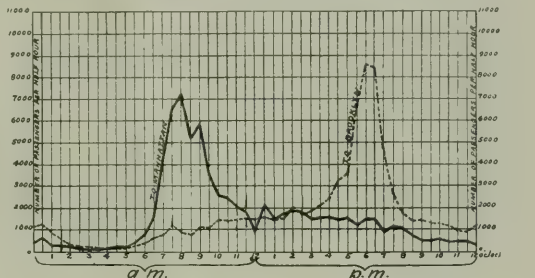
Diagram Showing Bridge Railway Car Service Round Trips by Half Hours.

preferably as an approach to this bridge, across the low ground of Jackson avenue and the extensive railroad yard which the Pennsylvania Railroad is building at this point. This is a matter of the very greatest importance, not especially to Long Island City, but to millions of people who must eventually reside in the Borough of Queens, between Long Island City and the easterly boundaries of the borough.

Realizing that bridges of this character cost immense sums of money, and are not likely to be easily duplicated, and in view of the fact that the large bridges should be given the greatest capacity possible, I have thought it advisable, at a slight increase only in cost, to recommend the construction of this bridge so as to provide for the addition of two elevated railroad tracks in the future, in case it should be deemed necessary to build them.

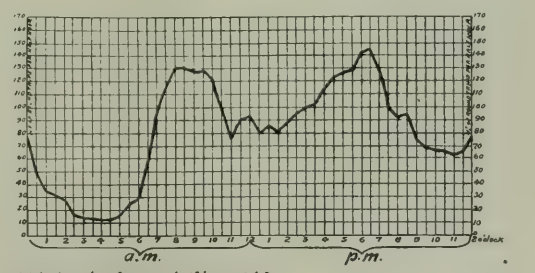
The studies of the Department of Bridges and of the Rapid Transit Commission as to connections for or with the bridges over the East river have been devoted almost exclusively to elevated or train service. It should be remembered that the number of great bridges over the river can never be very large, the excessive cost and the vast areas of real estate taken from private utilities and from the assessment rolls dictate that the number of such bridges shall not be excessive. Tunnels can be built quicker and cheaper than bridges and are the normal agencies for the passage of subways across the river. We cannot, however, put our highways in tunnels, and the great bridges should be used to their maximum capacity for highway purposes. They should provide for the safe and expeditious transit of vehicles and of surface cars. More people traveled in surface cars in New York City last year than in the elevated railroad cars, and even with the multiplication of subways the surface cars must still be used, certainly for many years, for transit over the East river, and these cars can be run most easily and most conveniently over the bridges. The discharge of passengers from the surface cars at the termini of the bridges is quite as objectionable as from the elevated railways, and careful consideration should be given to a wise distribution and collection of all railroad passengers over the bridges. The Boston Subway was built exclusively for the use of surface cars, and the old Hudson River Tunnel is being completed for the same service. There is no valid reason why the surface cars over all the bridges from Brooklyn and Queens should not pass into subways in Manhattan and thus secure a wider, safer and more expeditious distribution and collection of passengers for the surface cars.

The basement of the Centre Street Station could be used for an intermediate collecting and distributing station for Brooklyn surface cars, safer and more convenient than the present loop terminal; and an underground station could be easily built at the



To Manhattan	75974	Maximum per half hour	
To Brooklyn	82521	To Manhattan	7102
Total both ways	158495	To Brooklyn	8590

Diagram Showing Passenger Travel by Half Hours in Trolley Cars.



Highest number of cars per half hour 145
Lowest " " " " " " 13
Total number of round trips for 24 hours. 3840

Diagram Showing Trolley Car Service Round Trips by Half Hours.

Manhattan terminal of the Williamsburg Bridge which would conveniently accommodate and shelter the passengers from the surface cars and at the same time provide for the extension of the surface lines across or up or down town in Manhattan, as is now proposed for the surface cars through the old Hudson River Terminal from Jersey City.

The concentration upon the Brooklyn Bridge of most of the passenger travel between the boroughs of Manhattan and Brooklyn has developed abnormal traffic conditions that, in the rush hours tax every means of travel; and whenever the slightest opportunity is afforded or facilities provided the volume of traffic rapidly expands to the limit. When through surface car and elevated railroad train service was established upon the Bridge in the year 1898 the detail passenger travel rapidly increased to more than double that of the previous year. The increase was due, to a large extent, to the stipulation in the leases that the railroad companies must include passage over the Bridge as a portion of a continuous route on which a single fare is charged. A count made November 10,

1897, when the Bridge railway (then the only means of transportation upon the Bridge) was operated by the Trustees of the New York and Brooklyn Bridge, showed a total of 144,509 passengers carried in twenty-four hours. A similar count made by the Brooklyn Heights Railroad Company in October 17, 1901, showed a total of 356,976 passengers carried on Bridge railroad and in surface cars.

When the counts were made by the Brooklyn Heights Railroad Company, in 1904, employees of the Department of Bridges also made a record of the people that crossed the Bridge on the promenade and in vehicles. The following table shows the total number of people and direction of travel on the Bridge railway, in surface cars and vehicles and on the promenade, October 17, 1904:

	To Manhattan.	To Brooklyn.	Total.
In surface cars	75,974	82,521	158,495
In elev. R.R. cars	100,788	71,908	172,796
In Bridge	13,773	11,912	25,685
Totals	190,545	166,431	356,976
Foot passengers on promenade	9,207	5,278	14,485
People in vehicles	1,773	1,541	3,314
Grand totals	201,525	173,250	374,775

The train service on the Bridge railroad in the morning from 6 a. m. to 10 a. m., and in the evening from 4 p. m. to 7 p. m. each weekday, consists of four-car Bridge trains, hauled across by cable and switched from the incoming to the outgoing platforms by electric power. At all other hours of the day and night, and on Sundays, the train service consists entirely of through elevated railroad trains, operated over the Bridge by electric power, from ten different lines of the Brooklyn Rapid Transit system. Local passengers are carried from Manhattan in the rear car of all trains that load at the westerly platforms. The majority of the passengers that cross the Bridge each weekday on the Bridge railroad are carried in Bridge cars, transferring to or from elevated railway trains at the Brooklyn terminal. The average weekday passenger travel, determined by several counts made during the months of October, November and December of the year 1904, is about 108,400 passengers carried from Brooklyn to Manhattan; of this number about 78,700, or 72.5 per cent., are carried in Bridge cars; and of about 92,200 passengers carried from Manhattan to Brooklyn, about 67,800, or 73.5 per cent., are carried in the Bridge cars. In two hours, between 7 a. m. and 9 a. m. of each weekday, 52,000 passengers, or about 48 per cent. of the daily average, are carried from Brooklyn to Manhattan in Bridge cars; and in one and one-half hours, from 5 p. m. to 6.30 p. m., about 48,000 passengers, or about 52 per cent. of the daily average, are carried from Manhattan to Brooklyn.

In the evening rush hours four-car Bridge trains are run at intervals averaging about one minute, or at the rate of 240 cars per hour; during the busiest hours the elevated railroad train service on all lines to the Bridge terminal consists of 79 trains, or about 400 cars per hour.

The diagrams which follow show the number by half hours of passengers in trolley and bridge cars in a day of 24 hours. Also the number by half hours of cars operated. A study of these diagrams will give some idea of the enormous amount of traffic which has to be cared for during the rush hours.

Record of the "Scott Special" of the Santa Fe.

The transportation department of the Atchison, Topeka & Santa Fe has compiled a record of the run of the "Scott Special," which made the record-breaking run from Los Angeles to Chicago on the 9th, 10th and 11th of July last. The train consisted of a baggage car, a diner and a sleeper, the total weight of the three being 348 tons. The elapsed time was 44 hrs. 54 mins., and the total distance 2,246 miles, so that the average rate was 50 m.p.h. The delays amounted to 137 mins., making the actual running time 42 hrs. 37 mins., and the average rate of speed 52.7 m.p.h.

The train left Los Angeles at 1 o'clock p.m., Pacific time, and made the run over the Los Angeles division of 141.1 miles in 175 minutes, 12 of which were lost in delays. From San Bernardino to Summit, 25 miles, a helper engine was used, the adverse grade being 158 ft. per mile part of the way and 116 ft. the rest. The average speed over the division was 48.3 m.p.h. The Arizona division, 318 miles, was covered in 411 minutes, 20 minutes of which is accounted for by delays. The average speed was 46.4 m.p.h. The fastest time was between Newberry and Lavic, 23.2 miles in 35 mins., which was down grade part of the way and against a 53-ft. grade the remainder; also between Goffs and Ibis, 16.9 miles in 16 mins., which was practically all down grade, with some 21 ft. adverse grades. At Needles a change of engines was made in the remarkably short time of one minute.

The Albuquerque division of 429 miles was covered at the rate of 44.5 m.p.h. The larger part of this was mountain climbing, with ruling grades of 95 ft. per mile. On the New Mexico division, Albuquerque to La Junta, 348 miles, the average speed was 45.8 m.p.h. On this division is the famous Raton Pass, the elevation of the summit being 7,608 ft. The heaviest grades were 175 ft. per mile. From Summit to La Junta, about 100 miles, the descent is rapid, the elevation of La Junta being 4,045 ft. A hot box on the dining car caused delays amounting to 12 minutes on this division. Up to this point the locomotives had been ten-wheel, Prairie and Pacific types. From La Junta to Chicago four-cylinder balanced compounds were used on every division, with one exception. The next division, the Western, 355 miles, was covered at the rate of 60 m.p.h., the delays amounting to 30 minutes. Near Kent, Kan., the balanced compound drawing the train broke a side rod and knocked out a cylinder head. Train No. 8 was passed at Kent and its engine, a Prairie type, taken to Newton. The fastest time was made between Deerfield and Sherlock, 8.1 miles, which is recorded as having been traversed in 6 mins., or at the rate of 81 m.p.h.; between Spearville and Offerle, 11.4 miles, the time is given as 8 mins., or at 85.5 m.p.h.

The Middle division, from Newton to Emporia, Kan., is only 73.1 miles long, and it was traversed without a stop in 70 mins., or at the rate of 62.6 m.p.h. The Eastern division to Argentine, 124 miles, required 130 mins., but 15 mins. of this was lost on account of slow orders over bridges being repaired, and through yards. Lake View to Lawrence, 7.5 miles, was covered at the rate of 75 m.p.h. From Kansas City to Ft. Madison, Iowa, the Missouri division, the average speed was 53.04 m.p.h. for the 221 miles. There were no delays except to change engines. One mile between Norborne and Carrollton, Mo., is recorded as having been made in 40 secs., or at the rate of 90 m.p.h. The fastest long run in the whole journey was made on the last division, the Illinois. The distance was 236.8 miles, which was covered in 238 mins., or at a rate of 59.7 m.p.h. On this division, the 2.8 miles from Cameron to Surrey is recorded as having been made in 1 min. 35 secs., or at the rate of 106.1 m.p.h.

Railroad Shop Tools.

(*Continued.*)

MILLING MACHINES.

Milling machines have been in use for many years in manufacturing plants. At first they were used for making small machine parts, such as parts for firearms, sewing machines, clocks, etc. Their ability to do this class of work accurately and rapidly suggested to the machine tool makers that a wider field of work was open to this type of machine. Larger and more powerful designs of milling machines were then made and were principally used for

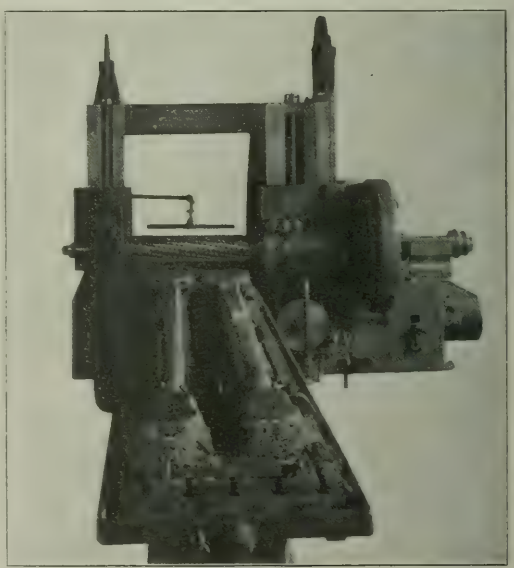


Fig. 1—The Ingersoll 36-in. x 16-ft. Milling Machine.

tool room work and for the heavier parts of small machines. The first use to which this type of machine was put in railroad shops was in the tool room, but gradually the machine tool makers increased the sizes, until to-day the milling machine forms a most important factor in the equipment of all large machine shops where heavy work is done. For the past few years the milling machine has rapidly increased in popularity among railroad shop men and now many machine tool makers are making milling machines especially designed for locomotive work. These machines are made

in many different designs, including universal milling machines, vertical milling machines, horizontal milling machines, plain milling machines, etc. The principal uses to which they are put in locomotive and railroad repair shops are for milling side-rods, driving boxes, truck boxes, motion work, etc. In many cases they are a far superior tool for this class of work than is the planer. By using specially formed tools and gang-cutters in connection with milling machines remarkable results can be attained in but a very short time as compared to the time it would take to do the same work on almost any other type of machine. The accompanying illustrations show some heavy milling machines which are particu-1, 2 and 3 are made by the Ingersoll Milling Machine Co., Rockford, Ill. Fig. 1 is a 36-in. x 16-ft. heavy type horizontal spindle

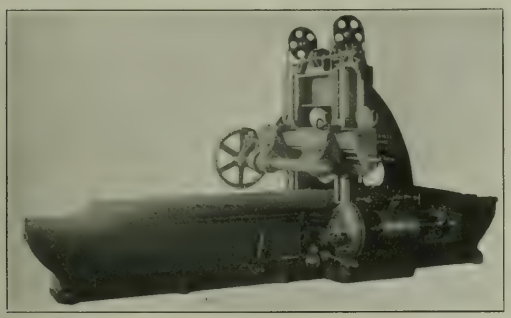


Fig. 2—The Ingersoll 24-in. Standard Type of Horizontal Milling Machine.

machine, which is used for milling side-rods and for miscellaneous work. The main housing is 27 in. wide on the face and 48 in. deep. The driving gear is 36 in. in diameter with a 4 in. face and a 2 in. pitch. The table has a working surface 36 in. wide by 16 ft. between the pockets, and is provided with a positive feed in both directions. All driving gears are contained in a gear box on the right-hand side of the machine. The horizontal head has a vertical feed on the housing, and the left-hand housing can be removed as well as can the top brace. By removing the above parts the machine can be used for milling the ends of very long pieces. The illustration shows this machine fitted with a 36-in. slabbing cutter cutting steel side-rod forgings. The surface of the forgings is approximately 20 in. wide; the depth of cut is ⅜ in., and the feed is 3½ in. per minute. This machine is driven by a

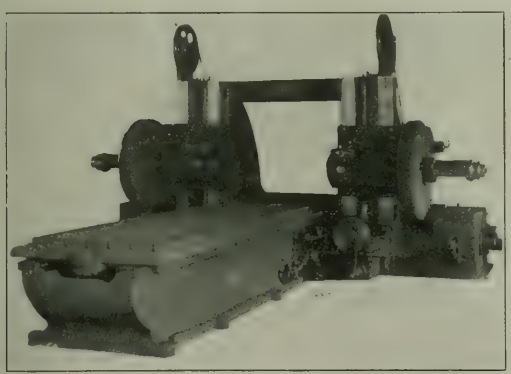


Fig. 3—The Ingersoll 50-in. Heavy Type of Duplex Milling Machine.

24 h.p. motor. Fig. 2 shows a 24 in. standard horizontal type of milling machine. For light general repair work this is a very useful machine. The table is 24 in. wide by 12 ft. between the pockets. It has positive feed in either direction and the cross rail is counterbalanced and can be raised or lowered by both hand and power. When motor driven it requires a 7½ h.p. motor. Fig. 3 shows a 50 in. heavy type duplex horizontal spindle machine. This machine is very powerful and will take extremely heavy cuts. It is especially adapted for milling driving boxes and truck boxes and for taking heavy cuts on side-rods. The table is 48 in. wide by 16 ft. between the pockets, and like the other two machines is provided with positive feed in either direction. The spindles are of large diameter and the spindle gears and driving gears are of steel throughout. The gear changes are made in the gear box, which is shown on the right-hand side of the machine. In paneling side rods two rods can be put on the machine side by side and independent cutters can be fitted on the shank arbors in each head. Each head has an automatic down feed, so that the sinking-in cut for paneling the rods can be taken and when the proper depth of cut is obtained the table feed can be started up without losing any time. This machine is fitted when motor driven with a 50 h.p. motor and two main side-rods can be paneled to the full depth of cut at one time with a very fast feed.

(To be continued.)

Passenger Coach Yards.*

Professor Oder and Dr. Blum have compiled in pamphlet form the result of their studies, directed especially to German and American practice, in the design and arrangement of yards for facilitating the care of passenger coaches, and the making up of passenger trains. The pamphlet is illustrated with a number of diagrams, but these are scarcely important enough for reproduction, in their relation to American practice.

Passenger coach yards serve for the reception of incoming trains as well as for the execution of all work necessary before starting new trains, and, as a rule, such yards are required at places where passenger trains have to be made up, that is, in large cities and at terminal stations. The make up of passenger trains is complicated by the necessity of arranging mail, baggage, sleeping and dining cars, etc., in a certain inflexible order. One of the safety precautions most commonly applied, is to have an empty car between the engine and the first passenger coach. In many cases the luggage car or the mail car is used as a protecting car. Furthermore, for express trains, only new or very well kept cars can be used, and care must be taken that the heavier cars are in front and the lighter cars in the rear of the train.

In loading and unloading, passenger traffic, which takes care of itself, has a great advantage over freight traffic, but in train despatching the reverse is true, because freight cars can be loaded before the train is made up, while passenger trains have to be ready to start before they receive their passengers. But passenger trains have a much more uniform composition than freight trains, and German practice classifies the cars in each train as follows:

1. Trunk, or through cars (Stammwagen) which continue in the train during its entire run.

2. Course, or set-out cars, which run only a portion of the distance.

3. Auxiliary cars, which are used to supplement either of the other kinds.

A large number of trains, especially in local and suburban runs, are ready again for service almost immediately after arrival, requiring no changes at all, or only insignificant ones, and these make no use of the yard. This is also true of a considerable number of through express trains, where the arrangement of cars can remain undisturbed, except that in German practice the protection car behind the engine must always be changed; but at terminal stations it is frequently necessary to make such changes in a train that a make-up yard proves very convenient, although a loop or a Y track often suffices to bring the train into the proper shape. The problem of making up a new train from cars taken from several other trains, constantly recurring in freight practice, is comparatively seldom found in passenger service, although passenger trains frequently require the addition of cars to provide for heavier traffic, and mail, express and dining cars have often to be changed. All special trains must, however, be made up new, and regular trains are often altered when extras or additional sections are used to carry a heavy fluctuating traffic.

When passenger trains have been emptied of travelers and drawn either by the road engine or by a switch engine into the make-up yard, mail and express cars must be separated from the others and taken to the place provided for them. Then the remaining cars must be arranged in the way in which they are to go out with the next train, and they must be cleaned, charged with gas and provided with the necessary appliances. To facilitate this work each make-up yard should have the following tracks and arrangements:

(1.) Ladder tracks to provide for trains leaving the station platform for the yard and arriving from the yard.

(2.) Classification tracks for separating and re-making trains.

(3.) Car-sheds with the necessary tracks to reach them.

(4.) Make-up tracks for "trains de luxe" and for dining and sleeping cars.

(5.) Storage tracks to provide ordinary coaches for fluctuating traffic.

(6.) Tracks for the storage of set-out and additional cars.

(7.) Switch tracks for the exchange of cars with the freight yard.

The designer of a passenger coach yard must aim to obtain the

*Abstellbahnhöfe (Betriebsbahnhöfe für den Personenverkehr.) von M. Oder, Professor an der Königl Techn. Hochschule zu Danzig und Dr.-Ing. O. Blum, Regierungs-Baumeister in Berlin. Wilhelm Ernst & Sohn, Berlin, 1904.

highest efficiency without diminishing safety; specifically, he must provide for ready enlargement in the case of increased traffic, and study out the best possible arrangement of the connections between the yard and the station platform. At large stations this connection requires several tracks and it is often a source of trouble, especially where there is dense traffic, to have the main tracks serve as part of the communication between the yard and the station platforms, although this is in many cases unavoidable. It is essential not only that all parts of a yard be so built as to avoid superfluous movements, but also that they be arranged in such a way that no operation is likely to disturb another one. If several switch engines have to work in one yard, independent groups of tracks should be provided for each one.

So far as design is concerned, it cannot be too strongly emphasized that a uniform and coherent arrangement is more important for a coach yard than for other yards or stations. It is not sufficient to reserve a certain space against the contingency of future enlargement, but this enlargement should be designed and provided for when the yard is first built. In case a yard is not sufficient for the traffic, it is generally not desirable to add further groups of tracks in order to increase its efficiency, but it will probably be better in most cases to change the whole track arrangement. In determining the number and total length of the tracks in a coach yard it is best to make an imaginary schedule containing the maximum number of trains to be handled at a given station. In no case should it be attempted to reduce the length of yard tracks and build larger platform tracks instead, for platform tracks are always more expensive than yard tracks, and require more space, as the platform must be considered and a certain number of safety devices and constructional arrangements will be necessary, which are apt to cost much more than those of a yard. Moreover, every platform track renders the whole plant more complicated and necessitates, especially at terminal stations, an increase in size of the station building. Furthermore, cleanliness and the general condition of the air are greatly impaired if trains have to be cleaned and provided with gas within the station building.

Coach tracks are generally united in a bundle, as this makes supervision easier, and the pipings for gas, steam (for preliminary heating), compressed air and water can be shorter.

The so-called classification tracks have in Germany generally a total length of at least 275 yards, while the length of each yard track is at least 44 yards. As it can happen very easily that cars have to be turned round, a turntable has to be provided for, which, in most cases, will suitably be located in the vicinity of the classification tracks. In America a turntable is regarded indispensable in case there is no Y track. Car sheds serve for the protection of the more expensive rolling stock against deterioration by climatic influences when out of commission.

Make-up tracks for Pullman, dining and sleeping cars are desirable, because these trains and cars require special treatment and have therefore to be so placed as not to be affected by the switching of the other cars, in order to facilitate loading provisions, ice, laundry, etc., by persons not employed by the railroad company. It is advisable to build these tracks at a place where they may easily be reached from outside the station. A much larger space is required for storage tracks for those cars which are not in commission during the time of slack service, because a considerably greater number of passenger coaches, mail and express cars are attached to a station than are regularly used. Generally speaking, storage tracks for set-out and additional cars have to be near the station platforms, as the latter class especially is often added to the train at the last moment.

Switch tracks serve for the exchange of cars between the station and freight yard on one side and the switching station on the other side. The latter is especially important at large stations, and includes:

(1.) Extra passenger coaches which have been used on scheduled trains and brought back to their home station in freight trains.

(2.) Passenger coaches which have been used for making up special trains and which cannot be brought back together to the home station.

(3.) Freight cars for express, animal or mail transport.

(4.) Freight cars carrying supplies for yard or station, as for instance coal, oil, etc.

(5.) Freight cars for private tracks which are only accessible from yard or station.

(6.) Passenger coaches which go to or come from the repair shop, in case there is no immediate communication between make-up yard and repair shop.

The administration of the German postal service has the right of adding one mail car to every scheduled train, and passenger trains are, of course, mostly used for this purpose, but as loading and unloading of mail often delays the trains considerably, and mail cars are liable to increase the weight of these trains, there has been a tendency to forward mail in special postal trains. But this practice has not yet been adopted generally. At most stations, mail is put into the car or taken out of it directly on the station platform, but at those stations where mail cars have to be added to or taken away from a train, this is not the case. All mail is arranged in a definite and very exact order in these cars, and, as such treatment requires much time, it cannot be done during the short space of time which a train remains at the station platform; for this reason special tracks for mail cars have to be provided for at many stations. Express goods have so far mostly been forwarded by passenger trains in Germany, but as this often necessitates delay an attempt has been made to provide special trains carrying express goods whenever this has been justified by the amount of business. In North America conditions are entirely different, because the express traffic is handled by express companies and not by the postal service.

It is very desirable that roundhouses should have direct communication with the station platforms, but if this cannot be arranged, special care ought to be taken that roundhouses do not interfere with the make-up yard or divide it into several parts, as this would make subsequent enlargement difficult. Coach yards require various kinds of special equipment, such as water stations, compressed air appliances, etc. These should be placed between the tracks so as to be readily accessible on both sides.

At a terminal station used by only one line, undoubtedly the best arrangement, as far as management goes, is to have the make-up yard placed between the main passenger tracks. From the constructor's point of view such a design might give great difficulties. For instance, the expansion of the yard under these circumstances is nearly impossible; moreover, there are corners of little utility, and in many cases it is difficult to reach the mail and express tracks from outside. Generally speaking, it is best to have the freight yard and the make-up yard at the same side of the main tracks, as the traffic between these two can thus be handled very easily and without crossing the main tracks.

If several lines come to an end at a terminal station, as for instance at the Broad Street Station in West Philadelphia, many trains will leave the station without undergoing material changes. A rather complicated station of this kind is the new station at Altona, near Hamburg, where there is a considerable interurban, suburban and long distance traffic. The outer platforms of those reserved for the long distance traffic serve specially to accommodate trains which are passing through, while the inner platforms are provided for trains beginning or ending their run at Altona. This arrangement has been chosen as it diminishes the interference of incoming and outgoing trains with each other and offers the greatest safety for all movements to and from the make-up yard.

Terminal stations have certain obvious disadvantages which are known to every railroad man. One of the best ways of avoiding these disadvantages—a device which is used very often and was known in the earliest days of railroad practice, is to arrange the tracks in form of a loop. This is very practicable for interurban and suburban trains, but for long distance trains, a loop has generally to be so wide that difficulties of another character will arise, such as scarcity of space, high cost of ground, etc. It is sometimes impossible, especially in large cities, to avoid terminal stations, but this should always be done at stations with through traffic, even if there are many trains which start from or begin at this station, by providing for a conveniently located coach yard.

Foreign Railroad Notes.

The insufficiency of the rolling stock of the Russian railroads is so great that it is said that the government contemplates giving permission to order cars and locomotives from foreign works.

The Austrian tax on railroad tickets, which went into effect Jan. 1, 1903, yielded the government in that year $3,324,019 at an expense of $41—the cost of collecting falling on the railroads.

The highest salary paid to any officer of the Swiss State Railroads is $3,000. No such salaries were paid in the Swiss service until recently; and it is only this year that the chief justice of the Supreme Court had his salary raised from $2,400 to $2,800.

An electric railroad from Lake Geneva at Montreux across mountains to the Bernese Oberland, connecting with Interlaken, a distance of 37 miles, was opened in the first week of July. This is the longest electric railroad in Switzerland, and for scenery must be one of the most remarkable in the world. It has grades as steep as 348 ft. per mile, all on the six miles of the road nearest Lake Geneva. It is worked with motors developing 80 h.p. with a tension of 750 volts. (See also page 228.)

The Italian government maintains an inspection of the corporation railroads of the country, which have now about 3,500 miles of road. Since it took over its own roads, it has reduced the number of inspection offices to 10. Besides overseeing the operation of the private railroads, these offices examine and report upon requests for charters for new lines, conduct negotiations for the acquirement of lines by the state, control the expenditures for new constructions by the state, etc.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XXXIX, No. 11. FRIDAY, SEPTEMBER 15, 1905.

It is reported from Washington that Senator Elkins will draft a railroad regulation bill for the next session of Congress. This means, presumably, that the Senator puts no faith in the claim, frequently made of late, that the arguments against legislation which were presented to his committee last spring have silenced the farmers, grain dealers and others who have been clamoring for a law to empower the Interstate Commerce Commission to reduce freight and passenger rates which the Commission deems too high. The Senator proposes to call his committee together for this work before Congress meets, so as to save time. This committee meeting now seems to be the only tangible result of President Roosevelt's oft-proclaimed intention of hastening important legislation by calling an extra session of Congress, and the President's critics are amiably enjoying the situation. Senator Elkins' present determination may mean much or little, according to what kind of a bill he has in mind. If he proposes to secure publicity for the operations of private car lines and what may be called private railroads, and have them so closely watched that they cannot be used as means of rate cutting and discrimination, that is one thing, and a good thing; but if he calls that regulating railroad evils, as the term has been understood for the past twenty years, he is, of course, missing the mark, and will fail to silence the E. P. Bacon crowd—if such a company may fairly be called a crowd. Those who demand that the Interstate Commerce Commission be empowered to make future rates know what they want. If they have grievances of real consequence they will continue to importune Congress, regardless of any private car statute. If they are mere agitators they will also keep up their so-called campaign, for their demand, whether it is based on injustices amounting to ten dollars a year or ten thousand dollars a day, has in it an apparent element of reasonableness. Marked inequalities in rates do exist, and probably many exorbitant rates also. The fact that these evils may be comparatively few, and that still fewer are curable by legislation, has no influence on those who are agitating for new laws, and so they keep on agitating. If they find themselves able to cite a single suit in which justice to the shipper would be facilitated by the establishment of transportation courts all over the country they call for such courts. This is the essence of the demand which Congress must listen to; and, as we said last winter, it behooves Congress and the railroad interest and all who desire a rational settlement of the freight rate problem, to listen and heed, and conciliate where possible, rather than overpower by mere force of numbers. It is said that Senator Elkins has spent the summer studying the English system of rate regulation. If he has, he will probably have to report, what all other observers have reported, that there is a Board of Trade to hear and investigate and recommend, on slow and pretty conservative lines; and that the Railway and Canal Commission, which finally decides, has all of the essential attributes of the highest and most dignified courts of justice; also that the practical use of these tribunals for these purposes is rare indeed. How to establish and maintain such instrumentalities in this country—from two to forty times as large as England, according to the basis on which the comparison is made—is our problem. For it is hardly to be doubted that, if our Federal District and Circuit Courts could deal with Interstate rate questions as promptly and as intelligently as such problems are capable of being dealt with in England, much legislative discussion would cease. But shippers would, nevertheless, forever continue dissatisfied, for we believe it is true that in Great Britain the relation between the traders and the transportation companies is more strained than it is in the United States.

THE DISASTER ON THE MANHATTAN ELEVATED.

The Elevated railroads of Manhattan, New York City, carrying from 150 to 200 millions of passengers yearly (215 millions in the last year recorded in Poor's Manual), have had an unparalleled record for safety, no passenger having been killed while riding in the cars during the 27 years that the lines have been in operation; but this record is now broken, and the tipping of a car full of passengers into the street on September 11, resulting in 12 deaths, is reported in another column of this paper. The immediate cause of the derailment was the same as that of the Mentor disaster last June, too high speed on a sharp curve.

The responsibility seems plain. The signalman at the junction, said to be a man of experience, and with a good record, says that the disks on the approaching train indicated that it should be turned into 53d street (for Sixth avenue), and he so turned it; though the conductor says that the disks indicated for Ninth avenue. But the wrong position of the switch was not the cause of the derailment, for the signals, 500 ft. and 50 ft. back of the switch, indicated that it was set for the diverging route, and this was, of course, a notice to the motorman to reduce his speed to 9 miles an hour, which is the prescribed maximum speed for that curve of 125-ft. radius. The

motorman has worked for the company six months, wholly on the Ninth avenue line, from which it seems probable that he has never run through this curve, or at least not at any time habitually; but in passing it every day he must have become familiar with it. He must also be familiar with the signal and its two positions, for although, in running regularly down Ninth avenue, he would always be guided by one and the same indication, he must have frequently seen the other indication; for, with the very numerous trains on those lines, he must many times have been obliged to wait until a preceding Sixth avenue train cleared the junction before getting the clear signal for his own movement. If Motorman Kelly succeeds in permanently evading the police, the State Railroad Commissioners, who are investigating the facts, will be able to do little besides clearing up Kelly's record. The reporters print stories of irregular behavior on the fatal trip, but none of these are as yet definite enough to throw any light on the man's actual mental condition.

The unequalled safety with which the billions of passenger journeys have been accomplished on the Elevated lines has led to much mild speculation as to the reasons for such immunity, and as to what the law of chances had in store for us. First, we must recognize the element of time. No other railroad has carried so many passengers on such a short length of road in the same number of years. Second, the speed has always been moderate, until the introduction of electric motors three years ago. With no change in men or in discipline, an increase of speed increases the liability that a train will some day approach a sharp curve at uncontrollable speed. A third element in the long record of safety is the fact that on the steam engines there were always two men. Moreover, with the light loads and the easily managed fuel (anthracite) the firemen had ample opportunity to keep a good lookout. But whether or not a second man would have prevented the error in the present case is purely speculative, and many railroad officers regard as unsolved—or at least not satisfactorily settled—the whole question of the value of the fireman as a lookout man. Certain it is that in a great number of cases where a collision has occurred and the conduct of the fireman has been inquired into, the result has been unsatisfactory. The fireman, because he was engaged with his fire, or for some reason or other, had not observed the signals.

But, whatever may have been the advantage from fixtures and appliances and rules and circumstances, the fact remains that for this fine 27 years' record great credit is due to the hundreds of men. The speed was indeed, moderate, but it was not everywhere slow. The speed of all trains was kept up to the limit of the power of the engines and of the alinement and grades of the road. That the men were well trained and disciplined and were kept in the same service year after year was an important element for which credit is due to the officers, of course. Colonel Frank K. Hain, for many years general manager, was a prince of disciplinarians. In comparing him with other railroad managers, it would be fair to add that he enjoyed a unique advantage in having his 4,500 men all within a half hour's ride of his office. We must also add that he worked himself to death. It is a fine thing for the service to have 4,500 men directly governed by a single master mind, but it is likely to be killing work for the one who governs.

The average length of service of Col. Hain's enginemen was a long term of years. Motorman Kelly had been in service only six months, though he had had several years' experience on street cars in St. Louis. Without more knowledge than is now available, Kelly cannot be condemned by reason of the brevity of his term; and yet there is no denying that a long term of service, with a good record, combined with suitable supervision and discipline, gives an assurance not otherwise attainable. For Kelly's character and qualifications the public will have to wait for the Railroad Commissioners' report.

A GOVERNMENT RAILROAD.

A storm of criticism from the Canadian press has followed the announcement by Mr. Emmerson, Minister of Railways and Canals, that the earnings of the Intercolcnial, the "People's Railway," would fall between a million and a half and two million dollars short of expenses during the fiscal year just closed. It is hard to see how any good Canadian, particularly if he is a taxpayer, can look upon this announcement with any thing but uneasiness, especially in view of Mr. Emmerson's concluding admission that he believed the Intercolonial had passed the stage at which it was possible to make both ends meet. In truth, it does seem a pretty discouraging admission from the manager of a railroad with nearly 1,500 miles of line, more locomotives per mile of road than any other line in Canada, connection with the two chief cities of eastern Canada and two tidewater terminals at good harbors on the Atlantic Ocean. Of late years, we have come to believe, and with good reason, that practically any railroad which operates more than one or two hundred miles of track can be made to pay. Since the dismal days of 1893, we have seen big systems taken out of receivers' hands and not only made to produce the bond interest necessary to keep them on their feet, but dividends—and good dividends—as well. Not only have some of the largest roads both in this country and in Canada been brought from bankruptcy to very great prosperity, but more recently smaller lines of less than 500 miles, notorious for years as persistent failures, have gotten on their feet and have at least begun to earn something above operating expenses. As a result, there is to-day only one railroad of more than 125 miles, either in this country or in Canada, in the hands of a receiver.

The Intercolonial, then, compared with all other American railroads of anything like its size, is an exception to the rule of very general railroad prosperity. This is on the basis of an even comparison. How striking is the exception when one remembers that the Intercolonial, being a government road, is free from taxes and has no interest or dividend payments to make. If it seemed strange that as an ordinary railroad the Intercolonial cannot be made to pay, how much more remarkable does it seem in view of its immunity from so many of the ordinary payments of a private railroad corporation. The situation is unusual enough to make it worth investigation. Mr. Emmerson, in his announcement, gives no figures for expenditures on capital account, which are unofficially estimated at somewhere in the neighborhood of $2,000,000 for the year. His own estimate of the deficit on income account figures out at from $1,000 to $1,355 per mile on the 1,476 miles of line of the Intercolonial. This he accounts for by the severity of the past winter, which severely crippled the road; an increase of about $750,000 in wage payments, and the fact that the Intercolonial was not built to be a commercial success. Of these reasons, the first seems plausible. In common with the other railroads in the maritime provinces, the Intercolonial was practically tied up for most of two months during the past winter, and, naturally enough, earnings fell off and expenses very largely increased. Yet none but government roads in Canada, so far as we know, even if entirely in this teritory, have reported large deficits on the year's operation.

The increase of $750,000 in wage payments, according to the Minister, does not mean that wages on the Intercolonial are now higher than on other railroads, but that they have been lower in the past. He says that as a result of the increase and an increase in the number of employees, better results have been obtained, and instances the mechanical department, in which, after an increase of 20 per cent. in the number of men, the output has in some cases been increased as much as 100 per cent. Looking at the matter from an ordinary business standpoint, there are one or two obvious comments on the large wage increase. An increase in output (assuming that output means efficiency), of five times an increase in working force is pretty sure to show that there has been inefficiency either in work or in organization. If it is possible on the Intercolonial to increase efficiency 100 per cent. by increasing the working force 20 per cent., any statement that the road has passed the point where it is no longer possible to make both ends meet seems somewhat premature. It certainly has reached that point, but a further reorganization of the working force, especially the traffic department, might possibly be tried before all hope is abandoned. This is on the assumption that the increase in wages, as the Minister intimates, has been a paying investment. On the other hand, it is obvious that few roads rolling up a deficit at the rate of $1,500,000 a year would choose an increase of $750,000 in payments for wages as a means of economy. If wages had been low compared with other roads, it would be good proof in the case of any but a government road that they could stay low, especially with the impending deficit as an argument against any increase. The managers of such a road would economize, it is safe to say, not by an increase in the general level of wages and the number of men employed, but by a reduction in wages, the laying off of men, or at least by an attempt to get, with the same expenditure, increased efficiency from the existing force. If output could in a given case be increased 100 per cent. by a 20 per cent. increase in the force, it is not at all unlikely that it could have been increased 50 per cent. by improved methods without any increase at all in wages or in the number of men employed.

What Mr. Emmerson means by saying that the Intercolonial was not built to be a commercial success seems to be that its through

line between Montreal and St. John, N. B., is 259 miles longer than the Canadian Pacific's line between these same points. He says that military rather than commercial considerations influenced its location on the north shore of New Brunswick, which, he implies, is barren territory for a railroad. The frequency of stations should be a rough gage of the barrenness of a railroad's territory. Comparing, on this basis, the Intercolonial with the Canadian Pacific, whose line runs through the northern part of the state of Maine, in the number of stations, counting east from St. John, we find that the Canadian Pacific has in the 306 miles east to Megantic, directly south of Quebec, only seven stations, while the Intercolonial, in the 267 miles east to Matapedia, which includes all of the line on the north shore of New Brunswick, mentioned by Mr. Emmerson, has 17 stations. That is, the Intercolonial just about averages one station for every 17 miles, while the Canadian Pacific averages one about every 44 miles. This makes it pretty clear that when the Intercolonial is referred to as a non-commercial line, its ability to compete for through traffic must be what is meant. In competition, the longer line is, of course, handicapped both in attracting traffic and by—other things being equal—its larger operating expenses. How little this handicap really amounts to, if the longer road is determined upon getting business, has been illustrated time and time again in this country. If the Grand Trunk has found it profitable to carry Chicago freight east from New York to New London, north by the Central Vermont to Montreal, and then to Chicago, after a preliminary journey of 500 miles that takes the freight farther from Chicago than it was when it started, surely there is hope even for a road with the Intercolonial's handicap on through traffic, especially as with much freight it makes no difference whether or not it travels two or three hundred extra miles before reaching its destination. Through passengers may be kept away from the Intercolonial by its longer line—in local passengers it apparently has an advantage over its competitor—but with an aggressive traffic policy, there would seem to be no reason why such through freight traffic could not be gained.

Station counting may or may not mean what we have above assumed it to mean, but it means at least this much, that the Intercolonial has enough stopping points for a profitable local traffic. This, however, is not enough and successful American roads have usually done more; they have taken energetic measures to find out and make known the productive possibilities along the line; they have encouraged settlement and developed industries. The traveler from Montreal to Metapedia sees from the car window hundreds of monotonous miles of burned forest with a prevailing industry of picking out its remaining wealth, such as cedar from the swamps, and getting from it pitifully small returns in money. Its agriculture and its fisheries seem to have no systematic encouragement. Is this not due to the blight of government ownership, the pall that comes from secure tenure with no incentive? The commercial department, the traffic-getting, of a railroad needs qualities not made by statute, and the Intercolonial seems to be an illustration of the fact that government control is badly handicapped in competitive work. It may, on occasion, fill a "long-felt want," but the encouragement, development and creation of industries and opportunities for earning a living are functions of individual and corporate enterprise.

In short, although the Intercolonial does not possess the best of situations, its case seems by no means as bad as the Minister's statement would lead us to believe. In spite of his arguments in justification of the deficit, we venture to assert that there are at this moment a large number of practical railroad men, any one of whom would, if given a free hand, be more than willing to stake his professional reputation on putting the road on its feet.

In contrast to Mr. Emmerson's explanations of the deficits, the following comments on the management of the Intercolonial by the Canadian press, some of them, of course, from opposition papers, are certainly suggestive:

"The road is generally admitted to be a good one, and it has a capital country to serve, but political control costs the people two prices for what they get."

"Not only has the railway been made a home for decayed or tired politicians—a sort of hospital for incurable friends of succeeding governments—but, for political purposes, rates have often been fixed absurdly low."

"Through incompetency at political headquarters, through the loading upon it for the benefit of political workers of unprofitable branch lines, through the interference of partisans with its operations, through overloading it with employees and compelling it to run trains that are not justified by the business done, the road has been brought to a position where the more business it gets the greater is the loss in operating it."

"Patronage is the real cause of the deficits under all regimes. In the first place, the member is besieged, and he in his turn lays siege to the Minister, and if such and such a one does not get a situation, he is sure to lose twenty-five votes or more in such and such a parish. * * * Then, there are the contracts, the purchases, the tariffs, all of which are regulated from a political point of view. Last year, for instance, there were the general elections, and they must have cost the Intercolonial at least $500,000. Had the Conservative party been in power, the same thing would have taken place. * * * To accuse the officials of the Intercolonial is to place ourselves on the wrong track. It is the system that is to blame."

"With such a wasteful system, it is surely no wonder that the Intercolonial has nothing but increasing deficits, while other railways are declaring increasing dividends."

These are strong and rather startling criticisms of government railroad management near at hand. The *Railroad Gazette* does not at all vouch for the truth of these statements, but, whether true or not, they throw light on possible workings of government management under the political party system.

Uganda Railway.

This road is now completed from Mombasa, on the east coast of Africa near the fourth degree of south latitude, east to the upper part of Lake Victoria. In connection with the railroad, a steamboat line is run from the railroad terminus on Lake Victoria.

A report for the year ending March 31, 1904, has been presented to Parliament. The construction committee turned over the road to the British Protectorate on Oct. 1, 1903, and it is now operated as a part of the East African Administration. In the following figures, pounds sterling are converted to dollars at 4.85 and rupees at 0.32. The report shows a deficit of $291,487, but all government stores were carried at cost price and the saving to the government in the cost of carrying stores over the former high cost of transporting goods by porters was greater than the amount of this deficit, so that in reality a small percentage of profit was realized on the capital spent on the road.

The road now consists of 584 miles of track between Mombasa and Uganda, on Lake Victoria, and 40 miles of sidings. The gage is 3 ft. 3⅜ in., and the maximum grade on the permanent line is 2½ per cent., all but one mile being less than 2 per cent. and about half being less than 1 per cent. The line is laid with Vignolles section 50-lb. rails. It has been found that steel ties give better results than wooden ones, which deteriorate rapidly from dry rot; contrary to expectation, the metal ties are not affected seriously by the salt in the soil and there were, on March 31, 1904, 1,156,262 metal ties in service, against only 169,407 wood. Three and a half miles of rail are laid on longitudinal pine stringers. At the end of the year there were 64 locomotives in running order and six undergoing repairs; 122 passenger cars and 73 miscellaneous (baggage cars, inspection cars, etc.); 273 box cars, 288 flat cars, 199 gondolas and 165 miscellaneous, all of 10 tons capacity excepting a few 20-ton gondolas and flat cars. The total passenger train-mileage was 102,354 miles; passenger train-mile receipts, $1.50; passenger train-mile cost, $2.58; number of passengers carried one mile, 12,490,525; passenger-mile receipts, 1.23 cents; passenger-mile cost, 1.99 cents. The freight train-mileage was 219,437 miles; freight train-mile receipts, $1.74; freight train-mile cost, $2.58; number of tons of freight carried one mile, 8,414,696; receipts per ton mile, 4.55 cents; ton-mile cost, 6.90 cents. Figures for construction and water trains are not included in these results.

Gross earnings were $638,102, and operating expenses, $929,589, leaving the net loss of $291,487 already mentioned. The gross receipts from freight traffic were $441,148; from passenger traffic, $154,988; from telegraph, steamboat service and sundries, $41,965. The percentage of operating expenses to gross receipts was 145.68; maintenance of way cost $318,313, or 34.24 per cent. of the operating expenses; locomotive and car expenses, $255,409, 27.48 per cent.; traffic expenses, $76,752, 8.25 per cent., and general charges, steamboat service, special and miscellaneous expenses, $279,115, 30.03 per cent. The cost of fuel was 6.48 cents per engine mile, a decrease of 3.52 cents from the figure for the year before. The use of coal had ceased by the end of the year and the settlers were expected to be able to furnish sufficient fuel hereafter, negotiations being under way toward making contracts with them for suitable wood for fuel. Interesting expense items are: Watch and ward, $8,854; railway schools, $811; 5 per cent. extra on salaries in lieu of provident fund, $10,147; importation and repatriation of coolies, $85,303.

The total imports (i.e., freight carried up from the coast by rail) were 10,667 tons, and the total exports, 5,704 tons, these figures being exclusive of railroad material. The largest single item of imports was building material (cement, corrugated iron, timber,

for a small electric plant for lighting the yard. There will be 30 stone and lime) (2,050 tons), other important ones being cotton goods, rice, manufactured iron and steel and kerosene. The largest of the exports was Indian corn and other grains (1,561 tons), and the only others of any account were raw skins and potatoes.

A review of the report for the preceding year was published in the *Railroad Gazette* of August 26, 1904.

NEW PUBLICATIONS.

Advanced Mechanical Drawing. By Alpha Pierce Jamison, M.E., Assistant Professor of Mechanical Drawing, Purdue University. New York: John Wiley & Sons. 1905. Cloth, 6 in. x 9 in.; 177 pages; 27 full page plates and 117 figures. Price, $2.

Professor Jamison has made a contribution to the already numerous works on this subject. This book is devoted to the advanced stages of mechanical drawing only and does not treat of the fundamental principle, such as the proper methods of handling the instruments, etc.; nor does it treat of design, it being preliminary to this subject. It consists principally of a series of progressive notes which are calculated to impart a working knowledge of the principles of graphic representation and at the same time a number of examples are offered which will acquaint the student with the conventions of the art. Part I is intended for the freshman year and contains three chapters on the following subjects: Isometric drawing, cavalier projection, shadows and perspective drawing. Part II is intended for the sophomore year and is to be used in connection with the class room and lecture work in descriptive geometry. It contains two chapters which treat of theoretical and practical problems in both plane and perspective drawing, such as developments, practical perspective, lettering, etc. The discussions are brief and clearly written, and the illustrations throughout are excellent. The work no doubt will be of great value when used, as intended, in class room work.

TRADE CATALOGUES.

The Ganz System of Electric Traction.—The Railway Electric Power Company, New York, sends a 30-page catalogue 11 in. x 14 in. descriptive of the Ganz three-phase alternating current traction system. A detailed description and illustrations of the apparatus used is given, and particular mention is made of the results obtained from its three years' use abroad. A full detailed description of this system as used on the Valtellina line, a part of the Adriatic system of the Italian Government railroads, was given in the *Railroad Gazette* September 30, 1904.

Pilot Couplers.—The Washburn Coupler Co., Minneapolis, Minn., is sending out an illustrated sheet showing its locomotive pilot couplers. The styles are illustrated on one side of the sheet by half-tone engravings showing the application to the pilot, and on the reverse side by detailed drawings. Schedules of parts also are given.

Car Journal Lubricators.—The Harrison-Williams Co., Toledo, Ohio, sends a small illustrated booklet in which is given a detailed description and illustrations of the Harrison car journal lubricator. A short talk on car journal lubrication is also given and the advantages derived from the use of this device are set forth.

CONTRIBUTIONS

The Cost of Locomotive General Repairs.

New York, Sept. 9, 1905.

To the Editor of the Railroad Gazette:

With reference to Mr. Geo. R. Henderson's article on "Locomotive Operation" in your Sept. 8 number, we do not quite understand his statement in regard to the cost of general repairs. He gives the impression that the cost of general repairs would average about one cent per mile. The cost for locomotive repairs on various railroads is as follows:

	Per mile.
Pennsylvania Railroad, 1903	7.74 cts.
Chicago & Alton, 1903	6.35 "
Louisville & Nashville, 1903	6.96 "
Northern Pacific, 1903	7.24 "
Missouri Pacific, 1903	7.27 "

It would seem from the above figures as though one cent per mile for general repairs is too low a charge, as the running repairs would hardly equal half the amount paid out for repairs.

The question of locomotive repairs is one of particular interest to us, and we should be glad to have some further information in regard to the data used in Mr. Henderson's article.

NILES-BEMENT-POND COMPANY,
M. ESTABROOK.

[It is always well, in attempting to correct an error, to give some additional information, and Mr. Estabrook has done this. Nevertheless, Mr. Henderson made no error. The even figure, one cent, was taken simply for the purpose of making the arithmetic easy when showing what happens when the mileage is increased or decreased, the effect of different waters, etc. Mr. Henderson will treat of actual costs in a subsequent paper.—Editor.]

New Dolton Yards of the Chicago & Eastern Illinois.

The Chicago & Eastern Illinois Railroad, which is the Chicago link of the Frisco System, has its principal freight terminal at Dolton, just south of the southern limits of the city. Its passenger trains enter Chicago over the tracks of the Chicago & Western Indiana and the Rock Island in the order named, and use the passenger terminal of the latter. The road enjoys a large coal traffic, which has been steadily growing and which has reached a volume that taxed the existing facilities at many points beyond their capacity. Of these, Dolton yard was the most in need of revision and material enlargement. This yard was built five years ago. It was not a gravity yard and its plan was not suited for the expeditious handling of business according to present standards. Besides, the traffic had completely outgrown it.

In order to permit of enlargement, considerable new property had to first be acquired and a tract of land of about 160 acres was bought. This land is south of the old yard and east of the main line. On this tract a complete new northbound gravity yard is being built and the old yard is being rearranged as a southbound gravity yard. Plans of both yards are shown in the accompanying illustrations.

The northbound yard extends from 159th to 147th streets and the southbound yard from 147th street north to beyond Frederick street, the total length of the two being something under two and one-half miles. Each is adjacent to the track of the same name; that is, the two yards lie on opposite sides of the main line, and communication between them is across main line traffic, the crossover being protected by interlocking.

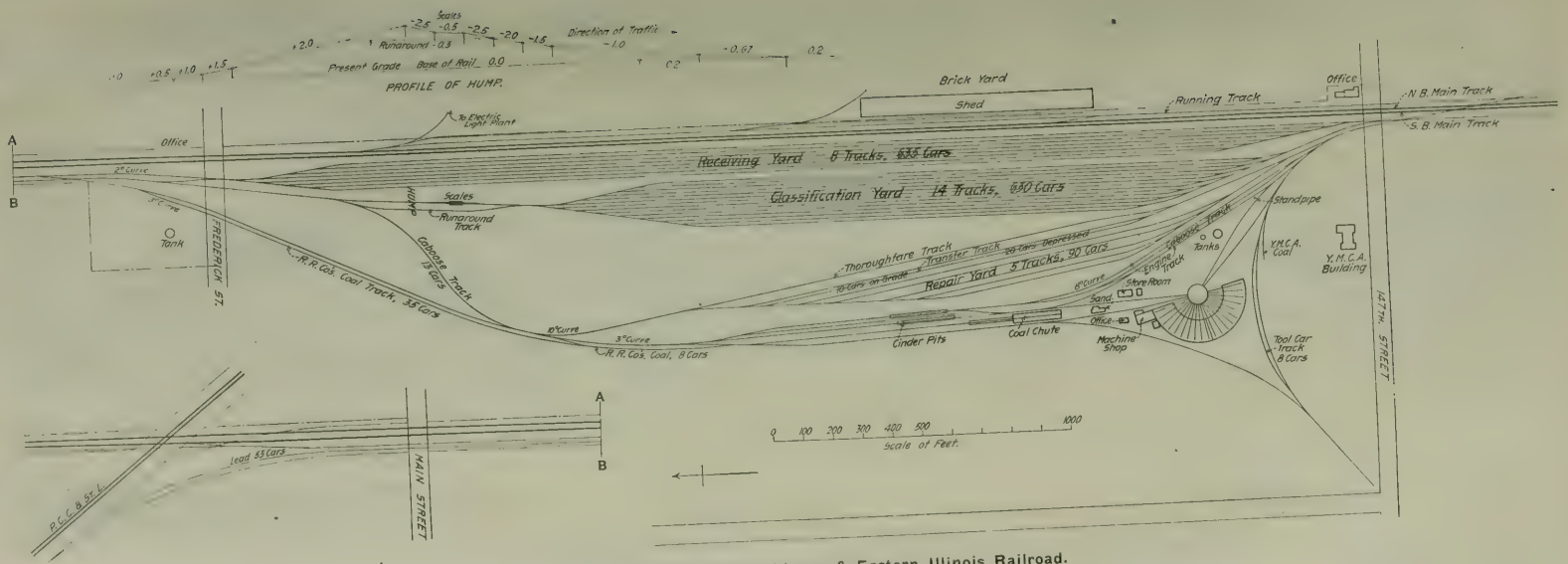
The northbound yard, when completed in accordance with the ultimate plan, will have a capacity for about 3,200 cars. The present work includes all of the tracks shown in solid lines on the plan. The receiving yard will have an immediate capacity of 636 cars on ten tracks, with provision for adding four tracks, holding 188 cars. Passing over the hump, a profile of which is shown, the cars are distributed in a classification yard of 16 tracks, having a capacity for 607 cars. East of and parallel to this yard are two storage yards. Storage yard No. 1 has a capacity of 640 cars and storage yard No. 2 for 528 cars. Both of these yards and all of storage yard No. 3, except six tracks, will be completed by December 1st, making a total available storage capacity of 1,568 cars. These storage tracks are needed to provide for the large number of loaded coal cars which often accumulate. For at times there are several thousand on hand at this and the smaller yards which the company has in several parts of the city.

Two caboose and two set-out tracks for bad order cars are located just west of the main hump track with a connection to the receiving yard ladder just ahead of the hump lead. The receiving yard, as will be seen from the plan, is crossed midway by the Little Calumet river, the width of the stream at this point being about 200 ft. The initial crossing will be a pile trestle structure, having continuous caps on the bents for the ten tracks, the bents being placed 14 ft. on centers. A floor will be laid between the tracks. It is expected that ultimately an arched concrete bridge will replace this wooden structure.

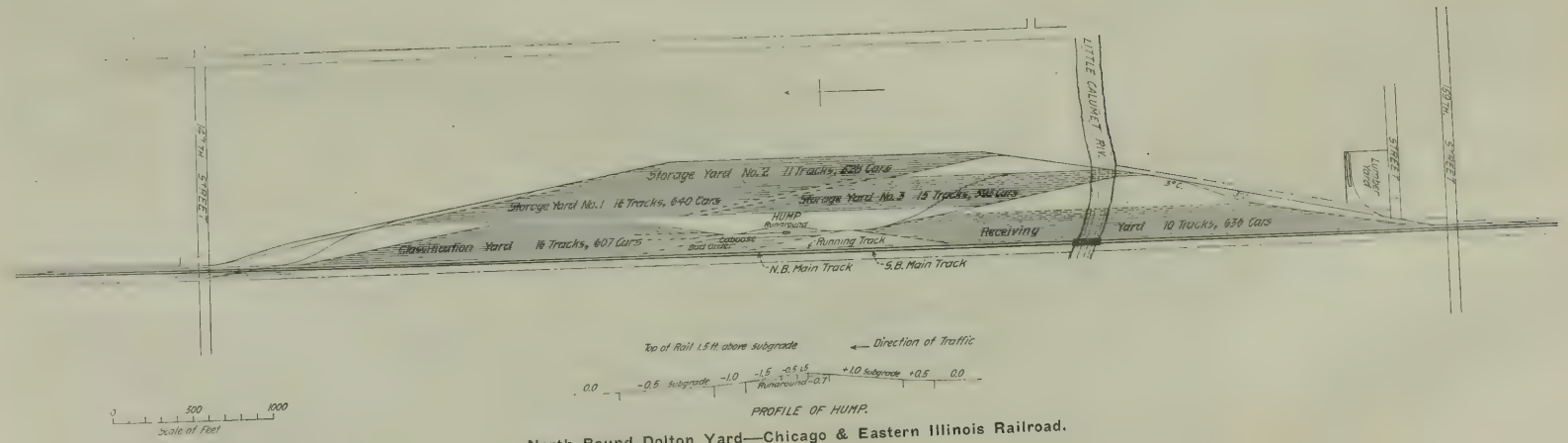
The southbound yard represents an adaptation of requirements to fit existing conditions. The land on which it is to be located was the site of the old yards, and, although containing 120 acres, is not shaped for a gravity yard plan as in the case of the northbound yard. This southbound yard will have as the larger part of its business the handling of empty coal cars to be returned to the mines. The receiving yard has a capacity of 635 cars, apportioned to eight tracks, the longest of which will hold 84 cars. The classification yard adjoins the receiving yard, the hump being at the north end. This yard has 14 tracks, which hold 630 cars. The repair yard is west of this and adjoining the latter are the locomotive terminal facilities, which will remain practically the same as formerly, except for a few improvements.

On the west side of the main line, near the hump in the northbound yard, a Davidson water softening plant is being installed by the Otto Gas Engine Works. The water is taken from the Little Calumet river, which is quite close to this point. The two tanks of the softening plant have a capacity of 85,000 gals. each, and the treated water is pumped to two service tanks of 100,000 gals. and one tank of 75,000 gals. capacity, the two former being located in the southbound yard and the latter in the northbound yard.

The machine shop annex of the roundhouse is to be enlarged somewhat to provide for increased boiler capacity and make room



South Bound Dolton Yard—Chicago & Eastern Illinois Railroad.



North Bound Dolton Yard—Chicago & Eastern Illinois Railroad.

series arc-lights and 350 16-c.p. incandescents; the latter will take current from the arc circuit through transformers. The electric plant will have a capacity for a 20 per cent. increase in this load.

The terminal headquarters will be in a building adjacent to the northbound hump. For the present, all switches will be manually operated. The mileage of the yards when finally completed will be in excess of 30 miles, and their capacity 4,550 cars. The grading for the two yards amounted to upwards 111,000 cu. yds., and almost all of the material used in the construction is new. The switching leads are of 85-lb. steel throughout and the remaining rail is of 70-lb.

The plans were prepared under the direction of Mr. W. S. Dawley, Engineer Maintenance of Way: Messrs. R. Y. Maxen, R. H. Howard and M. Hoffman assisting. Mr. Percy Jones is resident engineer in charge of the work.

Disastrous Wreck on the Manhattan Elevated.

On the morning of Monday, September 11, about 7 o'clock, a southbound passenger train on the Manhattan Elevated Railroad, New York City, was derailed at a sharp curve at Fifty-third street and Ninth avenue, in consequence of running through the curve at high speed, and the second car of the train was overturned and fell to the street below, about 15 feet. The car was packed with passengers, probably from 75 to 100 men and women, and a few children, and eight persons were killed in the fall. Four others died within a few hours, and there were 50 or more injuries besides these, some of them probably fatal.

The conductor of the train, riding on the forward platform of the second car, escaped. The motorman also escaped, and absconded. The third car was thrown part way off the structure and struck the dwelling house at the corner of Ninth avenue and Fifty-third street; and most of its occupants got out by crawling into this dwelling, through a second-story window. The roof of the second car was ruptured, as the car fell over, and some of the victims fell out of the opening and to the ground in advance of the car and were crushed by it. The first car of the train, a motor, and heavier than the second and third, was not derailed.

What are called the Sixth avenue and the Ninth avenue lines of the Manhattan Elevated Railway (operated by the Interborough Rapid Transit Company) are one and the same line from the northern terminus at 155th street southward to Fifty-third street. Here Sixth avenue trains turn eastward through a curve of 125 ft. radius. Disk signals 50 ft. back, and 500 ft. back, indicate the position of the switch. The train which was wrecked was bound for Ninth avenue, and as the Ninth avenue line is straight at the junction no reduction of speed is necessary; but the switch was set for the Sixth avenue line, and the motorman, disregarding the indication of the signal, went on as though his route were clear. It is said that the speed was 20 or 25 miles an hour. The signalman says that the indicators on the top of the front car of the train indicated a Sixth avenue train, and he set the switch accordingly. Immediately after the accident these indicators were found set to show Ninth avenue. To change them from one position to the other is but the work of a moment, the disks being turned by a handle projecting downward through the hood over the platform of the car.

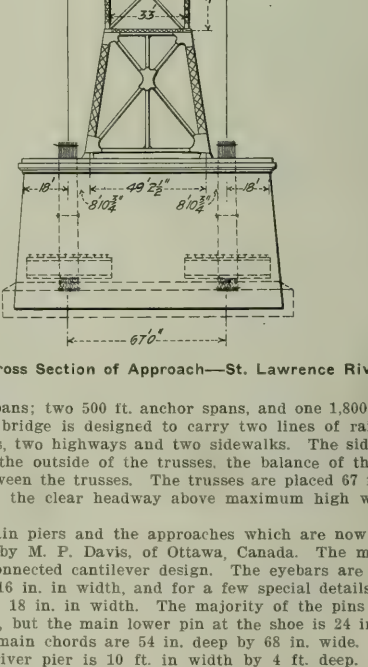
It is said that two or three men (passengers) riding in the first car noticed the motorman's error, before he passed the stop signal, and shouted to him. Stories are printed to the effect that the motorman claimed that the switch was turned immediately in front of him, too late to permit him to stop, but these are as yet unverified.

The following details of the accident are taken from the report of the New York *Sun*: The racket was fiendish. The wheels of the second car jammed over on to the third rail. This caused an explosion and a flash of electric flames which shot up past the windows of the toppling car and dazzled people blocks away. The men and women who filled the train screamed helplessly. Those in the second car, which was turning over, were silent for two or three heartbeats; then, realizing their situation, they shrieked horribly until their cries were drowned by the wrenching and clangor of resounding steel and the rending of woodwork and the clatter of splintering glass. Things happened faster than it is possible to tell them. The second car, whose passengers were doomed, nearly all of them, to death or maiming, turned over slowly and was thrust straight out above the street. The car was twisted and battered and rent by the strain and went all to pieces in the air, so that men and women came dropping down out of it like seeds from a bursting pod. So sudden had the catastrophe been that some of them clutched newspapers in both hands as they plunged. The roof of the car was undermost. It split and broke in ten places, and whenever it buckled and gaped people fell through the holes. Some cried aloud and some were silent. Slowly the wrenched wreck of a car tipped over until one end of it hit the Fifty-third street sidewalk. Then it ran into itself, crumpling itself together into a mass of kindling wood, with a score of people writhing and striking out through the chaos. The electricity of the third rail kept flaring up.

The St. Lawrence River Bridge at Quebec, Canada.

The St. Lawrence River bridge, which is being built for the Quebec Bridge & Railway Co. by the Phœnix Bridge Co., Phœnixville, Pa., and of which a brief description was given in the *Railroad Gazette* Dec. 2, 1904, is to cross the St. Lawrence River about six miles above Quebec, Canada, and about 165 miles below the city of Montreal, and some 800 miles from the sea. There is no bridge over the St. Lawrence between Montreal and Quebec, nor is there any suitable location for a bridge structure immediately below the city of Quebec, as the St. Lawrence widens out to such an extent as to make it impossible to bridge the river below that city. This bridge which is now under construction at Quebec will therefore be the only crossing of the river for a distance of about 160 miles, and will be of increasing value in serving the population on each side of the river, and it will be the only means of crossing the river by railroad and highway traffic. The bridge, upon its completion, will make it possible to transfer business between the Great Northern Railway of Canada, The Quebec & Lake St. John R. R. and the Canadian Pacific on the north side of the river, and the Grand Trunk R. R., Intercolonial R. R. and the Quebec Central Ry. on the south side of the river. The new Grand Trunk Pacific Transcontinental Line is planned to cross this bridge.

The bridge proper consists of two 210 ft. pin connected deck

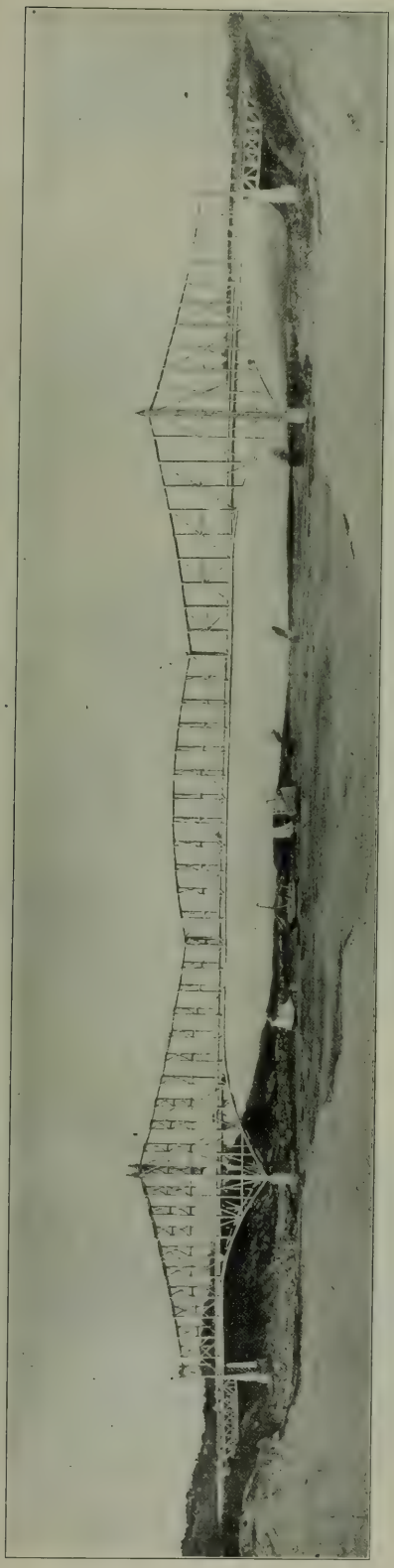


Pier and Cross Section of Approach—St. Lawrence River Bridge.

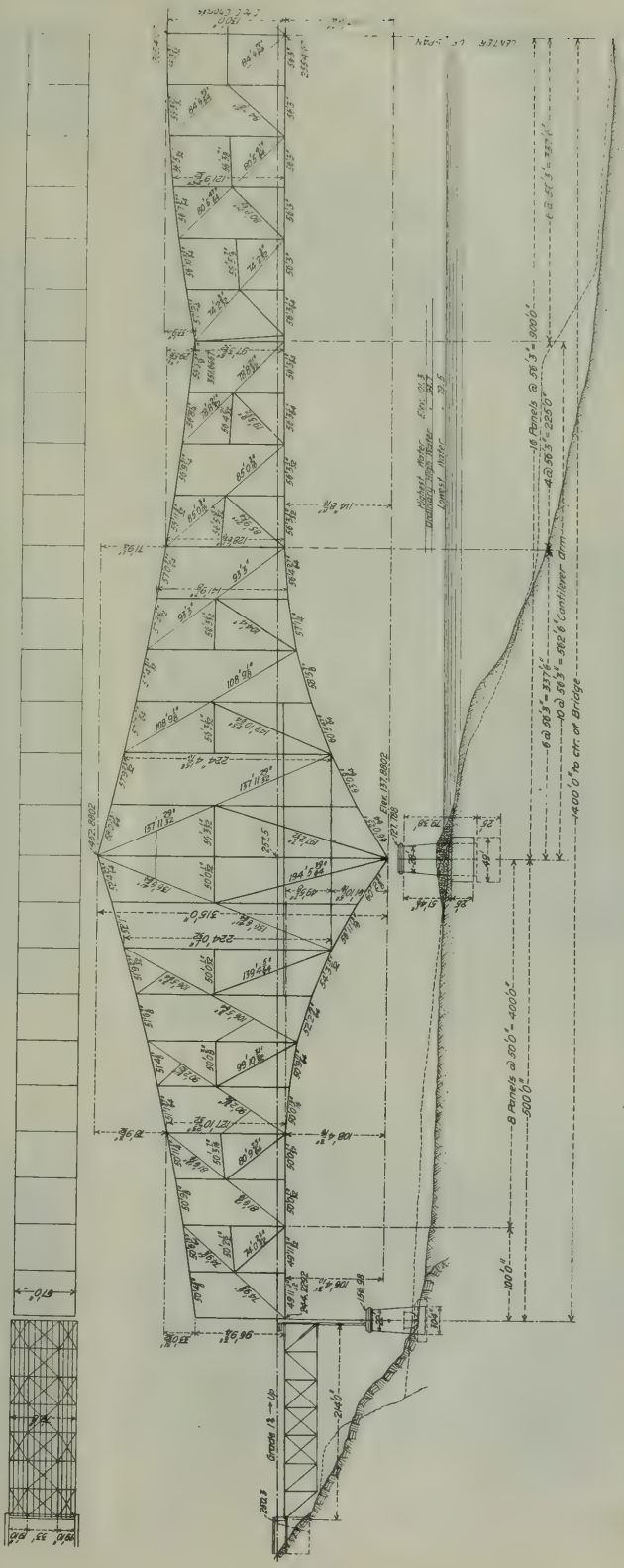
approach spans; two 500 ft. anchor spans, and one 1,800 ft. central span. The bridge is designed to carry two lines of railroad, two trolley lines, two highways and two sidewalks. The sidewalks are carried on the outside of the trusses, the balance of the traffic is carried between the trusses. The trusses are placed 67 ft. between centers and the clear headway above maximum high water mark is 150 ft.

The main piers and the approaches which are now completed were built by M. P. Davis, of Ottawa, Canada. The main bridge is of pin connected cantilever design. The eyebars are in general 15 in. and 16 in. in width, and for a few special details they will probably be 18 in. in width. The majority of the pins are 12 in. in diameter, but the main lower pin at the shoe is 24 in. in diameter. The main chords are 54 in. deep by 68 in. wide. The main post over river pier is 10 ft. in width by 4 ft. deep. The main intermediate posts are from 40 in. to 48 in. in width, and the main plate floor-beams are 10 ft. deep. The suspended span is 675 ft. long and 130 ft. deep at the center. The general outline of the main span, giving the heights at various panel points and other information is shown in the accompanying line drawings.

The main shoes and pedestals are of built up wrought steel girders, no castings being used in the entire construction. The falsework under anchor arm consists of two main parts. The central

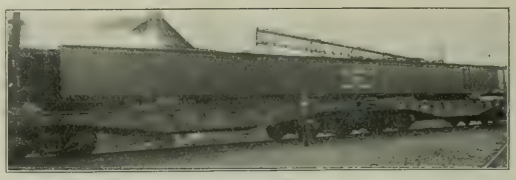


General Elevation of St. Lawrence River Bridge at Quebec.



Half Elevation of the St. Lawrence Bridge, Showing General Dimensions.

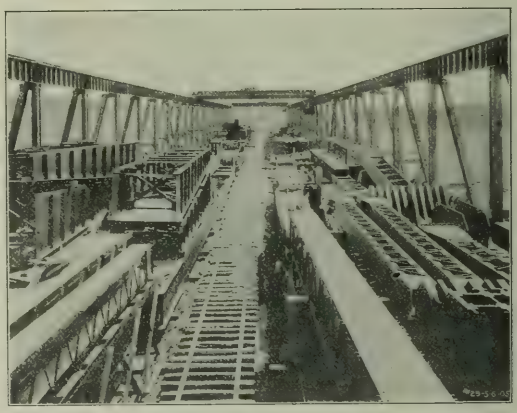
Showing False Work, South Anchor Arm, Main Traveler and Falsework Traveler.



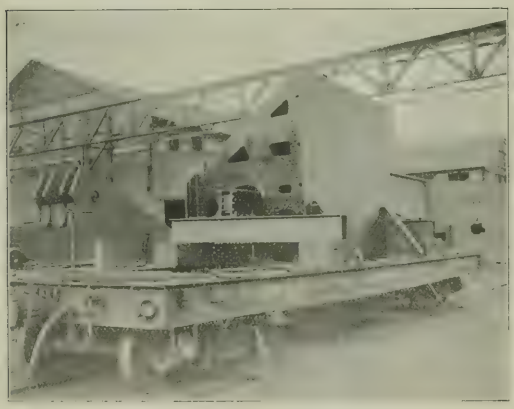
Intermediate Section of Main Post Ready for Shipment—Weight 24 Tons; Length 66 ft.; Width 10 ft.; Depth 4 ft.

Bottom Section of Main Post—Weight 70 Tons; Length 54 ft.; Width 10 ft.; Depth 4 ft.

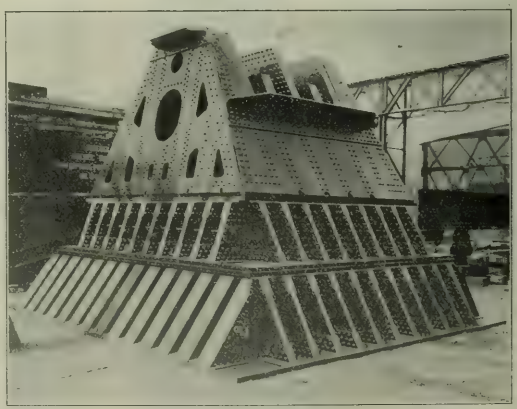
Top of Main Intermediate Post—Weight 63 Tons; Length 54 ft.; Width 4 ft.; Depth 4 ft.



Storage Yard South Side of Bridge—Length 750 ft.; Width 70 ft.; Two Electric Cranes, Each of 75-Tons Capacity.



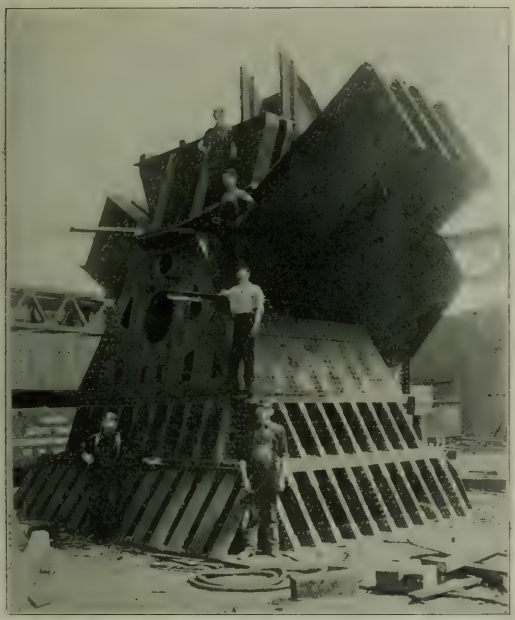
Main Shoe on Car Ready for Shipment—Weight 78 Tons.



Main Shoe and Upper and Lower Pedestals—Total Weight 199 Tons.

portion of the falsework is of wood, upon which the floor of the bridge is supported, and on which the materials are delivered to the traveler. The outer portion of the falsework is of steel, in groups of four columns at each panel point, thoroughly braced in all directions, and at the top each group has a metal platform to receive the lower chords of the bridge. This outer steel falsework also carries the metal girders upon which the steel traveler runs—this steel traveler being what is known as an outside traveler, enveloping the entire structure. The traveler is served by four electric hoists, two drums and four winches in each hoist, and designed to handle readily the heaviest pieces of 105 tons. The traveler has a base of 100 ft. and is 215 ft. high, with an over-reach of 66 ft. For the erection of the cantilever and suspended span the traveler is supported upon steel bents resting on temporary box girders, supported at panel points from the main pins of the bridge. The material is received from the shops at Phœnixville, Pa., in a storage yard near the end of the bridge, which storage yard is about 750 ft. long and served by two 70-ft. electric cranes. From this storage yard the material is run on cars at grade directly to the bridge underneath the main traveler.

Immediately upon the completion of the railroad approach, during July, 1905, the rigging of the main traveler was completed and the actual erection of the permanent metal began on July 22. On



Main Shoe and Connections Over Pier—Weight of Each Part as Follows: Pedestals, Upper 95,000 lbs.; Lower 155,000 lbs.; Shoe 148,000 lbs.; Center Chord 102,000 lbs.; Main Shoe 57,000 lbs.; Total About 557,000 lbs.

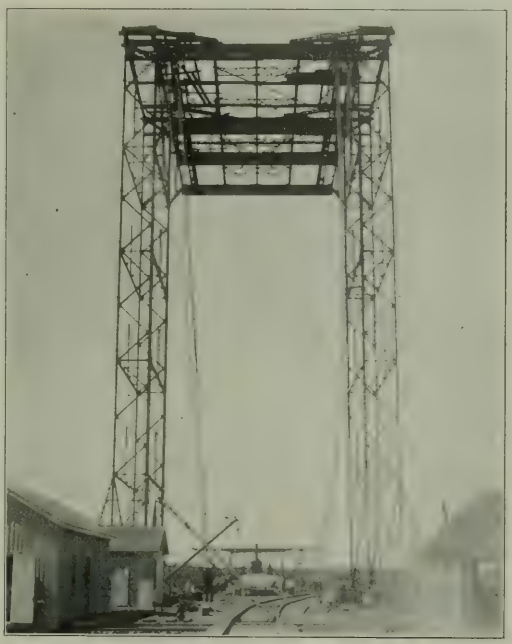
Sept. 1, 1905, the main anchorage bent on the south side of the bridge, all the lower chords and bracing of the south anchor arm, main pedestals, shoes, etc., over main pier, were in place, and the erection of truss web members will be started at the anchorage end early in September. The work of erection will have to be suspended during the winter months, probably about November 15th to April 15th. The general appearance of the bridge when completed is shown in the accompanying half-tone, which was made from photograph of paper model. The central span of this bridge is the largest span in the world, exceeding the Firth of Forth span by 90 ft. There were no precedents to follow in its design and its construction taxed the maximum capacity of the mills, shops, and the railroads in its transportation.

The management of the Alsace-Lorraine railroads, which has been discouraging the use of alcoholic drinks by its employees while on duty, noticed that at the picnics and other gatherings of railroad men and their families, some of them seemed inclined to make up for lost time; while often on such occasions there was nothing but beer to drink. It has recently made arrangements by which at such festivals a supply of coffee, milk, lemonade and aërated waters are to be had at prices which would ruin any brewer. How much the consumption of beer has been reduced we are not informed.

Automatic Block Signals on Single Track.*

Many plans have been adopted to abolish or reduce delays on single track lines. One way is to use Form 19 for train orders for inferior trains; another is to omit the engineman's signature to "31" orders; a third is to use Form 19 for all trains; and a fourth is to use the manual block system, keeping trains from four to six miles apart; but, if it is an absolute block, flagging becomes careless and a matter of form only. The movement of trains is slow; there is a busy day, and after a week of busy days the line is blocked. More enginemen are asked for; perhaps they are received; if they are, there are not enough men to man the engines for a great length of time; the men become worn out; overtime increases; cars are set out; yards are blocked, and the position of the superintendent is far from enviable, as he is always blamed when his division is blocked and freight is delayed.

Delays caused by train orders are varied and constant. The train despatchers refrain from giving time against passenger trains, knowing that the time will all be used up in getting the order delivered. The best that can be done is to have the conductor alone receive and sign for orders and get, for each engineman of his train, a clearance card showing the number of each order delivered with it. With Form 19 used for both trains, and



End View of Main Traveler.

a middle order at the meeting point, we have done the best we can with the cumbersome despatching system.

But for ten years the C., N. O. & T. P. has used automatic block signals; and by September 1 our entire line will be blocked. We estimate an increase of 30 per cent. in the capacity of the road as compared with the telegraph block system with sections four or five miles long. In that distance we now have three automatic blocks. Automatic signals should be placed so as to have a signal at each switch for a starting signal. The blocks should be from a mile to a mile and one-half in length, but never longer than a mile and a half. Greater efficiency can be had by staggering the signals. The setting point of the signals should be such as to make it impossible for two trains to enter a block simultaneously from opposite directions. The overlap should be so placed on grades as to give the advantage of protection to the down coming train, and be kept outside the switches of passing sidings. They should be marked plainly so that trainmen may become familiar with their location and know to which signal to send their flagman to bring trains through the block, in case of break-downs inside the overlap.

There has been some controversy as to delay to trains meeting at points inside of block limits. Our rule provides that when

*Abstract of a paper read before the Central Association of Railroad Officers by H. M. Waite, Superintendent of the Cincinnati, New Orleans, & Texas Pacific, and printed in the August *Proceedings* of the St. Louis Railway Club.

trains meet within the limits of a block the inferior train may pass the stop signal and proceed to the siding under control. This permits the despatcher to give the inferior train the best of a meeting point, so it will be in to clear and the superior train will receive a proceed signal. Each switch is supplied with a bell annunciator, which rings whenever the block is occupied, notifying trains in the siding that the block is occupied.

The setting point for each signal is placed 140 to 250 feet in advance of it, according to the kind of signal; this point is designated by a triangular cast-iron sign, marked "Electric Block Signal." As we operate normally clear, it gives the engineman an opportunity to see if the signal goes to the stop position before he passes it. Our passenger trains carry a speeder in the baggage car, and, when stopped by an automatic signal, it is immediately put on the track and the baggage master is sent ahead on the speeder with danger signals, thus greatly reducing the delay. Our block failures average fifteen to every one hundred thousand train movements.

I have said that flagging becomes a matter of form with the absolute block, and the question would naturally be asked, "How do you know that the men observe the automatic signal?" We know from experience and tests. Some time since we had an accident which proved that the men were not always respecting signals. After communicating with 20 of the best passenger and freight enginemen and conductors we tried surprise tests, notifying all the men what to expect. Automatic signals would be held in stop position, one and two torpedoes placed on the rail, burning fusees displayed and lights put out. Reports were made on a regular form for each test. If a man openly and grossly disobeyed the rules, ran past the block or fusees, he was dismissed. If he was slow in reducing speed, did not whistle out a flag or call it in promptly, he was taken out of service and sent to the "Train Rule Examiner" to be examined on the rules. This "Train Rule Examiner" examines all men for promotion, holds lectures on the rules three times each week, attends all investigations, and sees that all employees in the train service understand the rules.

With blocks one and one-half miles long, each semaphore signal installed costs $700, or $1,400 for a block of two home signals. The disc signals cost, installed, about $600 per signal, or $1,200 for a block of two home signals, and $2,250 for a block of two home and two distant signals. If the blocks are made one and one-half miles long, the semaphore will cost $900 per mile and the disc $800 per mile where two home signals are used.

The average cost of maintenance per signal per month for semaphores is $10.40; discs, $8.50. We use gravity battery on line and track; potash and storage on motors. Sixteen potash cells to each motor; four storage cells to each motor; four to 12 line cells to each signal, and four to eight track cells to each signal. Potash batteries are replenished every 18 months. All batteries are placed in concrete tubs under ground. Potash renewals cost 16 cells, $14.52; line batteries, 10 cells, $1.50; track battery, eight cells, $1.25.

Our Signal Department is organized as follows: A Superintendent of Signals, who has general supervision of the automatic signals, interlockings, telephones, etc., and the maintaining and establishing of all standards. He reports to the General Manager.

Each division has a Signal Engineer, who reports to the Division Superintendent. Under him are two foremen, one for each district, who have direct charge of all inspectors and gang foremen working on their respective districts. Each inspector has an average of 18 signals and eight to 12 miles of track.

The question is asked, "Is it worth the expense?" Unfortunately, we cannot say how many dollars the signals have actually saved—no one can; but considering the old stories of three collisions a day, and now none, and the actual experience of trains saved from collisions, etc., we believe the money is well spent; and we are spending more every day for new installations and improvements on the old.

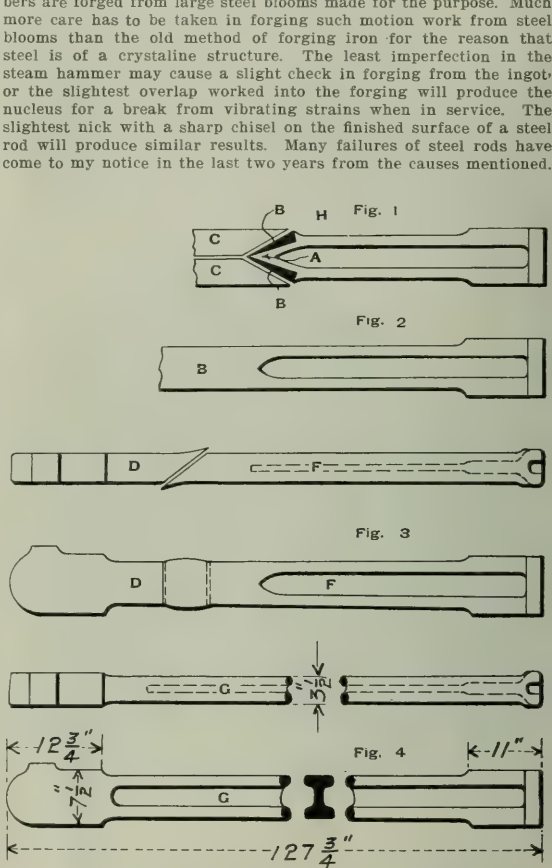
In some places we have the electric train staff, and for certain operations, gauntlets through tunnels or over bridges or between double tracks, it as near perfect for safety as can be had; but for high speed it is cumbersome, when it comes to picking up and delivering the staff. By means of rubber hose hoops we can pick up a staff at 40 miles per hour, and by a catcher on the engines of some of our fast trains we pick it up at 60 miles per hour; but for continuous blocking the staff would cause delays and is cumbersome. Train orders are not needed where you have the electric train staff. We operate the staff on a single track bridge over the Ohio river between two yards, with 100 train movements in 24 hours, and not a train order is sent; for such places it is unequaled.

The German and Austrian railroads have taken great interest in encouraging such employees as track watchmen and gatemen, who live on the right of way, to produce something which will help out their wages. Bee-keeping has been promoted, and fruit-growing; and now near Cologne they are told to raise poultry, and experts in that art are to be sent around to teach them how to do it to advantage.

Forging and Repairing Locomotive Motion Rods.*

In the past three or four years, what is known as low carbon steel has taken the place of iron in many cases to produce side and main rods as well as rod straps, consequently, the old method of forging and repairing these members, in a measure, has become obsolete and new methods have been adopted to meet the changed conditions.

We are all familiar with the old method of producing these members from the best quality of scrap material. The method of utilizing scrap steel, similar to the old method of using scrap iron, is not yet in evidence for producing such important members of the locomotive as side and connecting rods, straps, etc. These members are forged from large steel blooms made for the purpose. Much more care has to be taken in forging such motion work from steel blooms than the old method of forging iron for the reason that steel is of a crystaline structure. The least imperfection in the steam hammer may cause a slight check in forging from the ingot or the slightest overlap worked into the forging will produce the nucleus for a break from vibrating strains when in service. The slightest nick with a sharp chisel on the finished surface of a steel rod will produce similar results. Many failures of steel rods have come to my notice in the last two years from the causes mentioned.



Forging and Repairing Locomotive Side Rods.

Such defects may be produced in forging iron rods, as this material is a fibrous structure. The injury is not so pronounced as in steel, as one or two outside fibers are affected only, leaving the inside fiber intact, consequently the injury will not work its way into the metal to such an extent as it will with a metal of a crystaline structure.

Steel rods came in evidence in the Sacramento shops two or three years ago. During this period I have had to repair many steel rods. In many cases, on examination, a slight check would present itself on the rib of a grooved steel rod. If the rod is low in carbon and will stand a high heat, the slight defect is easily remedied by cutting out the defective portion and welding a piece of good iron in the cavity by taking separate heats. If properly done this will prevent the original fracture from working into the rod from vibrating strains. The method practiced by many smiths of putting in what is termed a "Dutchman," from my point of view, is a very bad practice. This method is accomplished by splitting the defective portion and driving a wedge of iron in the split, then taking a welding heat on the upper surface of the rod and wedge and hammering the wedge and welding the iron over the defect. This simply hides the defect. I recently had a rod cut where a defect was repaired by this method. The sections of the

*From a paper by S. Uren, read before the Cleveland meeting of the National Railroad Master Blacksmiths' Association, August, 1905.

rod showed the wedge in perfect shape, excepting a small portion of the surface.

We have many of these steel parallel rods coming into the shop with the defect so pronounced that it becomes necessary to cut the fractured portion off and put on a new end. Formerly the method practiced was to fill in the grooved portion of the rod with good iron, as well as the projecting ribs, continuing the iron portion about 8 in. from the broken section, then welding on the iron portions by the usual method of male and female scarfs. This method was not entirely satisfactory as we invariably found a slight defect on the surface of the grooved portion, when the groove was planed out of the repaired section.

Recently the Southern Pacific has been changing the heavy compound engines to simple engines. It became necessary to lengthen the main steel connecting rods; this is accomplished by welding on new ends. The original method as explained was not satisfactory. I adopted the method as shown in Figs. 1, 2, 3 and 4. We cut off the end that had to be renewed. The end of the old portion of the rod to be welded was upset with a battering-ram. Then by means of a steam hammer a point was formed on the end of the rod as shown at A, Fig. 1; this produces a round corner at H. To overcome this we raise a fillet at this point by cutting into the metal slightly and driving the metal back with a fuller, as shown. We then lay two pieces of iron, BB, on each side of the V shaped end of the rod, firmly welding them to the steel. Now we have the end of the rod shod with iron. By this method, the homogeneity of the different rods are discovered. Regarding carbon, the vibration is so pronounced that the same heat for welding on the two pieces B B, will not answer for different rods. This being accomplished, we have iron to iron welds and can get high heats without bringing the steel to an injurious heat. We now bring our two pieces, C C, to a welding heat in separate fires, welding them on to the surface B B, under the steam hammer. Another welding heat is now taken for the purpose of forming a perfect union of all of the parts as shown at B, Fig. 2. The remainder of the work is done by the ordinary method of lap welding under the steam hammer as shown at D F, Fig. 3. The portion D is forged by the steam hammer from the best scrap iron obtainable. The rod being finished as far as the forging is concerned goes to the machine shop to have the new iron portion finished and grooved as shown at G, Fig. 4. When the rod is being finished the slightest defect in the welded portion will be discovered.

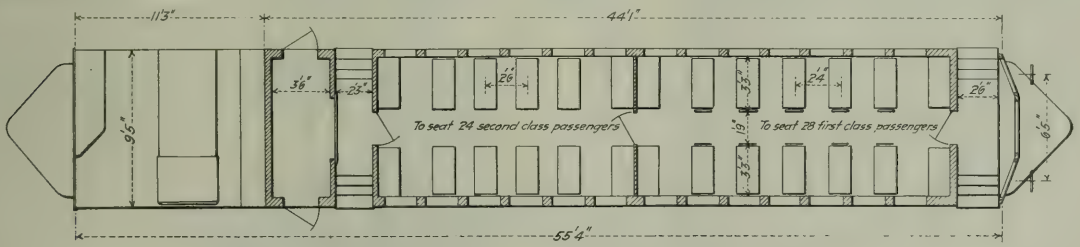
There have been 40 rods welded by the above method in the Southern Pacific shops in the last 18 months. A slight defect in the welded portion was found in one case only. Not a single rod has failed in service. Now we have the most important member of a locomotive two-thirds in low carbon steel and one-third in iron.

The question arises now as to which portion of the rod is best adapted to resist the combination strains which this important member is subjected to, such as vibrating and compression strains, jars and sudden shocks, often times the different strains acting at the same time. The writer claims that the iron portion is best adapted to resist the strains referred to as the iron has a fibrous structure and is not so apt to rupture from vibrating strains as low carbon steel with its crystaline structure, however, from laboratory tests I have had made from sections of hammered steel rods, I find a vast improvement regarding ductility from test made some years ago.

Steam Motor Coaches for the Buenos Ayres Great Southern

The Buenos Ayres Great Southern, which has a mileage of 2,481 miles of track, and ranks as one of the most important railroad systems in South America, has recently introduced into service around Buenos Ayres a number of steam motor coaches, one of which, designed and built by Messrs. Kerr, Stuart & Company, Limited, of Stoke-on-Trent, is illustrated in the accompanying photograph and line engraving. The front bogie carries the engine boiler with all connections complete, with the exception of the water tank, which is carried on the main frame of the coach behind the boiler. The bogie has been arranged so that it can be easily detached from the coach, when necessary to send the engine into the running shed. The cylinders are 9 in. in diameter by 15 in. stroke, and are placed outside the frames, driving one pair of wheels only. The pistons are of cast-iron, and each is fitted with two cast-iron packing rings. The wheels are 3 ft. 5 in. in diameter on the tread, the centers are of cast-iron with balance weights cast solid, and are fitted with rolled tires of Vickers "Australia" steel. The wheelbase of the motor bogie is 9 ft. 9 in. The axles are of Siemens mild steel, the journals being 6 in. by 9 in. The throttle-valve is of cast-iron with gun-metal double beat valve, and is worked from either end of the coach by means of a steel wire rope and pulley connections. The valve motion is of the "Walschært" type. The slide bars are of steel with one bar to each cylinder, 2¾ in. wide by 1¾ in. thick, fitted with gun-metal liners. The bogie frame is of solid steel plates, ⅞ in. thick, firmly stayed and bound together. The brake shoes are of cast-iron, one shoe to each wheel on the motor bogie, and are actuated by a steam arrangement, and can also be worked by a powerful hand screw operated from the cab. The boiler is of the locomotive tubular type, placed transversely on the bogie, and is made of the best mild steel plates; the shell plates are 7/16 in. thick, the smoke-box tube plates ⅝ in. thick. The longitudinal seam butt is jointed and riveted. The internal firebox is constructed of the best cop-

Steam Motor Coach for the Buenos Ayres Great Southern.



Floor Plan of Steam Motor Coach for the Buenos Ayres Great Southern.

per plates. The side sheets and crown sheet are $^{7}/_{16}$ in.; the tube plates are $^{11}/_{16}$ in. thick, and are stayed to the outer shell by copper stays $^{15}/_{16}$ in. in diameter and about 4 in. pitch, with the tell-tale holes at their centers drilled 1½ in. in each end. There are 150 solid drawn brass tubes of 1½ in. external diameter. The total heating surface is 336 sq. ft., and the working steam pressure is 160 lbs. per sq. in. The engine has been fitted complete with oiling apparatus, including a Wakefield's sight feed lubricator to the cylinders. There is a steam whistle actuated from either end of the coach. The boiler is fitted with two glass water gages with stop cocks and protectors, with steam pressure gages marked in lbs. per sq. in., and kilos per sq. c.m. Two combination injectors, with solid drawn copper pipes and rubber hose connections to the tank are provided. The cab is built of mild steel plates, with double roof, the inner roof being of teak. Sliding plate glass windows are provided in front, and there is also a louvre in the center as shown in the illustration. The cab is furnished with oil lamps for the water and steam gages. The vehicle is fitted with a steam turbine dynamo of 110 volts and the necessary switchboard.

The dynamo provides electric light for two headlights, two side lamps and for lamps for the engine compartment, as well as the lamps for lighting the interior of the coach. There are 11 lamps in all, each of 16 candle power. Both ends of the coach are fitted with a steel cow-catcher. The tank has a water capacity of 300 gallons, and there is a fuel space of 33 cu. ft. The tractive force, at three quarters "cut-off," amounts to 4,220 lbs. The interior of the coach is finished in polished oak paneling. The seats are turn-over upholstered seats. As shown in the illustration, the coaches are divided into two passenger compartments, having 24 seats in the second and 28 in the first class compartment; there is also a luggage and guard's compartment at the rear end.

The Chicago Freight Terminals of the Chicago & North-Western.

The Chicago & North-Western's problem in Chicago is to operate into the city three double-track through lines carrying more passenger trains daily than any other railroad into Chicago and at the same time to take care of a very large freight traffic which must be interchanged between these three lines, and the most comprehensive system of freight terminals in the city. In order to realize the seriousness of the problem it is worth noticing that against the three lines of the Chicago & North-Western there are only two other railroads, or three including the two Pennsylvania lines, the Pittsburg, Ft. Wayne & Chicago and the Pan Handle (operated separately), which have more than one through line into the city. These are the Illinois Central and the Chicago, Milwaukee & St. Paul. Having the largest needs, the North-Western is fortunate in possessing correspondingly large terminal facilities. According to an unofficial estimate the company owns about 320 miles of track within the city limits against something over 100 miles owned by the two Pennsylvania lines which together have the next largest trackage. On this basis the North-Western has more than twice as much track in Chicago as any other road. The *Railroad Gazette* is indebted for an inspection of the Chicago & North-Western freight terminals and the accompanying forms, maps and plans to Mr. W. D. Cantillon, General Superintendent; Mr. E. C. Carter, Chief Engineer; Mr. J. S. Robinson, Division Engineer; Mr. E. E. Betts, Car Service Agent, and particularly to Mr. R. H. Johnson, Trainmaster of Freight Terminals, to whose active and personal interest much of the information is due. A large number of others also whose names cannot because of their number be mentioned gave their time and hearty co-operation.

The accompanying map (Fig. 1) gives the general relation of the North-Western's lines into Chicago to each other and to the territory in and about the city. The Galena division runs due west from the Wells street passenger station to Omaha. The Milwaukee and Wisconsin divisions leave the Galena division in a four-track line just west of the Wells street station, the former to run north near the shore of the lake to Milwaukee and beyond to the northern peninsula of Michigan. The Wisconsin division, which leaves the Milwaukee division three miles out at Clybourn Junction, and runs to St. Paul and Minneapolis, forms roughly the bisector of the angle made by the other two. Though for operating purposes the Wisconsin and Milwaukee divisions are combined as the Wisconsin division, it will be simpler in describing the general terminal situation to consider them, as is done on the time cards issued to the public, as two separate divisions. The map also shows the cut-off south from Lake Bluff on the Milwaukee division, which was described in the *Railroad Gazette* of August 11, page 128. This is used to divert freight and through passenger traffic from the Milwaukee division at that point in order to relieve the Chicago end of the division on which is much the heaviest part of the North-Western's suburban business. This cut-off is also to be part of the new low-grade air line now building to a point near Milwaukee. This as described at that time is similarly to relieve the present Milwaukee division of much of its freight and through passenger traffic. Near the outside of the map is the Elgin, Joliet & Eastern, an outer belt line meeting the three divisions of the North-Western at West Chicago, Waukegan and Barrington respectively, with which considerable business is interchanged, relieving to that extent the crowded condition of the terminals in Chicago.

The other map (Fig. 2) shows the terminal situation more in detail. The territory embraced in the terminals includes the Milwaukee division to Central street station, North Evanston; the North Evanston-Mayfair cut-off, used for the same purpose as the Lake Bluff cut-off and the first step in the new line to Milwaukee; the Wisconsin division to a point beyond Mayfair; the freight connection between Mayfair (Hunting avenue) and the 40th avenue yards; the Galena division to Elmhurst (shown in Fig. 1) 16 miles due west of the Wells street station and 11 miles west of 40th avenue, and all territory included in or south of these lines. This includes 51 miles of double main track and is all under the direct authority of the Trainmaster of Freight Terminals, who ranks as a Superintendent. The yards in the terminal territory average in capacity from 50 (40 ft.) cars at some of the suburban stations between Clybourn Junction and Evanston on the Milwaukee division to 1,800 cars at 16th street, 2,000 at Western avenue, 2,000 in the new yard now building at Melrose Park just east of Elmhurst on the Galena division, 2,200 at Wood street, and 5,000 cars at 40th avenue. With the completion of this year's work on the new Melrose Park yard the terminals will have a total yard capacity of about 15,500 cars. The 51 miles of main double track in the terminals includes nine miles of three-track, three miles of four-track, two miles of five-track and three miles of six-track. There are also 144 miles

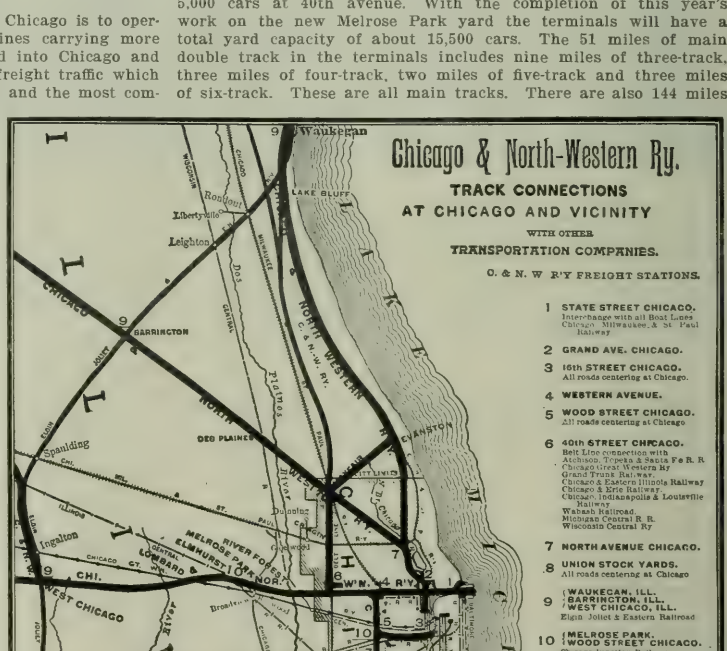


Fig. 1—Chicago Terminal Territory; Chicago & North-Western.

of yard track and 21 miles of private track. The number of actual cars handled in and out of the city each month is from 170,000 to 175,000 cars, or a total of from 340,000 to 350,000 car movements. In the month of June there were 349,000 car movements.

The principal freight houses are at State street, Grand avenue, Wood street and 16th street. The State street house receives from and ships to the Galena division, and the Grand avenue house, from the other two divisions. Wood street is a transfer freight house

for freight to and from connecting lines delivered in cars, and Sixteenth street for connecting line freight for the North-Western delivered by teams. The mixed freight (except perishable) from the road for connecting lines received at Wood street is there distributed into the proper foreign cars. Practically the only freight for Chicago received at either Wood street or Sixteenth street is in carload lots for delivery on near-by team tracks.

In addition to the four freight houses mentioned, the North-Western has Chicago freight stations at North avenue, 40th street, Deering, Cragin, and the Union Stock Yards. These handle car load freight only, which is delivered on team or industry tracks, there being for instance in the North avenue district, which covers the territory about Clybourn Junction, five team-track yards and over 70 industries, 40 of which have private tracks. Included in the Chicago terminals of the North-Western are a total of over 360 industries, 223 of which have their own industry tracks. Including the 108 industries in the Union Stock Yards district to which the North-Western has trackage rights from Wood street over the Chicago

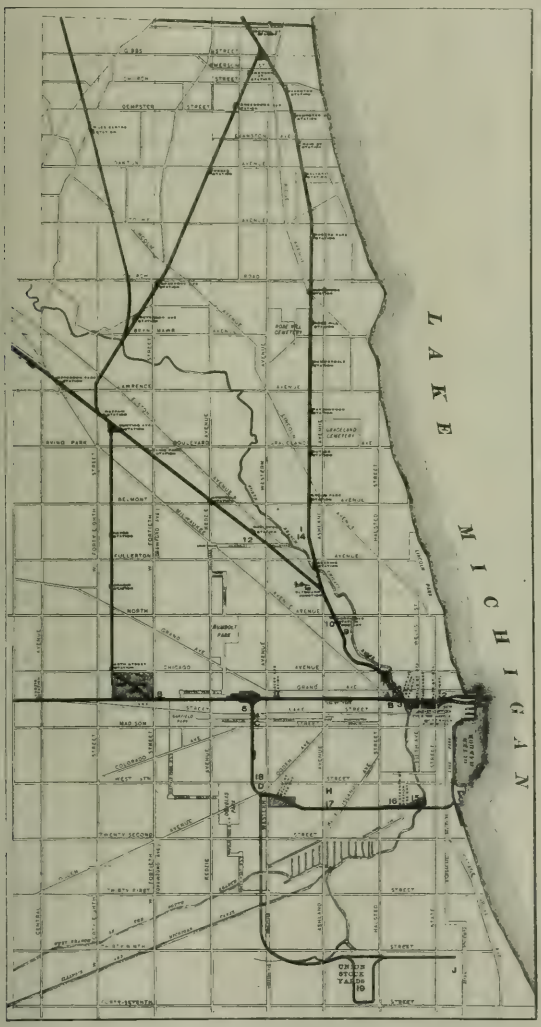


Fig. 2—Location of Terminal Facilities of the Chicago & North-Western at Chicago and Vicinity.

Junction Railway, there are 468 industries on the North-Western's Chicago terminal, 331 of which are reached by direct track connection. Some of these are reached exclusively by the North-Western; the traffic from others is divided with other roads. This is sometimes done on an agreed basis, as at Deering, where the large traffic originating at the works of the International Harvester Company at that point goes for six months of the year to the North-Western and for the other six months to the Chicago, Milwaukee & St. Paul. For each industry a switching report (Fig. 3) is made out each day for the information of the agent in the district, showing the cars removed from and switched to each industry track.

At the Union Stock Yards the North-Western handled during 1904 more of the live stock traffic into Chicago than any other road. In that year the total receipts at Chicago were 286,873 cars of live stock. Of these the North-Western brought 62,601 cars, the largest number for any single road. Its heaviest month's traffic was during February, when 6,526 cars were handled to the stock yards. The heaviest day's traffic was over 800 cars. During the year 42,032 head of cattle were handled by the North-Western out of Chicago.

The State street district is divided into two parts, one west and the other east of the north branch of the Chicago river. Each district contains about 50 industries. West of the river there is a connection with the Chicago, Milwaukee & St. Paul. The section east of the river is east of the Wells street station and takes in the docks near the mouth of the Chicago river and the factories and warehouses on North Pier. About a third of a mile east of the station are the inbound and outbound freight houses. At the "in" freight house is received all less-than-car-load freight from the Galena division. From the other divisions such freight comes only for trans-shipment to lake steamers. All lake traffic in both directions is handled at State street, and this is the only l. c. l. freight which comes to or goes out from State street to the Wisconsin and Milwaukee divisions. Perishable freight from the Galena division destined for other railroads comes to State street and is at once loaded on teams and carried across the city to connections, the whole process of trans-shipment sometimes taking no more than an hour. Perishable goods are the only sort of l. c. l. freight for connecting lines from the road, which do not go to Wood street for transfer. In order to have the least possible delay, such freight is carried into the center of the city at State street and, from the other two divisions, to Grand avenue, where the transfer can be made in the shortest possible time.

The State street "out" freight house loads cars for all points on the North-Western Line, large deliveries in l. c. l. lots being made at the house daily by teams. Five tracks of 18 cars each are loaded at a time. Each five cars opposite each other are called a "run" and are in charge of a stevedore, who is entirely responsible for correct loading. To make his responsibility complete, freight is not wheeled into the cars by the truckers. They leave the loaded trucks on the freight house platform just outside the door of the first car in the run. Then as the stevedore takes each piece of freight into the car himself, all mistakes in loading can be traced directly to him. It is also his business to examine each piece of freight for its actual destination instead of depending on the marker's chalk marks which are intended solely for the direction of the trucker. For instance, if his run were number 4 (i.e., the five cars each of which is fourth on its track) and the car on the third track were a straight car for Minnesota Transfer, he must be sure that each piece of freight that goes into that car is really destined for points on connecting lines beyond St. Paul and Minneapolis and not simply that it is marked "3-4" (third car on fourth track).

West of the Chicago river and just north of the junction of the Wisconsin and Milwaukee divisions with the Galena division are the Grand avenue freight houses and team tracks. Grand avenue is the regular freight terminus of the Wisconsin and Milwaukee divisions just as State street is of the Galena division, no freight from the Galena division going to Grand avenue except car load freight destined for some of the industries in that district. Grand avenue is a large receiving point for potatoes and for butter and cheese. During the four months, June to September, there is an average of about 400,000 lbs. of butter and 250,000 lbs. of cheese received there daily, as much as 560,000 lbs. of butter or 300,000 lbs. of cheese being sometimes received in one day. In this district of the North-Western's terminal there are about 70 adjacent industries.

Time freight trains of l. c. l. merchandise are loaded at Grand avenue for the Wisconsin and Milwaukee divisions. On one of these trains, No. 287, the Iron Range Time Freight, for the Milwaukee division, loading goes on until 6 p.m. The train leaves at 6.38, which does not give time for making up the complete waybills covering each shipment. In order not to delay the train, card or slip waybills are made out for each car and given to the conductor before starting. The regular waybills when ready are forwarded by passenger trains so that each will overtake the car at the proper station or junction point. All Milwaukee division through freight trains from Grand avenue run via Clybourn Junction and the Wisconsin division to Mayfair, and thence north to Milwaukee by the Lake Bluff cut-off.

At Wood street the Chicago & North-Western interchanges mixed car-load freight both ways with all roads entering Chicago, and straight car load freight both ways with the following roads: Baltimore & Ohio; Chicago & Alton; Chicago, Burlington & Quincy; Chicago, Rock Island & Pacific; Illinois Central; Lake Shore & Michigan Southern; Michigan Central (perishable shipments only); New York, Chicago & St. Louis; Pittsburg, Ft. Wayne & Chicago;

Pan Handle (P., C., C. & St. L.), and Pere Marquette. These are the roads with which car-load interchange is regularly at Wood street instead of via the Belt Railway of Chicago at 40th avenue.

There is, however, through the Chicago Junction and the Chicago Terminal Transfer connection at Wood street with all roads entering Chicago. The Illinois Central, Michigan Central and other roads east of Wood street send freight here over the St. Charles Air Line, a one-mile connecting road running east from the North-Western's tracks at 16th street to the Illinois Central yards. This is owned jointly by the Chicago & North-Western, Chicago, Burlington & Quincy, Illinois Central and Michigan Central. Its use is free to all adjoining roads when delivering to or receiving from one of the owning roads. But on strictly private business such as switching cars to industries on the St. Charles Air Line, there is a charge for trackage for both cars and engine.

New York, Boston, Philadelphia, West Albany Transfer, Buffalo, Cleveland, Pittsburg, Alliance, Columbus, Ft. Wayne Transfer, the Erie Despatch, Lackawanna Despatch and Merchants Despatch Transportation Co. are among the eastern points and fast freight lines which load straight cars for Wood street. These cars must contain nothing but freight for points beyond Chicago on or via the Chicago & North-Western. A mixed car, for instance, containing merchandise, part for some point on the Chicago & North-Western, the rest for Grand avenue or State street, Chicago, would be returned to the connecting line for proper loading. Straight cars from connecting lines are switched at Wood street to the proper westbound track for handling by transfer trains. Foreign cars of

CHICAGO & NORTH WESTERN RY. CO.

Industrial Switching Report.

_____ 190__

TO THE GENERAL YARDMASTER:

The track of _____

_____

WAS switched at _____ *o'clock this* _____ *M. and the following cars removed and placed.*

CARS REMOVED		CARS PLACED	
INITIALS	NUMBERS	INITIALS	NUMBERS

_____

FOREMAN

This report must be made by Engine Foreman for every industry switched.

Fig. 3—Industrial Switching Report.

mixed freight are run into the freight house from the east end on a track running through the center of the house. They are then unloaded and their freight reloaded into cars for the road, those for the Galena division being on the four tracks at the north side of the freight house and those for the Wisconsin and Milwaukee divisions on the four tracks at the south side. As the front cars in the house are emptied, the whole line is pulled through, the empty cars detached at the north end of the line and the whole process gone over again. If it is necessary to unload more connecting line cars at once than the number which this track inside the freight house will hold, extra cars may be unloaded at the south end of the house, where there is a platform 30 cars long. About 125 cars of such mixed merchandise freight are received daily from connecting lines. Some 60 or 70 of these cars are daily sent back to their home roads after having been loaded with connecting line freight which comes in in mixed cars from points on the North-Western Line. These mixed cars from the road are unloaded on platforms at the east end of the house.

Foreign cars are handled by means of form 55 A (Fig. 4), which was adopted July 1. It is a green slip and is used for all foreign car movements, loaded or empty, except as explained on its face. The space at the top marked "Symbol" is used in connection with the Chicago & North-Western's time freight system, which was described in detail in the *Railroad Gazette* of September 1, page 208; the letter designates the station from which the car is forwarded, and the number shows the consecutive number of the car from that station. The first spaces in the body of the slip are for directing the movement of an empty foreign car. If, for instance, a firm in Milwaukee wires the car service agent for a car to be loaded to Cincinnati via the Pan Handle, the car service agent, through men specially detailed to keep track of empty foreign cars for this purpose, sends the first empty Pennsylvania car that is available to the Milwaukee firm. To do this the card would be filled out "From Wood street to Milwaukee." "Empty movement authorized by E. E. Betts, Car Service Agent." Under the word "Penalty" is recorded the date on which the $1 a day car service payment will begin, the date on which the car was received, at what junction point and from what road. Under the head "Send Home" is recorded the road and junction point to which the car should be returned, which is, unless otherwise ordered by the car service agent, the same road and place as that from which the car was received, it being the general rule to return cars to the road from which they are received and at the same point at which they came on to the line.

55A SYMBOL { LETTER / NUMBER

Chicago & North Western Railway Co.

FOREIGN CAR,
Home Route and Record Card.

(This Space to be used for the Movement of an Empty Foreign Car.)

FROM

TO

(Empty Movement Authorized by)

Car Initials_____ Car No.

PENALTY

Will begin _____ 190

Received from _____ R. R.

At _____ Station

Date _____ 190

SEND HOME

To _____ R. R.

At _____ Statio

REMARKS

INSTRUCTIONS.

A card of this form must be completely filled in by Agent for each Foreign Car received, loaded or empty, from other roads, which the Agent will deliver to Conductor who moves car from his station. If a loaded car, the card must be attached to and put with the way-bills covering same, and the card must accompany car, loaded or empty, until it passes off this line.

When a car is delivered to connecting line Agent will take up this card.

When a car is received in "return" movement, the Agent will make a new card, showing the date (30 days after date of receipt) when Penalty will begin; the R. R. from which it is returned, station and date, and must ascertain from his record and fill in under the head of "Send Home" the original "Home Route" as was shown by the old card, giving the R. R. and station from which it was originally received.

Conductors will not move a Foreign Car, loaded or empty, unless accompanied by this card, except in handling Foreign Cars to or from Non-Agency stations, in which case they must deliver to or receive from the Agent who makes billing for such Non-Agency station, a card of this form to cover.

A Foreign Car belonging to a road with which we have direct connection should be returned to that road at nearest junction point, provided such routing does not involve additional mileage.

THIS CARD DOES NOT AUTHORIZE EMPTY MOVEMENT. SUCH MOVEMENT WILL BE DIRECTED BY THE SUPERINTENDENT, CHIEF TRAIN DISPATCHER OR CAR SERVICE AGENT.

NOTE.—These rules will not apply to such Refrigerators and other cars as are assigned to this Company from time to time, due notice of which will be given.

E. E. BETTS, Car Service Agent.

Fig. 4—Record Card, Foreign Cars.

The accompanying loading plan (Fig. 5) shows the arrangement of cars loaded for the road at Wood street. Each number space represents a car. Runs 1 to and including 14 on tracks 1 to 4 inclusive are on the north side of the house and are cars for points on or via the Galena division. Runs 16 to 31 are on the south side of the house and are cars for the Wisconsin and Milwaukee divisions. As will be seen from the chart, most of the cars are way or "peddler" cars which run on through trains to the beginning of their respective territories and over their territories on way freight trains. On these cars it is, of course, important that freight for the first station in the peddling territory be loaded next the door. Straight cars on the other hand such as the one for Elgin, Run 6, Track 1, or the nine for points west of Omaha, Run 1 to 9, Track 4, are loaded with no care for any special arrangement inside the cars. The "runs" are the same as at State street

but instead of marking with chalk on a box of freight destined for Elgin, "6-1," as would be done there, the trucker is given a ticket (Fig. 6) which would be filled out in this case: Run No. 6, Box No. 21. In each car is hung on a nail a tin box with a number on it. The box in the Elgin car is box No. 21, because counting from the first car on the first track and across and so on down it is the 21st of the Galena division cars. Similarly Run 17, Box 67, is a way car from Oshkosh to Neenah over the Wisconsin division, and is the second car on the third track south of the house and, counting in the way described, the 67th car from the first car on the first track of the Galena division.

The unloading of each foreign car on the track in the center of the house is done by a gang of seven men, a checker, caller and five truckers. The checker makes out a ticket for each piece of freight as it is brought out of the car. This the trucker takes along with him and drops into the box of the designated car when he deposits the freight in that car. Before the train leaves for the road, an inspector goes into each car and examines all tickets in order to see that there are none in any box except those which belong there. There is a stevedore for each "run" who, although comes from the cars and each set of truckers has exactly the same chance.

The 103 cars designated on the loading chart are the very least number of cars for the road which are loaded in any one day. The average at Wood street is about 130 cars per day. The extra cars not designated on the chart (most of which are usually "straight" cars, for instance extra cars for San Francisco or Minnesota Transfer) are set for loading on the tracks in places represented by the blank spaces on the chart or on available tracks at the east end of the freight house.

For computing train tonnage it is necessary to know the weight of the loaded cars. There is not time to make this up from the waybills and mark it on each car before leaving. It is necessary, therefore, to get a working average for the weight of a loaded car. In order to do this a record is kept each month of the weight of all cars loaded at Wood street and the average weight computed at the end of the month. This is used as a unit figure during the following month. For instance, during July the average weight of a loaded car was found to be something over 45,000 lbs. The nearest number of even tons was therefore adopted as the unit,

CHICAGO & NORTH WESTERN RAILWAY

WOOD STREET STATION. 190

TRACK ONE				TRACK TWO				TRACK THREE				TRACK FOUR							
Run	STATION	Box	Car No.	Run	STATION	Box	Car No.	Run	STATION	Box	Car No.	Run	STATION	Box	Car No.	Run	STATION	Box	Car No.
1	AUSTIN TO OAK PARK	1		1		2		1	KELLY TO DES MOINES	3		1	OGDEN	4		1			
2	RIVER FOREST TO CORTLAND	5		2	SYCAMORE AND DE KALB	6		2	MARSHALLTOWN AND IOWA CENT	7		2	U. P. TRANSFER	8		2			
3	ELVA TO SPRING VALLEY	9		3	NACHUSA TO MALTA	10		3	CEDAR RAPIDS	11		3	SAN FRANCISCO	12		3			
4	TERRA COTTA TO WILLIAMS BAY	13		4	DIXON	14		4	CLINTON OIL	15		4	SACRAMENTO	16		4			
5	DUNDEE TO ALGONQUIN	17		5	STERLING	18		5	CLINTON TO LUZERNE	19		5	POCATELLO	20		5			
6	ELGIN	21		6	FULTON TO LIMESTONE	22		6	BOONE TO GLIDDEN	23		6	U. P. TRANSFER	24		6			
7	PECATONICA TO WAYNE	25		7	Tracy to Union, Fierro and Gettysburg	26		7	CHADRON TO CASPER AND BELLE FOURCHE	27		7	PORTLAND	28		7			
8	FREEPORT & RIDOTT	29		8	MASON CITY TO YESTA AND WALNUT GROVE	30		8	Fremont to Lincoln, Superior and Hastings	31		8	PORTLAND	32		8			
9	ROCKFORD	33		9	Belle Plaine to Belmond, Boone and Ames	34		9	Sioux City to Carroll and C. St. P., M. & O. Ry.	35		9	COLORADO	36		9			
10	BELVIDERE	37		10	Grundy City to Linwood, Marshall and Tamaha	38		10	Carroll to Anthon, Rattan, Tara, Vail and Brenton	39		10		40		10			
11	BATAVIA	41		11	THOR TO ALTON AND MONTROSE	42		11	Denison to Crescent Grove, Lime and Blencoe	43		11		44		11			
12	AURORA AND NO. AURORA	45		12	Ames to Woodstock and Auburn	46		12	BLAIR TO BORDEAUX	47		12		48		12			
13	GENEVA AND ST. CHARLES	49		13	Eagle Grove to Magnolia and Estherville, Inc. Cantebury	50		13	OMAHA, VIA BLAIR	51		13	LYONS TO ANAMOSA	52		13			
14	WEST CHICAGO	53		14		54		14	COUNCIL BLUFFS	55		14	PEORIA	56		14			
15		57		15		58		15		59		15		60		15			
16	NO. CHICAGO & WAUKEGAN	61		16	WOODSTOCK TO HARVARD	62		16	OCONTO TO ATKINSON	63		16		64		16			
17	Milwaukee Park to Shoreline	65		17	WIS. DIV. OIL CAR	66		17	OSHKOSH TO NEENAH	67		17	POWERS TO MICHIGAMME	68		17			
18	NO. EVANSTON TO ZION CITY	69		18	MINNEAPOLIS	70		18	APPLETON TO GREEN BAY	71		18	MILTON JCT TO OAKFIELD	72		18			
19	KENOSHA	73		19	MINNEAPOLIS	74		19	MILWAUKEE	75		19	KIRKWOOD TO GALESVILLE	76		19			
20	RACINE JCT	77		20	ST. PAUL	78		20	MILWAUKEE	79		20	SPARTA TO LA CROSSE	80		20			
21	RACINE	81		21	ST. PAUL	82		21	MILWAUKEE	83		21	MADISON TO WOODBAR, LANCASTER AND GALENA	84		21			
22	DEERING TO EVANSTON	85		22	EAU CLAIRE TO ITASCA AND STILLWATER JUNCTION	86		22	MILW. NORTH	87		22	WINONA	88		22			
23	Winthrop Harbor To So. Milwaukee	89		23	DULUTH	90		23	MILW. WEST	91		23	WINONA TRANS.	92		23			
24	MINN. TRANS. G.N.	93		24	WEST SUPERIOR	94		24	SHEBOYGAN TO PLYMOUTH	95		24		96		24			
25	MINN. TRANS. G.N.	97		25	HUSTLER TO ALTOONA	98		25	LAKE SHORE JC TO KIMBERLY	99		25	SUGAR BUSH TO MARSHFIELD	100		25			
26	MINN. TRANS.	101		26	JANESVILLE	102		26	FOND DU LAC	103		26	BIRNAMWOOD TO ASHLAND	104		26			
27	MINN. TRANS.	105		27	BELOIT	106		27		107		27	LAUREL, NEW LONDON and C. B. & W.	108		27			
28	MINN TRANS.	109		28	CALEDONIA TO BARABOO	110		28		111		28		112		28			
29	MINN. TRANS	113		29	HIGHWOOD & LAKE FOREST	114		29		115		29		116		29			
30	CUDAHY	117		30	HIGHLAND PARK	118													
31		121		31		122													
32		126																	

Fig. 5—Loading Plan; Wood Street Station; Chicago & North-Western.

he does not himself truck the freight into the cars as at State street, is responsible for its being in the right car and for its arrangement in the car. The weight of each piece in each car, taken generally from the waybill or as weighed when taken out of the foreign car, is recorded on a slip by a clerk in the office and the total tonnage unloaded from that car recorded to the credit of the gang which did the work. Instead of being paid by the hour, as at State street, the check clerks, callers and truckers are paid on a tonnage basis, the amount actually handled from each car being credited each to the checker and the caller and divided among the five truckers. There is a minimum day wage which is paid in case the tonnage payment falls below that amount, but this seldom happens. The system is said to have worked most satisfactorily both to the compauy and to the men. The same system has not been applied at any of the other freight houses because at all of them, freight is received by teams and by collusion between truckers and teamsters some men would be able to make large earnings on the tonnage basis by getting all the heavy freight to carry, while others would handle only light freight and would make correspondingly low wages. At Wood street the freight is trucked just as it and during August all train tonnage was reckoned on the basis of 23 tons for each loaded car. This is on the basis of 17 tons for the weight of the car and six tons for the weight of the merchandise in the car. If during August the average recorded weight of all cars loaded for the road rose to over 47,000 lbs., 24 tons per car would be the working basis during September. Refrigerator cars are rated two tons heavier than the working figure, this amount extra being allowed for the weight of the tanks.

There are daily shipped west over the Chicago & North-Western from Wood street from 15,000 to 20,000 pieces of merchandise. A careful record shows that the mistakes in loading amount to at most one-tenth of 1 per cent., or about 15 out of the 15,000 to 20,000 pieces handled. This is quite remarkable in view of the fact that merchandise received at Wood street comes out of foreign cars indiscriminately instead of as at freight houses used by the public being delivered at the most convenient door by a teamster who knows the arrangement of the house and the destination of his goods and who keeps his shipments separate for loading.

At 5 p.m. the "boxes" are taken out of the loaded cars, the doors are closed and sealed and the cars are ready for the road.

The connecting line cars are closed at 6 p.m. In addition to the road cars loaded in the house, solid cars loaded on nearby team tracks go out of Wood street.

The Sixteenth street freight house and team tracks are about two miles east of Wood street between the Chicago, Burlington & Quincy main line tracks coming in from the west just before they turn north to run into the Union Station, and the Chicago Terminal Transfer Co.'s tracks used by the Baltimore & Ohio, Pere Marquette and Chicago Great Western. The Chicago & North-Western owns five tracks directly north of the Burlington's eight tracks. Two of these, crossing the Burlington and the Pittsburg, Fort Wayne & Chicago, run on east to the river, where from 40 to 50 cars of sand and gravel are handled daily. At Sixteenth street is the eastern terminus of the St. Charles Air Line previously mentioned. From here it runs east about a mile to a connection with the Illinois Central yards.

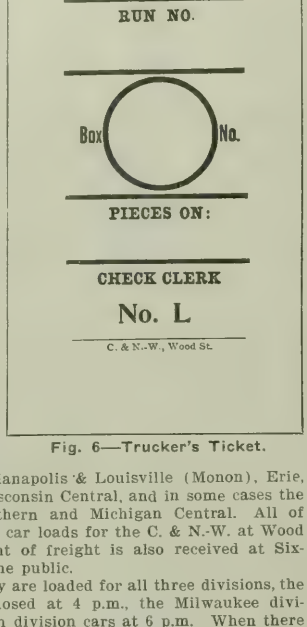


Fig. 6—Trucker's Ticket.

Not more than three tons a day of l. c. l. freight is received at Sixteenth street, but the "out" freight house has a capacity of 60 cars—30 on three tracks inside the house and 30 on three tracks outside. Much l. c. l. freight from those railroads which are most conveniently situated in relation to Sixteenth street comes here by teams for loading to points on the North-Western Line. These are principally the Atchison, Topeka & Santa Fe, Chicago & Eastern Illinois, Chicago, Indianapolis & Louisville (Monon), Erie, Grand Trunk, Wabash and Wisconsin Central, and in some cases the Lake Shore & Michigan Southern and Michigan Central. All of these roads interchange mixed car loads for the C. & N.-W. at Wood street. A considerable amount of freight is also received at Sixteenth street by teams from the public.

An average of 40 cars a day are loaded for all three divisions, the Galena division cars being closed at 4 p.m., the Milwaukee division at 4.30, and the Wisconsin division cars at 6 p.m. When there is not enough freight to fill a road car at Sixteenth street, the partly filled car is sent on to Wood street, where it is consolidated with a Wood street car for the same destination.

(To be continued.)

Railway Construction in North China.*

BY E. H. RIGBY AND W. O. LEITCH, JR., RESIDENT ENGINEERS.

The first standard-gage (4 ft. 8½ in.) railroad in China, the original section of the system now known as the Imperial Railways of North China, was built in 1880-1881, and connects the Tongshan collieries with the head of the Lutai canal, seven miles distant. An account of the great difficulties met with in the construction of this line and in its subsequent extension to Tientsin in 1888, has already been published. So successful was this work that the Chinese Government decided to extend the line westward from the original starting point; this extension was proceeded with after many unavoidable delays, chiefly due to the opposition of the people, who drove back the first survey party in 1888, and delayed the work for years.

The rails reached the Ma Chia Pu terminus, outside Peking, in 1897. In 1899 an electric tramway was laid to the South gate. From a point near Peking the railroad to Pao Ting Fu was next constructed; this line was opened in 1899. A new city station was subsequently opened in Peking, at the Chien-Men, and a branch line eastwards to Tungchou was constructed in 1901.

Eastwards from Tongshan the railroad was gradually pushed on to Shan Hai Kuan, where the Great Wall of China meets the sea, and almost on the boundary between Chihli and Manchuria. The extension was opened to Kuyeh in 1890, to Lanchou in 1892, and to Shan Hai Kuan in 1893. At Lanchou is the largest, although not the longest, bridge on the system; it consists of five spans of 200 ft., ten spans of 100 ft., and two spans of 30 ft. This bridge was opened on Feb. 27, 1894. It was intended at that time to prolong the line to Chinchou, Mukden and Kirin, and surveys were made. A considerable amount of earthwork was done as far as Ta Ling Ho, but want of funds seriously hampered the work, and the war between China and Japan, declared on Aug. 1, 1894, not only stopped operations but swallowed up the funds and completely altered the whole political situation in North China. By 1896 the rails had been laid only to Chung Ho So, 40 miles from Shan Hai Kuan. To enable progress to be made, it was necessary to put the funds on a firmer basis, and in 1898 a preliminary agreement was made to raise a loan in London for the purpose of extending the line to Hsin Min Tun and Yingkow (Newchwang) with a branch to Nan Piao, where there is a good coal field. The Russian Government strongly objected to this, and a long diplomatic battle ensued, one result of which was an important alteration in the original agreement, to the effect that the new lines were not to be mortgaged to meet the services of the loan, and finally, on Oct. 10, 1898, an agreement was arrived at between the Administrator-General of Railways and the Hong Kong and Shanghai Banking Corporation, to raise a loan of £2,300,000 for the purpose of executing certain works on the old line, paying off former loans, and extending the railroad as already described, the total length of the extension, east of Chung Ho So, being 270 miles.

The work has been completed within the estimate, and in this paper the authors propose to describe the Chinchou-Yingkow section, 97 miles in length, commencing one-half mile east of Chinchou; and to supplement the general information given in the two papers already referred to. The line as far as Chinchou was opened for traffic in October, 1899.

Chinchou-Yingkow Section.

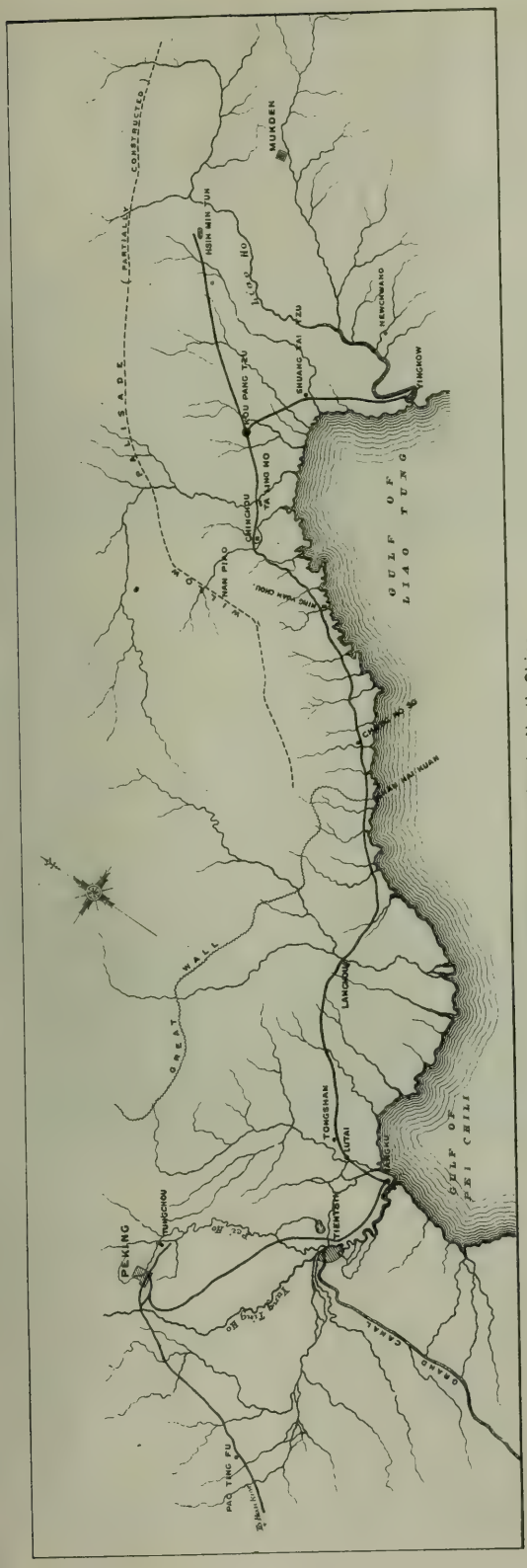
The survey for the Chinchou-Yingkow section was completed in April, 1899, and the laying of the rails was finished in December of the same year. Deviations were made round bridges, and as little work as possible was done in advance of the track-laying, in order to get the benefit of rail transport. By the spring of 1900 all the bridge foundations except those of Ta Ling and Shuang Tai Tzu bridges were finished, a wharf was built at Yingkow, the stations and buildings were well advanced, and the plant and material necessary to complete the work were on the ground, when the Boxer outbreak completely upset all arrangements. The head office was burned to the ground, the Director-General was killed and the other directors had to flee for their lives; 130 miles length of the line from Peking to the East of Tangku was rooted up, the buildings were demolished, and the Engineer-in-Chief and his staff were besieged in Tientsin. Although the railroad from Chinchou to Yingkow was not much damaged, the whole country was in violent disorder. The foreign staff made their escape to Newchwang, and the railroad was taken over by the local military authorities, who destroyed a part of the temporary bridge at Shuang Tai Tzu as a military precaution and held the line till October, 1900, when it was taken by the Russian military authorities. In order to keep open their lines of communication, the Russians repaired the railroad, ferried locomotives across the river, and reopened traffic with a trans-shipment at Shuang Tai Tzu in April, 1901. By the month of August the Shuang Tai Tzu temporary bridge was rebuilt by the Russian military engineers, and trains were run through again. Several bridge-tops were permanently finished, and buildings were erected to accommodate the troops, but nothing was done to the permanent work of the bridges at Ta Ling Ho and Shung Tai Tzu, or to the ballasting, etc., as the object was simply to keep the trains running, pending developments. Besides the Chinchou-Yingkow section, the Russians held the line as far as Shan Hai Kuan, and also the construction-stores and bridge-works at that place. After protracted negotiations, the line was returned to the Chinese Government on Oct. 10, 1902, and immediately afterwards the engineering staff resumed control, but little could be done during the winter season, and it was not until the spring of 1903 that the necessary materials were obtained and operations were again commenced. After another interruption, due to severe floods, the rails were finally laid to Hsin Min Tun, in the autumn of 1903. Pending the opening-up of the coal field, the Nan Piao branch, 30 miles in length, has not yet been constructed.

Excluding the Pao Ting Fu line, the total length of the railroad and extensions is 588 miles. The total expenditure on the lines, when completed, will have been about £3,850,000.

The Peking line, 78 miles in length, was originally a double line and cost £10,000 per mile, but after the Boxer outbreak it was relaid as a single line, and the remaining rails and girders were used for the Tungchou extension, 20 miles in length, and for relaying the Tangku-Tientsin section, in order to have 85-lb. rail right through from Tangku to Peking, the Tangku-Tientsin section originally having only 70-lb. rails.

General Description of Route.—Chinchou, the starting-point of the section to be described, is a walled city near the northwest corner of the Gulf of Liao Tung. From Chinchou to Ta Ling Ho 15½ miles, the route lies among hills; from Ta Ling Ho to Kou Pang Tzu, 25 miles, along the plain at the foot of the hills; and from Kou Pang Tzu to Yingkow, 57 miles, across the flat alluvial

*Extract from a paper read before the Institution of Civil Engineers.



Railway Construction in North China.

plains forming the head of the gulf. At Kou Pang Tzu is the junction for the Hsin Min Tun line, which is 70 miles in length. Yingkow, the terminus, is on the right bank of the Liao river, which is navigable for steamers up to Newchang, and for river boats for 200 miles into Southern Manchuria. The route to Hsin Min Tun was laid out to run through the center of a grain district. The junction for the Yingkow line is so fixed that the route from Kou Pang Tzu (the junction station) is the shortest possible. There would have been no advantage in keeping nearer the coast, as the plains across the head of the gulf are salty, unfertile and scantily populated. All trees, except a few around villages or near graves, have long ago been ruthlessly cut down, and hardly any timber can be obtained locally. The nearest accessible coal mine is about 300 miles away, and neither metals, gravel-pits, nor brick-clay are found near the line.

Survey.—Chinese maps partake more or less of the nature of a pictorial sketch, sometimes giving a fair idea of the district, but no measurements can be taken from them and they are of little use for railroad work. The chief difficulty in making a survey is to avoid graves, which are scattered about everywhere, instead of being collected in cemeteries. The burying-grounds of wealthy people practically cannot be touched; graves belonging to poor people were avoided if possible, but where it was necessary to remove them a money compensation was arranged and the coffins were interred at another place. Another difficulty is to ascertain flood-levels, and to estimate the effect of the embankment on floods. The river channels, in general, have gradually become silted up, and after a heavy rainfall the adjacent plains are inundated. From Chinchou to Ta Ling Ho a route was found which offered easy gradients and curves, the worst gradients being 1 in 200, about two miles in length, and the sharpest curves of 3,000 ft. radius, the worst point of the line being where these occur at the same place. From Ta Ling Ho to Yingkow, across the plain, the gradients are very slight.

Spring and autumn are the best seasons for outdoor-work in North China. Between June 15 and the early part of September heavy rains may be expected, and work in the river-beds must be arranged accordingly. In winter, in southern Manchuria, there is an unbroken spell of frost from the end of November until March, the night temperature being sometimes 10 deg. below zero Fahrenheit. During the winter season, however, the roads are in their best condition, and most of the transport is done then.

Land.—As soon as the location, pegging out, and leveling of the center line were completed, the side-widths were calculated and a list of them was given to the Chinese official appointed to buy land and to pay compensation for removal of graves. Land-buying in China is an art, requiring the services of an expert. Many of the plots are small and crooked in shape, the boundaries between adjacent plots being difficult to trace. The result is that the railroad land boundary is far from straight.

After the railroad was completed, stones were put in to mark the boundaries and a survey of them was made. Special surveys were made, to a larger scale, of all land near stations; this is the only land which increases much in value after the railroad is built, and it is quickly encroached upon by neighboring land-owners if not carefully looked after. A large area was bought for each station-site, and parts not immediately required were rented out.

The average price of land was 10 dollars[1] per mou[2] (equal to £5 17s. per acre), and compensation was paid for removal of graves at an average rate of five dollars (8s. 9d.) each, most graves containing only one coffin.

Earthworks.—The earthwork for the whole line was let to a Chinese contractor who had done a large amount of similar work on the lines previously constructed. He was supplied with a list of the heights of embankment or depths of cutting at each peg, and was told the width of formation and the inclination of slopes required. He employed several thousand coolies, who lived in huts of mats stretched over bamboo half-hoops. Each man has a shovel, and two baskets carried at either end of a shoulder-pole; an alternate method, rarely used for contract work, is by means of a large basket carried on a shoulder-pole by two men. The embankments were all made from side-cuts, and the spoil from cuttings was heaped up in mounds on either side. The height of the highest embankment is 35 ft., and the depth of the deepest cutting is 20 ft. The Yingkow yard, where, on an average, 7 ft. depth of filling was required, was partly done from borrow-pits in the yard and partly from others two miles away, the earth being brought in trains of 25 cars, each of 200 cu. ft. capacity and taking 6 cu. yds. of excavation.

The rates of payment for the earthwork were:

	Per cu. yd.
All work between Chinchou and Yingkow	1.1*d.*
Filling at Yingkow (station borrow-pits)	1.7*d.*
Filling at Yingkow (haulage by train)	1.4*d.*

The contractor found all his own tools, etc., but paid nothing

[1] The average value of the dollar during 1902-1903 was 1s. 9*d.*, and this value has been adopted in calculating the English equivalents for the various rates given in the paper.

[2] 1 mou = 6,510 square feet.

for rent of engine, cars, etc., which would probably add another 0.8d. per cu. yd. to the price of the filling by train haulage at Yingkow. Between Chinchou and Ta Ling Ho are several cuttings through rock of varying hardness. These were let out in separate contracts to different contractors at an average price of about 9d. per cu. yd. Gunpowder, drill-steel, etc., were supplied to these men at cost price, and any surplus on completion of the contract was paid for at the engineer's valuation, which was rarely disputed. The Chinese are excellent at earthwork, but not so good at rock-cutting. They drill only small holes, and use very small charges of explosive. Through country not exposed to floods, a berm of 5 ft. is left between the toe of the embankment and the edge of the side cut. The berm is increased to 10 ft. in districts subject to floods. Pitching is often placed on it and up the slope to about 2 ft. above highest flood-level, for protection against waves. Willows are also planted, and with their long roots afford excellent protection against floods. When grown to sufficient height, they shield the trains from side-winds, a protection by no means to be despised in a country where high winds are frequent during many months of the year. Where the soil is suitable and the natural growth is not rapid, the slopes are sown with grass-seed, but in the salty ground between Kou Pang Tzu and Yingkow nothing has been found to grow well, and the slopes are pitched with stone where they are exposed to heavy floods. Between the top of the cutting-slopes and the toe of the spoil-heap a berm of 15 ft. is left, and a surface-drain is cut in it. When the banks were first constructed, they were made higher at the sides than in the center; this was done in order to allow them to become saturated by the rain-water, and to insure rapid and proper settlement. Before rail-laying was commenced they were re-formed, and a slope was made from the center to the edges in the usual way. Ample allowance was made for settlement, and in few places is the formation below the level at which it was originally intended to be, after complete settlement. A large portion of the earthwork between Chinchou and Ta Ling Ho was completed before the outbreak of the Japanese war, but that between Ta Ling Ho and Yingkow was only started in April, 1899, and was finished in September of the same year. This does not include the filling at Yingkow or at the ends of each bridge. Excluding the filling at Yingkow, which amounted to 245,643 cu. yds., the earthwork amounted to 4,549,724 cu. yds., or about 46,900 cu. yds. per mile. The amount of rock-cutting was 53,160 cu. yds.

Track.—The Chinchou-Yingkow extension is laid throughout with steel flange-rails of Sandberg standard section, weighing 60 lbs. to the yard, this weight of rail being now in use over the whole system, except between Tangku and Peking, where heavy locomotives are run and an 85-lb. rail is laid. The 60-lb. rail has a 2½-in. head and a flange 4⅝ in. in width, and is 4½ in. in height. The angle fish-plates, 2 ft. 2 in. in length, and weighing 52¼ lbs. per pair, are fixed with four ⅞-in. bolts, and are spiked to the joint-sleepers, to prevent creeping. The sleepers are of Japanese hardwood, 8 ft. by 9 in. by 6 in., and have an average life of six years, the rails being spiked to the sleepers with square spikes. The cost of the sleepers was 1s. 11d. to 2s. 1d. each, delivered at the Railway Company's wharf. To each 30-ft. rail there are 13 sleepers, spaced 2 ft. 5 in. apart, center to center, except near the joint, where the spacing is 2 ft. 2 in., and at the joint itself 1 ft. 6 in. The track amply fulfils the requirements of the traffic; high speed is not necessary, a maximum speed of 40 miles an hour for passenger trains and 20 miles an hour for goods trains being sufficient. With an axle-load of 13 tons for locomotives, trains of 130 loaded axles are worked on the easy sections; this compares well with the loads on many lines having much heavier rails and engines. The ballast is all rock obtained from the nearest quarries, no gravel ballast being available. It is laid to a depth of 8 in. under the sleepers, and has a top-width of 11 ft. level with the tops of the sleepers. The ballast was specified to be broken to pass through a 4-in. ring, but a fair percentage of it was considerably larger, in spite of the contractors being fined and made to send men out on the line to break it. The sub-contract price for the ballast, loaded into cars, was between 6½d. and 9d. per cubic yard, the price varying at different quarries. Rail-laying was conducted from both ends of the line. From Chinchou the existing line was extended and all materials were brought forward from Tangku, but before starting at the Yingkow end a wharf had to be built for the landing of locomotives, cars, and track material, the rolling stock, of course, being erected on the spot. For purposes of rail-laying, a portable track of 2 ft. gage, three-quarters mile in length, was laid along the edge of the formation. The rear end of this track overlapped the rail-head train, and all materials were unloaded on to the 2-ft. gage trolleys, pushed forward, and spread out by coolies, who left everything ready for the spiking and bolting gang. Another gang following straightened and packed the track, so that trains could be run to the rail-head a few hours after the track was laid. Owing to the length of the dry season, a very good track can be kept without ballast, and no temporary or service roads were used to distribute the materials. A day's work in track-laying was one-half to three-quarters mile, including deviations round bridges and sleeper-stack temporary bridges where required. The work was done partly by contract, at a cost of per lineal yard, including the cost of the trolley track, unloa materials, carrying them forward, laying, spiking, and bolting track, and packing and straightening it sufficiently for a trai be run over it without damage to the rails. No charge was for tools supplied to the contractor. The ballasting was don special ballast trains of 20 to 25 cars, holding about 17 cu. each. These cars were unloaded through side doors by mea shovels. The track was lifted in two lifts, and after it had well packed and straightened the top-ballast was spread. rough packing was done by contract, the price paid for unloa the ballast, lifting the track 8 in., and leaving it well packed straightened, was 1.6d. per lineal yard. This contractor was lowed by a gang of men paid by time, who thoroughly packed straightened the road, making it ready at once to receive t running at 20 miles an hour. The track is maintained by re gangs of six men, who have to look after 10,000 ft. of track flying-gang is put on when necessary to do any extensive which cannot be accomplished satisfactorily by the regular g Over each five or six regular gangs is placed a section fore who reports to the engineer. If possible, his house is built n station, so that he can communicate with the engineer by teleg Mileage and gradient-stones, instead of being placed facing the are set at right-angles to it and can be seen for some distance an approaching train. The mileage-stones are 5,000 ft. apart, the figures on them represent the distances, in chains of 100 ft., the starting point at Tangku. . . .

Traffic Working.—The traffic headquarters are at Tientsin the system adopted on older sections of the line will be exte to the Yingkow section. The rates for passenger traffic are: class, 6 cents (1.2d.); second class, 4 cents (0.8d.); third cla cents (0.4d.) per passenger mile. For specially large num cheaper rates are allowed; for example, large numbers of travel in the spring and autumn between Tientsin and Ying to work in Manchuria, and these men are carried in full car- 385 miles at a rate which is equal to 1d. for 12 miles. Con able private cars, arranged with a kitchen, servants' and sle accommodation, are available for those requiring them, and di cars are run between Peking and Shan Hai Kuan. Between Hai Kuan and Newchwang the number of foreign passenge very small, but dining-cars will soon be run on that section as the increasing popularity of the Siberian route will bring travelers over the line to Peking. In addition to the purely stock, the dining-cars of the Wagon Lit will run between Newch and Peking twice a week, in connection with the mail trains Europe. Two rates for freight are in operation: (1) by picul (133 lbs.); and (2) by the car. The result is that merch hire a car, and put into it whatever they please, provided capacity is not exceeded, and the great bulk of the traffic is in car-loads. Parcels may be sent by express agency, or at ord parcel rates. Excluding dangerous goods, the rates per car for full car-loads are: For first class goods, 5 cents (1d.); se class, 3½ cents (¾d.); third class, 1¾ cent (½d.). First goods include general merchandise and manufactured articles ond class, agricultural products and flour, timber, salt, wool, third class, coal, lime, stone, etc. For special large shipr cheaper rates prevail, according to circumstances. The railro operated on short and busy sections by the electric tablet, and tric staff block systems, and on the less-developed portions o line, where the distance between stations is considerable, by ordinary train staff and links. Under the ordinary staff, to pr mistakes a double telegraphic form of inquiry and answer is when it is necessary to suspend the ordinary staff working, a issue a "line clear" form in lieu of staff; and this can only be by the traffic inspector of the district. Under these system traffic on a long single line is worked with regularity and safety. . . .

Wages.—The following were the rates of wages paid:

	£	s.	d.		£	s.	d.
Office clerks	1	15	0	to	4	7	6*
Foremen	1	6	0	"	4	7	6
Fitters and smiths	1	6	0	"	2	12	6†
Helpers	0	16	0			....	
Carpenters and masons	0	16	0			....	
Coolies	0	12	6	"	0	16	0

*Sometimes more. †Southerners, up to £8 15s.

Table of Rolling Stock in Use.

Locomotives	105
Passenger cars	109
Brake vans	92
10-ton four-wheel freight cars	743
16-ton eight-wheel freight cars	53
20-ton " "	1,201
24-ton " "	12
30-ton " "	101

Extract from Annual Report, 1903.

Revenue for year ending Sept. 30, 1903	£407,550
Expenditure, year ending Sept. 30, 1903	199,500

The expenditure was roughly 50 per cent. of the revenue the lines east of Chinchou are not yet in full working order.

New Locomotives for the Indian State Railroads.

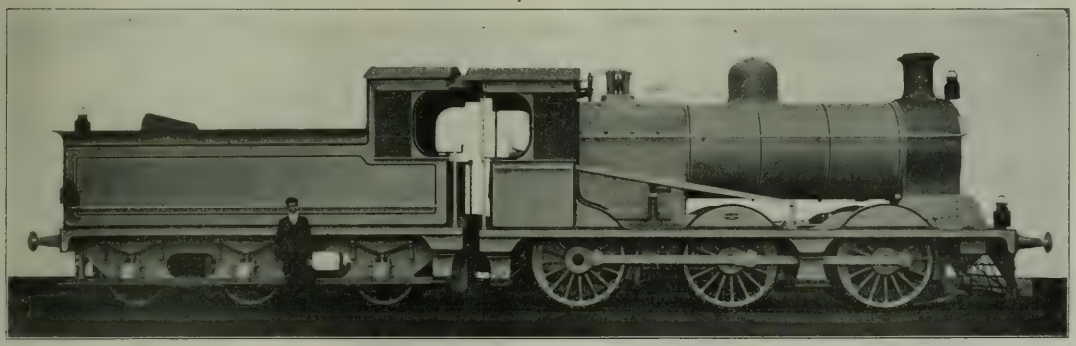
During the past few months somewhat extensive orders have been given to British makers for new locomotives for many of the Indian State Railroads. In the first illustration is shown one of a number of powerful six-wheels-coupled bogie express locomotives which have recently been erected by Messrs. Robert Stephenson & Co., Ltd., of Darlington, England, for hauling the heavy mail express trains of the Bengal-Nagpur Railway Company between Calcutta and Bombay. The locomotives have been built from the specifications of Sir John Wolfe Barry, K. C. B., who is the Consulting Engineer of the Bengal-Nagpur Railway. They have cylinders 20 in. in diameter with a stroke of 26 in., and have ordinary sliding valves, the motion being of the Stephenson link with its eccentrics on the driving axle, and the rods bent clear of the leading axle. The boiler is of large capacity and has its center line pitched 8 ft. 6 in. above the rail level and is of steel plates, with copper fireboxes stayed with copper stays, the tubes being of brass. The boiler barrel has a mean diameter of 4 ft. 9$^{9}/_{16}$ in., and a length of 14 ft. 1½ in.; the plates are $^{9}/_{16}$ in. thick. The firebox is of the Belpaire pattern, and the length outside of the shell is 8 ft. 8 in., and the width, at the bottom, outside, is 4 ft. 7⅝ in. The tubes number 196 and are 2¼ in. in diameter. The total heating surface is 1,831 sq. ft., to which the tubes contribute 1,673.5 sq. ft. The grate area is 32.184 sq. ft., and, taking 90 per cent. of the boiler pressure, the tractive force amounts to 22,922 lbs. The six coupled wheels have each a diameter of 6 ft. 1½ in., and the truck wheels a diameter of 3 ft. 6 in., and the six wheels of the tender are 3 ft. 8 in. in diameter each.

Bogie Express Engine for Indian State Railroad.

The cab has been specially designed for Indian climatic conditions, and, as will be seen from the illustration, affords ample protection from the power of the sun. Instead of the slide windows, sometimes seen on European, and almost invariably on American locomotives, there are louvred shutters sliding between light angle iron framing, fitted to both the engine and tender. These six coupled bogie mail-express locomotives have a weight, exclusive of tender, of 63 tons 5 cwts., distributed as follows: Bogie wheels, 16 tons 2 cwts.; leading wheels, 15 tons 14 cwts.; driving wheels, 15 tons 15 cwts., and trailing wheels, 15 tons 14 cwts. The tender, which has a capacity of 3,500 gallons of water and carries seven tons of fuel, weighs an additional 41 tons 4 cwts., distributed thus: Leading wheels, 13 tons 9 cwts.; intermediate, 13 tons 10 cwts., and trailing wheels, 14 tons 5 cwts. The engines, in running order, have therefore an aggregate weight on rails of 104 tons 9 cwts.

The second illustration shows one of 50 freight locomotives which have quite recently been built by the Vulcan Foundry, Limited, of Newton-le-Willows, Lancashire, England, for service on the North Western; the Oudh and Rohilkhand, and other of the Indian State Railways. This type of locomotive is that recently decided upon by the Locomotive Engineering Standards Committee in England for operating freight trains on the Indian State Railroads.

The engine has six-coupled-wheels, and in general outline is in accord with British specifications for similar engines in operation in the United Kingdom. The coupled wheels have a diameter of 5 ft. 1½ in., and the cylinders are 18½ in. in diameter, with a stroke of 26 in. The total heating surface amounts to 1,349.5 sq. ft., of which 1,229.5 sq. ft. is in the tubes. The working pressure of the boiler is 180 lbs. per sq. in., and the grate area is 25.3 sq. ft. The engine has a wheel base of 15 ft. 6 in. and weighs, in working order, 48.1 tons, distributed as follows: Leading wheels, 16.425 tons; driving wheels, 16.475 tons, and trailing wheels, 15.2 tons. The tender, which runs upon six wheels, each 3 ft. 7 in. in diameter, has a wheelbase of 13 ft., and weighs, in running order, 39.15 tons, with a space for 7½ tons of coal and a capacity for 3,000 gallons of water. The total wheelbase of the engine and tender is 38 ft. 4⅜ in., and the total length over buffers is 52 ft. ⅜ in. The locomotive is equipped with the automatic vacuum brake, and also with a hand-brake on the tender, and weighs 87.25 tons.



Freight Engine for Indian State Railroad.

Electric Railroads in Michigan.

Some interesting figures regarding the electric railroad situation in the State of Michigan for the year 1904 have been gathered by the Michigan State Railroad Commissioner. The majority of the report is in tabular form and contains the names of all electric lines operated in the state as well as the location of their offices, names and addresses of managers, capital stock, whether operated in city or were interurban, number of miles measured by a single track, number of miles that were interurban, amount expended for permanent improvements during the past year, receipts from passenger traffic in past year, receipts from foreign traffic during the same time, all other receipts, number of cars, both passenger and freight, price of single fare and rates when purchasing tickets, whether transfers were given, total number of

passengers carried during the year and average fare for each passenger carried. In addition to this a classified list of employees is given, with the average hours worked per day for each class and the average number of hours constituting a day's work.

A summary of the data given in the tables show that there are 25 separate electric railways now being operated in Michigan, having 1,158 miles of single track. This would equal two lines from the Straits of Mackinaw to the southern line of the state and two lines across the state at its widest point, a wonderful development in the few years since the use of electricity as a motive power.

The capital stock of these electric roads is given at $34,075,000, of which $1,600,000 is reported as preferred stock. The actual value of the roads with their equipments will approximate $45,000,000. Last year 18 of these lines spent $1,682,718 for permanent improvements, 10 of them extending their lines to the extent of over 62 miles.

During the year 151,001,029 passengers were carried on these lines, the sum of $6,581,275 being received for passenger traffic alone. The average rate of fare for all passengers carried being .04⅓ each. During this same period the receipts from freight traffic were $229,612, and $99,314 was received from other sources, making the total receipts of the 25 lines $6,910,201. The receipts of the electric roads in the state for one year equals the entire expense of the state government for the same period.

The combined lines operate 1,494 cars, of which 1,352 are for passenger traffic. Many of these cars are of the most elegant modern construction, especially those used on the interurban lines. In furthering the conveniences of travel 17 of the lines give universal transfers, the lines that do not, being the ones operating outside the cities, or where the lines are continuous so that a transfer is not needed. On five of these lines transfer tickets are given where one transfer has already been made. The usual price charged for a single ticket is five cents, and on most of the interurban or county lines tickets are sold at the rate of one and one-half cents per mile, but almost every line has different conditions in selling tickets, such as "six for 25 cents," "50 for $1.50," "less per round trip," "school children tickets," "laborers" tickets at certain hours," "party tickets," etc.

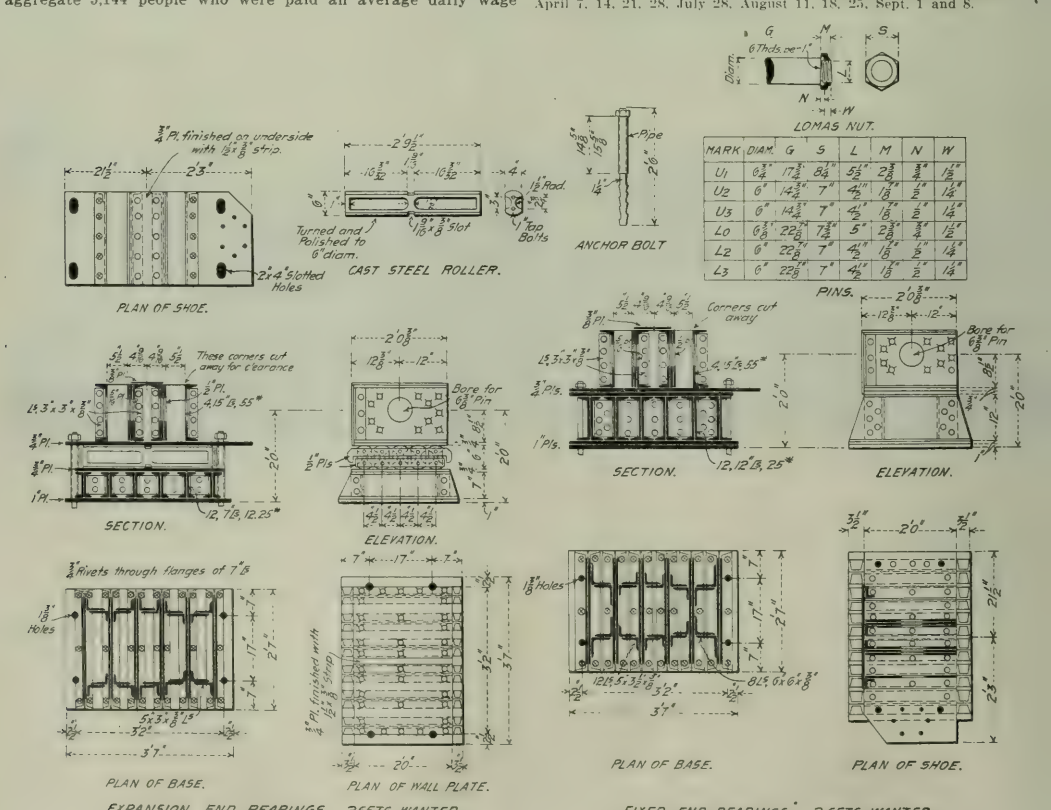
At the time the canvass was made the lines were employing in the aggregate 5,144 people who were paid an average daily wage of $1.89, ranging from $4.16 for a division superintendent to $ for the most common laborer. Among the classified employees wages of a large per cent. are computed by the hour, none of classifications averaging more than 11 hours per day, the aver of the entire canvass being slightly above 10 hours for each The statistics show that approximately 50 per cent. of the rece of the electric lines in Michigan is paid for the labor they emp

In 1895 Michigan had but few electric lines outside the p cipal cities, a partial canvass made that year showed many of lines on the verge of bankruptcy. The aggregate capital stoc all the companies was less than $8,000,000. They operated 400 m of track, much of which was in very poor condition. The ann receipts of all the companies were reported at $2,231,468, w their indebtedness approximated $11,000,000. At that time 1 employees were canvassed, 75 per cent. of this number were ductors and motormen. Although this large per cent. were of better paid employees, the canvass showed that the average diem received by all employees was only $1.69. The canvass that year also showed that over 13 per cent. of the employees compelled to lose more or less time.

Standard Bridges on the Harriman Lines.*

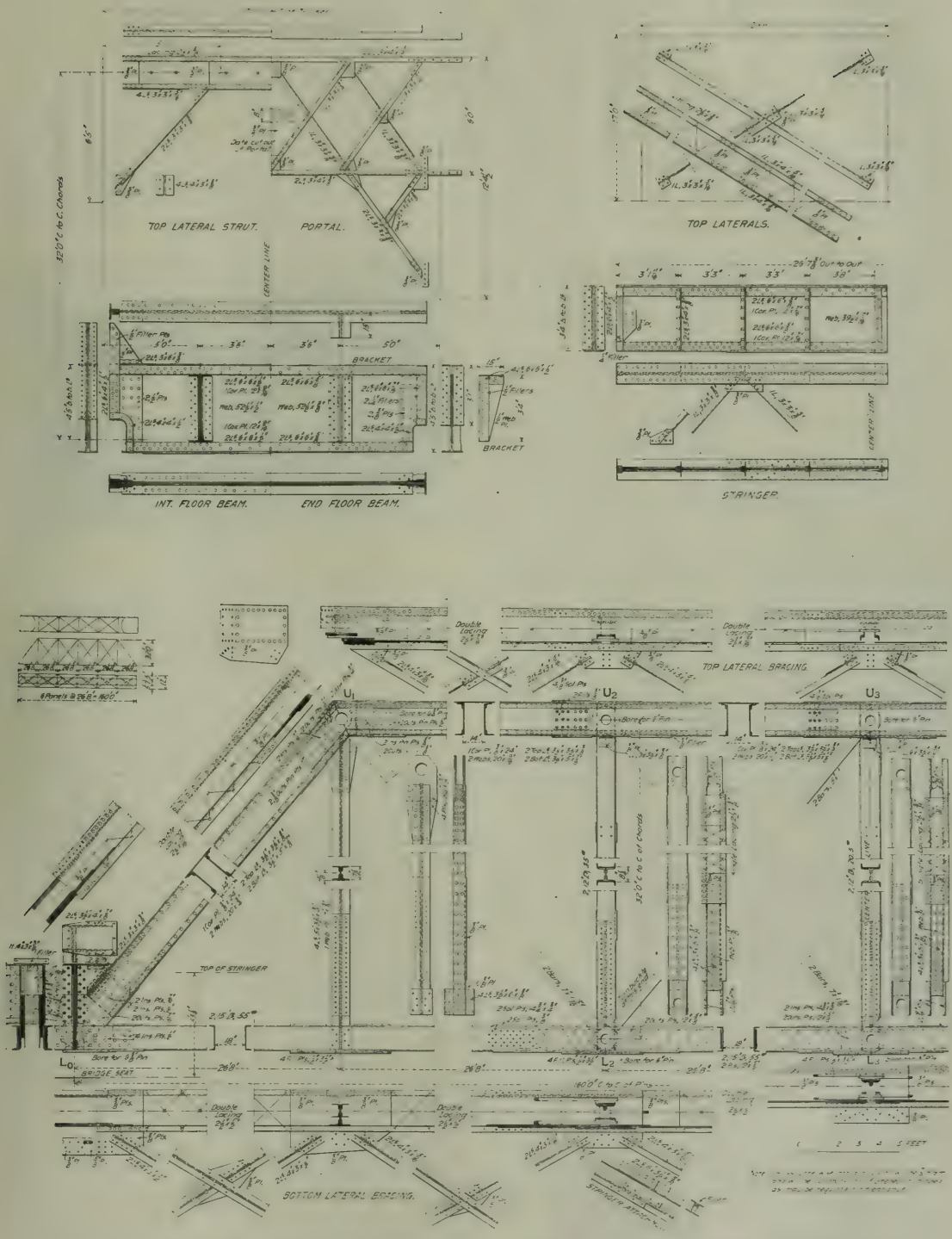
The 160-ft. span through pin-connected truss bridge shown week differs but little in regard to details of its various m bers over the 150-ft. span bridge shown last week. The nun of panels and the method of bracing remains the same, but diagonals are slightly heavier. The top chord is similar in e respect excepting that the cover plate is ⅜ in. x 24 in. instea ⅜ in. x 21 in., and the web plates are 20 in. x ⅜ in. instead o in. x ½ in. The spacing of the web plates remains the same, 1 The bottom chord is made up of two 15-in. 55-lb. channels and 12-in. x ⅝-in. side plates. The end diagonals are fabricated similar manner to those used in the shorter span, the only di ence being in the width of the cover and web plates. The end b ings are also practically the same as those for the 150-ft. s excepting that a few of these parts have been made a trifle hea The estimated weight of one span is 348,000 lbs.

*Previous articles appeared in the *Railroad Gazette* March 17, 24 April 7, 14, 21, 28, July 28, August 11, 18, 25, Sept. 1 and 8.



MARK	DIAM.	G	S	L	M	N	W
U1	6¾"	17⅜"	8¼"	5½"	2⅜"	¾"	1⅜"
U2	6"	14½"	7"	4½"	1⅜"	1"	1¼"
U3	6"	14½"	7"	4½"	1⅜"	1"	1¼"
L0	6⅜"	22⅛"	7⅜"	5"	2⅜"	¾"	1⅜"
L2	6"	22⅛"	7"	4½"	1⅜"	1"	1¼"
L3	6"	22⅛"	7"	4½"	1⅜"	1"	1¼"

Details of End Bearings for 160-ft. Through Pin-Connected Span—Common Standard, Harriman Lines.



Details of Trusses and Floor System of 160-ft. Through Pin-Connected Span—Common Standard, Harriman Lines.

The Roadmasters' Convention.

The twenty-third annual convention of the Roadmasters' and Maintenance of Way Association was held at Niagara Falls, N. Y., September 12, 13 and 14. The Mayor of Niagara Falls, Hon. O. W. Cutler, opened the meeting by an address of welcome, and the President gave a brief outline of the origin and work of the Association from the time of its beginning. The election of officers for the ensuing year resulted as follows: President, C. Buhrer (L. S. & M. S.); First Vice-President, W. E. Emery (C. & N.-W.); Second Vice-President, W. A. Brandt (St. L., I. M. & S.); Secretary and Treasurer, C. E. Jones (C. B. & Q.), Beardstown, Ill. It was voted to hold the next meeting at Chicago in November, 1906. A report of the proceedings will appear in a future issue of the *Railroad Gazette*.

A list ofthe exhibits follows:

American Steel & Wire Co., New York.—Wire railroad fencing and wire rope.

American Valve & Meter Co., Cincinnati.—Full-size "Little Giant" and "Economy" switch stands; point guards; catalogues of the "Poage" water column.

Atlas Railway Supply Co., Chicago.—Complete line of "Atlas" braces, tie plates, step joints, insulated joints and straight track joints.

The Avery Stamping Co., Cleveland, Ohio.—The Avery steel tie; patent plain back shovels and spades.

Brown Sphinx Co., Chicago.—The Brown switch stand.

Buda Foundry & Mfg. Co., Chicago.—Switch stands, Buda derail, Paulus & Wilson track drills, Buda jacks, McManus combined gage and level, Buda hand cars and car replacers.

Chicago Wire Fence & Tool Co., Chicago. The new field built fence; fence tools.

The Climax Stock Guard Co., Chicago.—Climax shale clay cattle guards—full-size clay block and complete model of guard.

Continuous Rail Joint Co. of America, Newark, N. J.—Samples of rail joints.

Deadman & Holden, Sault Ste. Marie, Mich.—McCann & Brassel's rail chair and joint.

Dilworth, Porter & Co., Ltd., Pittsburg, Pa.—Descriptive matter and samples of "Goldie" claw tie plates, "Goldie Perfect" spikes and Glendon flange tie plates.

Dressel Railway Lamp Works, New York.—Switch lamps, long-burning founts and semaphore lamps—all steel.

Elliot Frog & Switch Co., East St. Louis, Ill.—Models of Hasty three-throw switch and Eureka spring rail frog.

Fairbanks, Morse & Co., Chicago.—Full line of track tools, motor cars, hand cars, push cars and velocipedes.

Wm. Goldie, West Bay City, Mich.—The Goldie tie plug and Goldie girder rail.

Grip Nut Co., Railway Exchange, Chicago.—Grip nuts.

Handlan Buck Mfg. Co., St. Louis, Mo.—Handlan switch stands, Handlan switch lamps, Mitchell's patent switch points, Paulus track drills, Waterman track drills, Beland track drills, Noble's switch-locking device, Joker wheel holder, Handlan's "Unexcelled" tool handles, Huntington track gages and Eyeless picks.

Hart Steel Co., New York and Elyria, Ohio.—Hart tie plates.

Hayes Track Appliance Co., Geneva, N. Y.—The Hayes lifting and pivot derails.

Hussey-Binns Shovel Co., Pittsburg.—Samples of track and locomotive shovels and scoops for handling stone ballast.

Independent Railroad Supply Co., Chicago.—Wolhaupter standard tie plate, Wolhaupter "C" rail joint, "Chicago" 4-flange tie plates and "Federal" single-flange tie plates.

Indianapolis Switch & Frog Co., Springfield, Ohio.—A 90-lb. "T" rail spring frog.

International Acheson Graphite Co., Niagara Falls, N. Y.—Specimens of artificial graphite made in an electric furnace and samples of the raw products from which it is made; also specimens of graphite paint films and samples of artificial graphite pigments.

Philip S. Justice & Co., Philadelphia, Pa.—"Reliance" hydraulic jacks and the Justice spike puller.

Light Inspection Car Co., Hagerstown, Ind.—Light inspection cars.

Locomotive Appliance Co., Chicago.—Smyth derailing switches and Newton wrecking frogs.

McCord & Co., Chicago.—"Gibraltar" bumping posts.

A. Morrison (Cambria Steel Co.), Newark, N. J.—The "100 Per Cent." rail joints.

Louis Mueller, Owosso, Mich.—A patent truss support for rail joints.

National Lock Washer Co., Newark, N. J.—Samples of the "National" lock washers.

Pennsylvania Steel Co., Philadelphia, Pa.—Spring rail frog, split switch, switch point locking device, reinforced split switch with adjustable connecting bar; "New Century" adjustable and non-adjustable switch stands and the "New Era" switch stand.

Railroad Supply Co., Chicago. Samples of Wolhaupter and Q. & W tie plates.

Scott Mfg. Co., Racine, Wis.—Rail anchors.

F. A. Smith, Railway Exchange, Chicago.—Railroad curve lining gage.

D. P. Springer, Waverly, N. Y.—Rail joints.

Standard Railway Track Appliance Co., Kalamazoo, Mich.—Track and car jacks, cattle guards and a collapsible self-feed rail drill.

U. S. Metal & Mfg. Co., New York.—"Victor" and "Perfect" car replacers and samples of the "Columbia" lock nut.

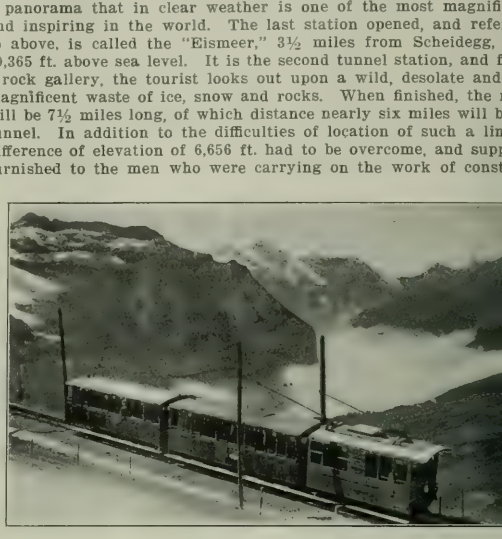
Walters & Okell, Ft. Madison, Iowa.—Walters ballast placing device.

Wm. Wharton, Jr., & Co., Inc., Philadelphia.—Wharton's unbroken main line switch and manganese steel frogs.

The Jungfrau Railroad.

BY REGINALD GORDON.

Another section of the highest mountain railroad in Europe has recently (August, 1905) been opened to the public. This line, projected to ultimately reach the summit of the Jungfrau, the highest peak in that part of Switzerland known as the Bernese-Oberland, 13,660 ft. above sea level, was begun several years ago, but in its construction great difficulties have had to be met and overcome, the cost has been very great, and its completion correspondingly slow; but it is now confidently expected that it will be finished about 1910. Starting at Scheidegg station on the Wengern Alp Railway, 6,770 ft. above the level of the sea, the Jungfrau railroad runs along the edge of the rocky slopes alternating with green pastures; and at a point about one mile and a quarter from the place of beginning, reaches the first station, situated at the glacier of the Enger m tain, thence into a tunnel through this; and when finished, have traversed the next, called the Mönch, and finally will bore the third mountain, whose summit is the objective point, the J frau, in the top of which the tunnel station will be 13,425 ft. a sea level. An elevator, running in a shaft rising from this tion to the peak, 239 ft., will carry passengers to the outer where they will be surrounded by a mass of perpetual snow, a panorama that in clear weather is one of the most magnifi and inspiring in the world. The last station opened, and refe to above, is called the "Eismeer," 3½ miles from Scheidegg, 10,365 ft. above sea level. It is the second tunnel station, and f a rock gallery, the tourist looks out upon a wild, desolate and magnificent waste of ice, snow and rocks. When finished, the will be 7½ miles long, of which distance nearly six miles will b tunnel. In addition to the difficulties of location of such a lin difference of elevation of 6,656 ft. had to be overcome, and supp furnished to the men who were carrying on the work of const



Train on the Jungfrau Railroad.

tion in regions usually visited only by guides and climbers ac tomed to the hardships of Alpine exploration. There will be intermediate stations, three in the tunnel, and at such points the line is very near the outer face of the mountain, and w lateral tunnels, about 50 ft. in length, lead to galleries from w the various views of the cliffs and glaciers can be obtained, where small waiting and refreshment rooms will eventually built.

To operate a railroad through the 6,600 ft. rise in 7½ m (the conditions to be met in this case), the rack rail system adopted, with electric locomotives taking power from two head wires supplying polyphase alternating current. The roa single track, substantially built, and stone ballasted. With the ception of two short stretches the grade is 25 per cent. Ther a moderate amount of curvature, the smallest radius of whic 328 ft. The rails, laid to a gage of one meter (39⅜ in.), w 42 lbs. per yard, and together with the rack rail, are securely bo to steel ties 5 ft. 10 in. long, weighing 81 lbs. apiece, and sp about 39 in. apart, center to center. Power to operate the is obtained from the White Lütschine river at the village of La brunnen, where a steel pipe line 6 ft. in diameter and 2,26 long, conveys water from an intake to the power station, a subs tial building of concrete with tiled roof and containing the bines, generators, switchboard, etc. The available head of wat 115 ft. In the station are two Girard turbines, 500 h.p. each, by J. J. Rieter & Co., of Winterthur; and two Francis turbines, h.p. each, by Escher, Wyss & Co., Zurich. Two small wheels h.p. each, for driving the exciter dynamos, make the total h power installed 2,650. Each one of the four main turbines di by direct shaft coupling at 380 revolutions a minute; a gener developing two-phase alternating current at 7,000 volts and 3 riods per second. For the excitation of these generators there two small machines driven by the 25 h.p. wheels before menti at 700 r.p.m., and generating a current of 250 amperes at 65 These six generators were furnished by the Oerlikon Machine W and by Brown, Boveri & Co., of Baden.

From the switchboard in the power house the energy is t mitted by a three-wire line of hard drawn copper, bare wires in. in diameter on triple porcelain insulators being used fast on iron brackets screwed into "treated" wood poles, 40 ft. high, spaced 98 ft. apart. This line is about 3⅛ miles long, and is ried up over the mountains to Scheidegg, more than 4,000 ft. hi than the power house. Here two transformers are installe which the line pressure, 7,000 volts, is stepped down to 550 for the trolley wires. At each station there is also a small t former to reduce the pressure from 7,000 to 200 volts for ligh and heating in and about the station. On all open stretches

trolley wires are hung from a cross suspension between a double line of poles, and the feed wires (high tension) are carried on the same poles; but in the tunnel the trolley suspension is anchored into the roof and the high tension lines are rubber covered and fastened on brackets set into the side wall.

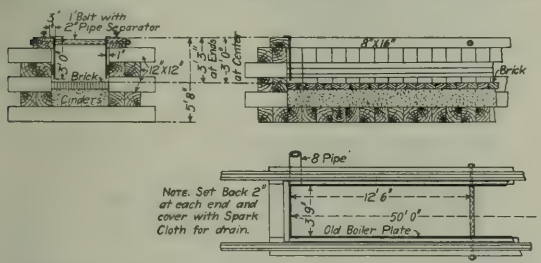
The trains consist of a locomotive with a car body on the same frame, and two trail cars. They were furnished by Brown, Boveri & Co., the Oerlikon Machine Works, and the Swiss Locomotive Works. The locomotive proper is 14 ft. 4 in. long and 8 ft. 5 in. wide, with four wheels on the running rails and two toothed driving wheels meshing into the rack rail. The other end of the frame carrying the car body is supported on a four-wheel pivoted truck. There are six locomotives, nearly alike except in certain details, the lightest weighing 13 tons and having two 120 h.p. motors; and the heaviest weighing 18½ tons, with two 150 h.p. motors. The motors drive the toothed wheels by double reduction gearing, and have the controller and resistances mounted above them and in a horizontal position in the motorman's cab. These resistances are air cooled by a fan driven by a 1½ h.p. motor also mounted in the cab. For controlling the speed when running down hill there is a band brake applied to a drum on the axle of the toothed wheel, a lever brake that grips the sides of the rack rail, and also means of controlling the motors so as to retard their rotation. In the last locomotives built, the motors are disconnected from the trolleys when going down grade, and acting as dynamos, feed current into the starting resistance. There are two trolleys connecting with the overhead wires, one for each phase, and instead of the usual trolley wheel a trough-shaped current collector is employed, about 11 in. long, with its contact surface faced with aluminum.

The car body on the locomotive frame and the trail car as well will seat 40 persons. These cars have cross seats and side doors in accordance with European practice, as well as one compartment in each where smoking is allowed. The trail car is 23 ft. long, mounted on two axles, one of which has also a toothed wheel engaging the rack rail so that a brake similar to that on the locomotive, and controlled from it, can be employed. This car weighs about eight tons. The carrying capacity of the Jungfrau railroad has been already severely taxed by the crowds that in fine weather are desirous of making the trip into this unique mountain tunnel.

A Cheap Wooden Spark Pit.

BY PAUL STERLING.
Assistant Engineer, N. Y., N. H. & H.

The accompanying drawing shows a cheap spark pit built of old bridge timbers which was recently put in at the Branch Switch yard of the New York, New Haven & Hartford at Hartford, Conn. The property on which the old engine house at this point formerly stood was recently sold to the State of Connecticut, and when the transfer was made a temporary spark pit was wanted immediately by the operating department. The pit was excavated 5 ft. 8 in. deep, about 56 ft. long and about 10 ft. wide. The bottom was laid with old 8-in. x 8-in. and 10-in. x 10-in. bridge timbers, cut in lengths of about



A Cheap Wooden Spark Pit—New York, New Haven & Hartford.

9 ft., and a crib of short pieces of 12-in. x 12-in. timbers was built up to within 8 in. of the level of the bottom of the rail, the pit thus formed being 3 ft. 11 in. wide by 50 ft. long inside. Over the bottom was laid a bed of cinders about 14 in. deep, and this was covered with brick pavement. The bottom was given a slope of 3 in. each way from the center for drainage, which was carried off through an 8-in. drain at each end. An 8-in. x 16-in. stringer was bolted along the top of the sides of the pit, and on these pieces the rails were spiked to gage. To prevent spreading these stringers were bolted together at 12-ft. intervals with 1-in. bolts inside of 2-in. pipe spreaders. The inside edge of the stringers was made to project 1 in. beyond the face of the crib, and old boiler plate, 3 ft. wide, was bolted to the stringers projecting down to the brick floor and separated from the wooden crib by a 1-in. air space. This pit was built under the supervision of Mr. W. T. Spencer, Division Engineer, and was completed ready for use in three days from the beginning of the excavation. The cost, including labor, material and the value of old timber, was only about $200.

A Large Reinforced Concrete Standpipe.

BY GEORGE W. BLODGETT.

The town of Attleboro, Mass., has had for many years public water works, which, when built, were considered of sufficient capacity to satisfy the needs of this growing community, but which, because of the totally unexpected increase in population, and especially of manufacturing establishments, have been for some time entirely inadequate. The system included a Deane duplex pumping engine of 1,500,000 gal. daily capacity connected to a circular well 30 ft. in diameter and 25 ft. deep from which the water was forced through a cast-iron main to a 661,000 gallon steel standpipe.

To meet existing needs, a new well, 40 ft. in diameter, has been sunk, and a reinforced concrete standpipe, 50 ft. in diameter and 110 ft. high, is being built. This standpipe is located on the top of the highest elevation anywhere in the vicinity, and is now being built of reinforced concrete by the Aberthaw Construction Co., of Boston, the owners of the Ransome patents. The base of the standpipe is at elevation 252 ft. above mean tide—about 100 ft. higher than the old one. The bottom is a horizontal circle of about 40 ft. diameter through which pass the 24-in. cast-iron inlet and outlet pipes, which are controlled by suitable gates and valves placed in a concrete chamber about 8 ft. x 10 ft., built at one side, and partly below the level of the bottom of the standpipe.

The bottom of this standpipe, which is of concrete laid on a prepared surface, is united to the side walls by a curved invert of about 6 ft. radius; steel rods about 1 in. in diameter extend 8 ft. into the floor of the invert from the sides, and are curved upwards with the proper radius, and carried about 10 ft. up the side walls, to form a firm connection between the sides and and the bottom of the standpipe. These rods are twisted, as in most of the construction by the Ransome system.

The concrete-steel construction was decided on after due consideration for the following reasons:

1. Lower first cost, by which some $3,000 could be saved over the cost of a standpipe of the same capacity built entirely of steel.
2. Decreased cost for maintenance, as there is estimated to be practically no deterioration of consequence; hence
3. An unlimited life.

The vertical reinforcement consists of steel channel-bars 3 in. wide with 1½ in. flanges set vertically in the side walls every 9½ ft. These are spliced and bolted or rivetted at the joints, so as to be continuous for the whole height of the structure. Besides these, small vertical rods ¼ in. to ⅜ in. in diameter are placed at intervals of about 1 ft. apart around the walls, just inside the surface on the outside and inside of the wall, to prevent surface cracks. As there is great practical difficulty in building a structure of this kind as a monolith, it is to be made in sections about 5 ft. high, each of which is united to those above and below it by the steel channel-bars just mentioned, also by concrete keys, made by moulding in the upper surface of each section a channel or recess 3 in. wide and 4 in. deep, about midway of the thickness of the wall. These constitute the sides of a somewhat irregular polygon—no pains being taken to bring them into symmetrical form or connection with each other, and are practically chords of arcs of the circumference about 2 ft. long. When the section above is built, these are filled with the concrete being placed at the bottom of that section, thus firmly uniting the two.

The horizontal reinforcement, which, of course, it is of the highest importance should be ample in amount and properly placed, is composed of steel rods from 1½ in. in diameter at the bottom, diminishing to 1⅛ in. at the top. These are made in lengths of 56 ft. and bent to a radius such as to allow them to be placed in the wall just outside or just inside the vertical channel bars before mentioned. They are connected together so as to form a continuous ring by lapping about two feet at the joints, and secured by two heavy special clamps at each joint held by strong bolts firmly to the rods. The vertical channel bars are pierced through the flanges with holes about ⅝ in. diameter, 4 in. apart; through these holes pass half-inch rods of steel, projecting about 2 in. beyond the channel bars on each side. These short horizontal rods or pins serve to hold up the circular reinforcing rods which rest against the channel bars. The vertical distance between the curved rods forming the horizontal reinforcement varies from 4 in. at the bottom to 8 in. at the top, and the size from 1½ in. at the bottom to 1⅛ in. at the top. The concrete is composed of one part Atlas Portland cement, two parts sand, and four parts broken stone, carefully graded in size so as to fill the voids as completely as possible. The hill on which the standpipe is built contains many boulders of size from a few inches diameter up to several cubic yards, and of excellent quality for concrete. A stone crusher and concrete mixer operated by a steam engine have been installed and are furnished with suitable elevating machinery.

From the mixer, which holds about two cubic yards at a charge, the concrete is delivered into buckets and hoisted by a derrick to the platforms at the side of the wall, where it is dumped and shovelled into the moulds and thoroughly rammed. The mould for the outside of the wall is formed of narrow pine sheathing planed

smooth, tongued and grooved and set vertically to a true circle. No finish except a slight dressing with pneumatic hammers is to be given the exterior surface. The inside is to be plastered one-half inch thick with a mortar composed of cement, sand, glue and alum, trowelled smooth; hence no special pains is taken to have the interior surface smooth at present, as the mortar will adhere all the better for the little roughnesses that are present.

The wall of the standpipe is 18 in. thick at the bottom and 8 in. at the top, being built vertical on the outside, and having a batter of one-eighth of an inch per foot on the inside. It is to be finished with a heavy concrete cornice, and, as before mentioned, covered with a dome-shaped guastavino tile roof. When completed it will be the largest standpipe of this kind ever built.

Forging Machine Formers and Bulldozers.

The following extract is from a paper read at the Cleveland meeting of the National Railway Master Blacksmiths' Association by William J. Mayer, former blacksmith of the Michigan Central shops at West Detroit.

An upsetting machine or bulldozer, is an essential factor in an up-to-date blacksmith shop. The possibilities of these machines are unlimited and the articles that can be made on them are too numerous to mention. We hear considerable talk about doing work with "one stroke of the machine." I am not so much an advocate of the "one stroke" idea, as of the one *heat* idea. I believe in doing just as much as possible in one heat. The majority of formers and dies designed to complete a piece in one stroke are apt to become so complicated that the cost of making and maintaining the same would be considerable. We make articles such as brake mast rests, dead lever guides, ladder steps and grab-irons with two or three strokes of the machine, but always with one heat. The greatest trouble we experience is with the quality of iron furnished by the purchasing department. We never know what kind of iron we have until we come to work it, and you can imagine what we think, when we come to work a lot of hot short iron on the bulldozer.

The men operating the machines know how and what they can do and I have received some valuable hints from these men and believe in encouraging their suggestions as much as possible, and when the dies are made as suggested by them and prove a success don't say "I made this," but rather "We made this;" it costs no more and pays well. As to the quality of the work done on these machines: I met a Master Blacksmith who contended that bent hooks on arch-bars were better than up-set hooks. After returning home I had one of the repair men keep account of the arch-bars repaired on account of cracked hooks, and the result was that out of 28 hooks which failed 22 were bent hooks and 6 were upset hooks. This I think is evidence conclusive, and no more need be said on this score. We have recently experimented with chilled cast iron dies for the upsetting machine with very good results and I believe with a saving to the company. We have entirely eliminated machine work on these dies, using them just as they come from the foundry. The New York Central lines have recently adopted ¾ in. ladder steps as a standard; also the inspector of Safety Appliances require that grab-irons be placed on the four corners of all cars. This meant the making of thousands of grab-irons and the question of dies and headers became a serious one. Instead of making the dies for these of machine steel and the headers of tool steel, as formerly, we had them made of chilled cast-iron. These castings were obtained for the same price as grey iron, and no machine work was required. They gave the best of results, better even than that procured from the machine or tool steel dies formerly used.

Welding Locomotive Frames with Thermit.

The process of welding locomotive frames was recently introduced at the Boulton Shops of the Richmond, Fredericksburg & Potomac, and it has proved a perfect success in welding both cast steel and wrought frames.

The first cast steel frame welded by this process was on a large Pacific type locomotive. This frame broke in the top rail between the pedestals as shown by Fig. 1. The frame at the point of fracture was 5½ in. deep and 4½ in. wide. After dropping the front pair of drivers and removing only that part of the spring rigging which would facilitate the work on the broken parts, the fractured ends were drawn together and the frame carefully measured, after which a number of ⅝-in. holes were drilled through the fracture, and then chipped out, making a slot ⅝-in. wide through the frame. To allow for the contraction caused by the cooling of the weld, the frame

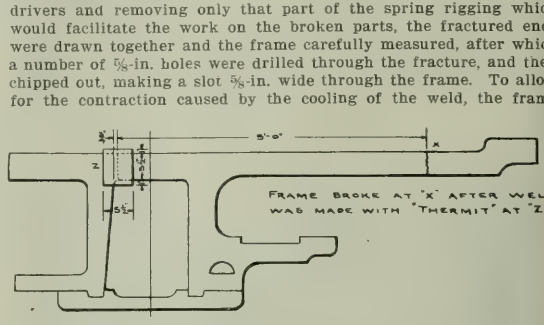


Fig. 1—Showing Location of Thermit Weld.

was sprung open ⅛ in. wider, making the total width of the slot ¾ in. The broken ends were heated with a gas burner to remove all grease and dirt, the frame was then ready to be welded.

Fig. 2 shows the mold used for welding the frame; it consisted of 3 parts of sharp core sand, 3 parts of river sand and one part of ordinary red clay. It will be noted that the mold is in six sections, the advantages of this is that it is more easily made and placed in position. These sections are denoted on fig. 2 by small letters enclosed by circles. The mold and also the sand surrounding the mold were thoroughly vented to allow for the escape of gases. The mold was also made to allow for a band 1 in. thick and 5½ in. wide around the frame at the point of fracture. This band was left on the frames, except when it was necessary to remove the same for clearance. In the case shown in Fig. 1, it was not necessary to remove any part of the band. All sections of the mold were covered with plumbago and thoroughly dried over a slow fire. A wooden box was used to secure the mold in position and a 3-in. space was left around the mold. This space was filled and rammed tightly with sharp sand. The advantage of using a wooden box in preference to a sheet iron box is its cheapness and the rapidity with which it can be constructed and placed in position.

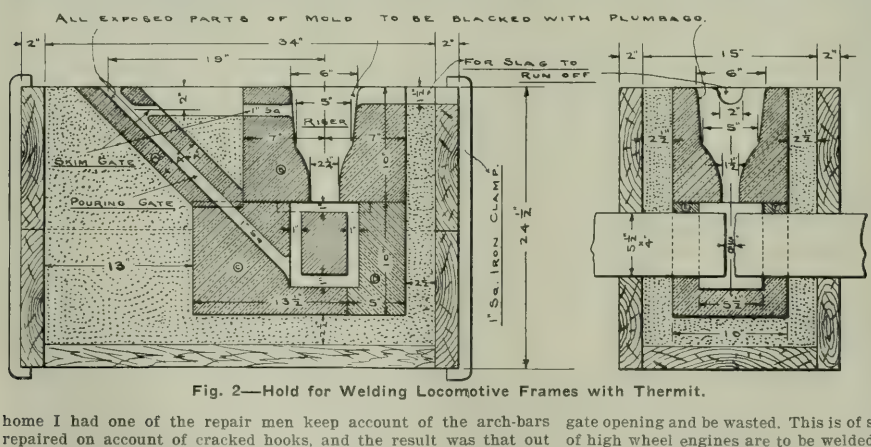


Fig. 2—Hold for Welding Locomotive Frames with Thermit.

Care should be taken to see that the crucible is large enough to allow for the reaction which takes place, and in making welds it should be held securely in position by brackets attached to the running boards; as the vibrations caused by the reaction are liable to cause the metal to run outside the pouring gate opening and be wasted. This is of special importance when frames of high wheel engines are to be welded, as it is necessary to raise the crucible to a considerable height. The thermit was ignited with a red hot rod, and a successful weld was made in less than one minute. After the metal had cooled sufficiently the mold was removed and the frame was measured, and was found to be its original length. The frame had been in service for a number of months when it again broke 5 ft. from the thermit weld. This is shown on fig. 1. It was necessary to remove the frame from this engine when it passed through the shops for repairs but the thermit weld was not disturbed. In making these thermit welds on both cast steel and wrought iron frames, the same good results were obtained, and in no case was it necessary to hold the engines out of service more than 2 days. The importance of getting these engines in service so quickly was clearly demonstrated during our last busy season.

In regard to the proper amount of thermit necessary for a good weld, our experience has been that the best results are obtained by using a liberal amount of the composition with ten per cent. of small steel punchings.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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Three weeks ago allusion was made in these columns to the effect of the new railroad construction on the grain production of Western Canada. The agricultural possibilities of this great region have so far been only lightly touched, and yet the returns are phenomenal, comparable with successful mining operations. For example, the Manitoba region, with a population of, roughly, 40,000 polls, produced last year $100,000,000 of agricultural returns; an average of $2,500 a year for each head of a family. We know of no like result anywhere else. The new Grand Trunk Pacific is about to increase these possibilities by its line, which opens an enormous addition to the wheat belt. In view of these facts, the Dominion Government's Tariff Commission is making local investigations of the effect of duties on United States manufactures of agricultural machinery and tools used in railroad construction, such as rock drills, steam shovels and grading machinery. The present duty is from 20 to 25 per cent. Its circular letter is mainly devoted to an inquiry for determining to what extent the consumer pays the duty and whether or not the effect of heavy duty is to reduce the quality. The facts obtained through this series of inquiries and the use which the Commission makes of them will be interesting to United States manufacturers, but the student of enconomics will not look for the development of any new laws or principles. The vital interest in the Commission's report and the action which may be taken as a result of it is rather its effect on the future of the wonderful agricultural region being opened up by the Dominion railroads.

The advantages of the three-position semaphore seem to be as follows: First.—That it makes for economy. Mr. E. C. Carter, of the Chicago & North-Western, in a paper sent to the International Railway Congress of 1900, reported that the average cost of maintaining a signal was thirty-five dollars a year. In view of the great number of signals involved in an extended application of block signaling, the savings effected by a device that consolidates two signals into one should not be ignored. Second.—The three-position signal extends the scope of application, while preserving clearness. With the constant increase in the speed of trains, the marked increase in the number of high-speed trains, and at the same time the increase in the length of freight trains and the accompanying decrease in the ability to handle them smartly, it is becoming essential to give indications covering longer stretches of track. There are urgent objections to lengthening the blocks, so that it seems desirable to extend the indications over three or more blocks, instead of confining them to two as now. With the three-position signal this may be done and at the same time restrict the number of signal blades on a post to two, as required by the best practice. Third.—There are material advantages in having the semaphore moved through the upper quadrant instead of the lower, as in the present practice. This condition has been met by the Loree-Patenall signal. The cost of construction is reduced by eliminating the castings used for counterweights, and the danger from loading by sleet is removed, while the practicability of working this signal with the present type, with the possibility of five indications, may materially aid in developing the possibilities of signaling. What are the objections to it?

Mobile papers reported a short time ago that, as a result of local sentiment adverse to the original plan, the officers of the railroads which are to build the fine new union station there had agreed to build a train shed instead of umbrella sheds as originally planned. Just what arguments were presented to induce this change of mind on the part of the railroads we are not informed. We assume, however, that as usual in the most of such cases, the objections of the citizens are based largely, if not altogether, on the matter of appearance. If this is so, it is plain that through ignorance or mistaken pride they are failing to consult either their own comfort or that of other travelers who will use their station. The primary purpose of the train shed is, of course, to afford protection from rain, snow and wind. Its value is largely a matter of climate. In regions where the winters are long and cold and the snows heavy and frequent, the advantages afforded by the train shed at such times possibly offset its objectionable features; though this is not necessarily true, for in inclement weather the train shed is drafty and unhealthy. But Mobile, with its short, mild winters, where snow is rarely seen, and its long, hot summers, when the discomforts of a train shed are extreme, would experience only the disadvantages; whereas, umbrella sheds, properly designed, while furnishing ample protection from rains, afford the maximum of coolness and light, and entire freedom from smoke and gas, while other nuisances of the large shed are mitigated

if not entirely avoided. Any objections that attach to the usual form of umbrella shed appear to have been overcome in the design adopted for the new Washington terminal. In appearance the roof is inverted, the low point being at the middle, over the supporting columns, and the sides extending out well over the cars. The drainage is therefore toward the middle, avoiding annoyance from drippings. A consideration which does not affect the citizens, but is paramount to the railroad companies is the greater first cost and the high maintenance cost of the train shed. These points, together with the other objectionable features, have been dwelt on at length in these columns at various times, the *Railroad Gazette* having been for years a consistent advocate of the umbrella shed. Those wishing a compromise plan will find the design of Mr. Bush, of the Delaware, Lackawanna & Western, described in our issue of September 1, most interesting.

Mr. Joseph Ramsey, Jr., has furnished one of the two highly interesting news items of the week, by advertising, over his signature as President, an appeal to the debenture and stock holders of the Wabash, recounting his services on the road, enumerating the cost of improvements made under his administration, saying that he had been denied access to the stock books of the company and asking proxies for use at the annual meeting on October 10. This notice was published after the stock transfer books of the company had been closed. In interviews since that time, Mr. Ramsey has said that he was not acting in the interest of any other railroad and that he had taken the step solely on his own responsibility and for the welfare of the road. As to the result of Mr. Ramsey's campaign there is much doubt. Definite information on the subject seems to be entirely lacking. It is known in general that Mr. Gould's policy is to hold 40 per cent. of the securities of his roads, and the Wabash has long been a Gould line. It is also known that Standard Oil interests have large ownership in the property. Without the support of nearly all outside share holders, it seems doubtful that Mr. Ramsey can succeed in opposition to the Gould party; but it is only fair to him to say that in all probability he knew full well what he was doing when he took the step, and, as a railroad manager and financier, he has a high reputation to live up to. Should the control of the Wabash be taken from the Gould family, the ambitious plans of Mr. George Gould for a line under his control from the Atlantic to the Pacific would be overthrown, for the Wabash is the connecting link between St. Louis and Pittsburg. The importance of the Wabash in this proposed ocean-to-ocean line appears in the following enumeration of the controlled lines and the parts under construction. Beginning at Baltimore, the Western Maryland is in operation to Hancock, 116 miles. There is under construction a line from Hancock to Cumberland, 55 miles. The West Virginia Central & Pittsburg is in operation from Cumberland to Belington, 131 miles, leaving a so far unfilled gap of about 100 miles from Belington to Pittsburg. Here the Wabash-Pittsburg Terminal line extends to Pittsburg Junction, 60 miles, and the Wheeling & Lake Erie from Pittsburg Junction to Toledo, 190 miles. The importance of the Wabash lines from Toledo to St. Louis, 436 miles, or from Toledo to Kansas City, 713 miles, is overwhelming, for the Wabash connects at St. Louis with the Missouri Pacific line to Pueblo, 923 miles, or an alternative route on the Missouri Pacific from Kansas City to Pueblo, 640 miles. The Denver & Rio Grande reaches from Pueblo to Salt Lake City, 624 miles, where the projected Western Pacific line will run from Salt Lake City to San Francisco, about 1,000 miles. By alternative routes, therefore, the total distance from ocean to ocean is quite alike, being estimated at 3,629 miles or 3,635 miles; but the Wabash is indispensable.

A LIFE-SAVING INCIDENT.

It is not at all uncommon in attempting to derive lessons from derailments and wrecks to arrive theoretically at a conclusion that certain life-saving appliances might have prevented the disaster or lessened it. It is unusual to get an exact measurement of the value of a life-saving appliance in a case where it has just barely prevented a great disaster; and when such a case occurs, comparatively little attention is apt to be paid to it. Great tragedies arouse all of us, but prevention makes us shudder for a moment and pass by.

On August 4 last, the Atlantic City express to New York, consisting of an engine, baggage car, combination car and three coaches, was crossing a bridge over Newark Bay and met an open switch leading to an uncompleted track. The engine and tender went off into the water, and the baggage car came to rest with one end on the tender and the other end on the bridge. One life was lost, that of the engineman. The combination car next behind the baggage car was derailed, but came to rest so near to the limit of the bridge floor that it might have been pushed off by hand, and we may fairly say that the limit of brake efficiency on this train was fully reached in preventing a great disaster. It is worth while, therefore, to inquire into the condition of the brakes of this train and compare it with that of thousands of other high-speed trains running every day in this country.

In 1903 some tests were made on the Central Railroad of New Jersey for the purpose of determining the proportionate value in stopping trains of the high-speed attachment to the quick-acting brake, as well as other improvements in the art of retarding trains. It may be well to summarize again here, what was demonstrated at that time, as follows:

1. It was found to be practicable to brake passenger trains at a higher percentage of their light weight than was considered standard practice throughout the country.

2. Brakes on the locomotive truck wheels shortened, approximately 100 ft., the stops of a six-car train from a speed of 60 miles an hour. The truck brake shortened the stop of three-car trains at 80 miles an hour by about 300 ft.

3. It was found practicable to brake the front trucks higher than had previously been considered good practice.

4. The use of an air gage in the cab, with connection to the driver and truck brake cylinder, frequently showed the brakes to be in poor condition when, without the gage, they were thought to be in first-class condition. This was apparently due to a liability to leakage from the driver brake cylinders, which did not ordinarily exist on cars.

5. The substitution of the quick-action triple valve for a plain triple on the tender secured a quicker application of the emergency brake because of the venting of the train pipe pressure in the cylinder instead of to the atmosphere.

6. A uniform and minimum piston travel on all the vehicles not only aided in handling the train smoothly, but shortened the stop by securing an equal distribution of brake force on all wheels and permitting the application of high braking force with little danger of skidding the wheels.

As a result of the experiment and the above demonstrations the Atlantic City express had the high-speed attachment to the quick-acting brake on the engine and all vehicles. The locomotive truck wheels were braked; there was an automatic slack adjuster on the engine truck brake; there was a gage in the cab of the engine connected to the driver and truck brake cylinders. In fact, all the appliances found to be of any value in the 1903 experiments were in use on this train, which was stopped within inches, or a fraction of a second, of complete wreck and drowning of its passengers. It is plain, therefore, that the absence of any one of these refinements of brake practice, would have resulted in one or all of the passenger cars on this train being plunged into the bay. It is highly probable that, aside from saving life, the money cost to the company of those lives and of the destruction of property has in this one incident fully paid for all the improvements.

THE CINCINNATI, HAMILTON & DAYTON SALE.

The sale of the control of the Cincinnati, Hamilton & Dayton through Messrs. J. P. Morgan & Co., to the Erie, at a price of 160 for the stock, eliminates the last important independent group of roads in trunk line territory. By the acquisition last year of the Pere Marquette and the Chicago, Cincinnati & Louisville, the C., H. & D.—"The Great Central Route," as Mr. Zimmerman called it—came into control of about 3,450 miles of line in addition to car ferries on Lake Erie and Lake Michigan. The C., H. & D. proper owns lines from Cincinnati west to Springfield, Ill., north via Dayton to Toledo, and from Dayton southeast to Ironton on the Ohio river. The Pere Marquette occupies an important place on the lower peninsular of Michigan connects with the C., H. & D. at Toledo, and has a through line from Chicago to St. Thomas, Ont., with trackage rights over the Michigan Central from St. Thomas to Suspension Bridge and Buffalo. The Chicago, Cincinnati & Louisville runs from Cincinnati to Hammond, Ind., 20 miles out of Chicago (its passenger trains to Griffith, 29 miles out), but as yet—map makers to the contrary notwithstanding—it has no line into the city. At Hammond, however, it connects with some of the Chicago belt lines. The record of these companies for the last two years is a history of syndicate transactions. First, the Pere Marquette syndicate bought $12,071,-

000 of P. M. common and preferred stock; second, the Chicago, Cincinnati & Louisville syndicate built most of that line, and was bought out for $3,500,000, paid in Pere Marquette notes; third, the original Cincinnati, Hamilton & Dayton syndicate bought control of the C., H. & D. through purchase of a majority of the common stock. Under the guidance of this syndicate the C., H. & D. bought the stock of the Pere Marquette (which had cost the Pere Marquette syndicate [No. 1] about $85 a share) for $125 a share, paid for in bonds and notes of the C., H. & D. The C., H. & D. also guaranteed 4 per cent. on Pere Marquette preferred and 5 per cent. on Pere Marquette common stock. This syndicate, under threat by the minority interest in the Cincinnati, Hamilton & Dayton, bought out the preferred stockholders at a good price, thus reducing the total amount of C., H. & D. stock outstanding. Fourth, came the H. B. Hollins syndicate, formed in 1904, which bought subscription rights at a price estimated at 135 to more than 50 per cent. of the controlling interest in C., H. & D. stock owned by the original Cincinnati, Hamilton & Dayton syndicate. There were profits all along the line. The Chicago, Cincinnati & Louisville syndicate No. 2 made its profits in notes of the Pere Marquette. The Pere Marquette syndicate No. 1 made its profits in securities of the C., H. & D. The original Cincinnati, Hamilton & Dayton syndicate No. 3 profited from the sale to H. B. Hollins of the controlling interest in its controlling interest, and will profit in the final sale of the road. The Hollins syndicate profited by the difference between the price paid by it for a controlling interest in the stock owned by the original C., H. & D. syndicate and the price at which it sold its subscription rights to J. P. Morgan & Co. This scant record of the recent syndicate operations connected with the property is given in order to show the number of middlemen's profits which increased the cost of the road to the final purchaser. The financial powers which were interested enough in eliminating the C., H. & D. and P. M. system as a possible rate disturber in trunk line territory to buy control, will pay at least $160 a share for a stock that pays no dividend, of a road that is said this year to have failed by nearly $1,000,000 to meet its charges and guaranteed dividends, and will furnish profits to a whole line of syndicates or middlemen who have dealt in the securities of the roads during the past two years. In other words, it is still a profitable business to consolidate new "systems" out of potential rate disturbers in trunk line territory. Unfortunately, however, for the ambitions of others, this can hardly again be successfully carried out for the simple reason that material is lacking; there are no more independent roads left in that territory large enough to make such a process effective.

So far as we know, Messrs. J. P. Morgan & Co. have bought subscription rights to some 56,000 of the 65,000 shares to which H. B. Hollins & Co. held subscription rights. By the operations of the various syndicates the total amount of Cincinnati, Hamilton & Dayton stock outstanding has been reduced to 80,000 shares, of which the 65,000 shares are in the hands of a voting trust. Although actual shares of stock, amounting to a majority, are not therefore held at present by J. P. Morgan & Co., yet to all intents and purposes the road is sold; and being sold to this firm means, we are informed, sold to the Erie railroad. That this control would be divided between the trunk lines seemed reasonable, for there are no other interests in a financial position to afford to make an investment so unprofitable, *per se*, and at the same time so sound an investment for preventing loss of traffic. For some time it has been reported that the Erie has been negotiating for the property. The Erie has no line into Cincinnati, but runs trains from Dayton to Cincinnati over the Cincinnati, Hamilton & Dayton tracks. Since the C., H. & D. has gone to the Erie, it gives that road entrance to Toledo, Ironton, Cincinnati, Indianapolis and Springfield, Ill. On the other hand, the Erie brings to the Chicago, Cincinnati & Louisville a real entrance into Chicago from Griffith and Hammond, Ind. That the control of the road goes to the Erie, will be to many a strong indication that the Erie is controlled in the interests of the two dominating trunk lines. The Erie's financial weakness and the natural interest of the Vanderbilt lines in the transaction makes it seem natural that the Pere Marquette should eventually go to the Michigan Central, of which it is an active competitor all the way between Chicago and Buffalo. In addition to the value of the Cincinnati, Hamilton & Dayton to the Erie, in securing terminals and feeders, the control of the whole system will relieve the Erie, Pennsylvania, Baltimore & Ohio, Lake Shore, Big Four and Michigan Central of a weak and therefore dangerous competitor. Not only was there potential danger to the general rate situation in a combination of roads which, although almost uniformly poorly situated, could, at a pinch, handle competitive traffic in a variety of directions, but in particular the trunk lines south of Lake Erie were losing the former C., H. & D. business. The road for about 100 miles north from Cincinnati runs through a region alive with manufacturing plants. Before taking over the Pere Marquette, the C., H. & D. turned over the large eastbound traffic from these industries to the trunk lines which it intersects between Cincinnati and Toledo—the two Pennsylvania lines, the Erie and the Lake Shore. With the Pere Marquette in the family, this traffic, instead of going east by one of the direct lines, was turned over to the Pere Marquette at Toledo, and by it carried north to Detroit or Port Huron, thence east to St. Thomas and Buffalo, taking the freight, as a traffic officer expressed it, round Robin Hood's barn to get to the coast. Thus not only were the trunk lines suffering from the natural competition of the lines in the C., H. & D. and P. M. system, but much business which they considered should naturally come to them was entirely diverted. Though at first sight it would scarcely seem that they had anything to fear from the Great Central aggregation, these facts help to show why it was important that these roads should be in safe hands. It appears, in fact, that the sale of the C., H. & D. and P. M. system is merely a modern development of the old business of selling out to strong competitors. With this lastest acquisition by the Erie or its backers, trunk line territory is held in close control, in marked contrast to the territory west of Chicago, where strong competition still exists. An interesting conjecture, however, is as to whether the Detroit, Toledo & Ironton, lately formed by the same interests which have controlled the C., H. & D., from the reorganized Detroit Southern and merged with the Ann Arbor, will be taken over by the trunk line powers as was the Hocking Valley, a somewhat similar Ohio river to great lakes coal carrying road.

It is to be observed that the railroad dividing line at Chicago is not disturbed by this most recent change of control. Some members of the syndicate which held control of the road wanted to consolidate the C., H. & D. and P. M. with the Wisconsin Central and the Toledo, St. Louis & Western, which would have resulted in mixing trunk line and granger territory; but happily this possible addition of one more thorn in the flesh of Chicago rate adjusters has failed.

August Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of August, printed in another column, contains accounts of 19 collisions and 28 derailments. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
1st	Kendallville, Ind.	0	14
4th	Bayonne, N. J.	1	0
8th	Emporia, Kan.	0	10
10th	Elkins, W. Va.	2	4
13th	Vermillion, Ohio	12	25
15th	Rushville, Ind.	0	8
16th	Corona, Cal.	6	15
16th	Cincinnati, Ohio	..	..
17th	Bruce, Va.	15	25

The most prominent item of these nine, the last one, affords two very simple lessons; the need of derailing switches at drawbridges, and the importance of having only experienced enginemen on passenger trains. Every one admits the universal application of the last-mentioned lesson, the need of a rule forbidding the sending out of inexperienced men on important trains; but in the light of this disaster a more specific question is, What regulations are established for the government of trainmasters and despatchers in making temporary exceptions to this rule? The most noticeable point of superiority to be found in the rules of English railroads, or of the United States army or navy, in comparing them with American railrod rules, is their more careful and minute provision for a suitable temporary arrangement when regular arrangements fail; for a temporary substitute when a regular man is unexpectedly incapacitated. American railroad rules are worded as though reliable men were to be always on duty; never sick and never needing a vacation. When a railroad puts a man of little experience temporarily in a place where the maximum of experinece is needed, the public charitably assumes that such course was made necessary by an emergency; but do not trainmasters and despatchers many times submit to a supposed emergency which really is not one? In other words, do we correctly weigh the risks and put forth a reasonable degree of energy to avoid them?

There should be an interlocked derail at every drawbridge in a passenger line; we have called this a simple lesson. But if we may judge by the actual situation on some thin lines, not all railroad managers agree with us; except, perhaps, in theory, which does not mean much. If the traffic on a given line is very light

the stopping of the trains before crossing is deemed a sufficient safeguard, without a derailer. But what do we mean by "very light" traffic? Is traffic light where trains carry two or three hundred passengers each?

The existence of a drawbridge in the middle of a two mile block-section, with no mechanical or electrical connection between the bridge and the block signals, is an arrangement the farthest possible removed from complete signaling; and yet it is theoretically no harder to manage than some very common conditions, such as those of outlying switches. A very simple rule serves as a substitute for interlocking, and the rule may no doubt suffice for years with an extremely small percentage of lapses or failures. But in a case where several safeguards have been omitted it is perhaps a waste of time to speculate concerning the probabilities of disaster from the failure of a single safeguard.

The Vermillion collision seems to have been due to a very well-known kind of forgetfulness and therefore would appear to belong in a common (and disgraceful) class which does not at present call for discussion—at least not in the presence of readers of the *Railroad Gazette*. The derailment at Bayonne, N. J., was discussed in our issue of August 18, and is also the subject of an editorial in this issue.

The number of electric car accidents reported in the newspapers as occurring in the month of August was 33, in which 21 persons were killed and 277 injured, the most disastrous record for many months. The worst accident in this class was that at Butte, Mont., on the 20th, when a street car was struck by a switching freight train at a crossing, in the evening, killing 10 passengers. This was reported in the *Railroad Gazette* of September 1. At the inquest it was claimed on behalf of the street railway that there was no brakeman, or other person, on the front end of the freight train (which was being pushed). It is said that the street car had been brought to a full stop before passing over the crossing. At Cincinnati, on the 16th, a street car, which was struck by the locomotive of a passenger train at a crossing, threw the passenger train off the track, and the accident appears in our train-accident record. Three of the street car passengers were killed. In a crossing accident at Columbus, Ohio, on the 10th, a switching engine of the Hocking Valley road "came out second best," the engine being derailed and getting one of its driving wheels broken, while the street car held to the rails. Twelve of the 33 electric car accidents of the month occurred in New York City or Brooklyn and five of the fatalities are charged to these 12 accidents.

Hocking Valley.

The Hocking Valley operates 647 miles of line from Pomeroy and Gallipolis on the Ohio river across the state of Ohio to Lake Erie at Toledo. It also controls the Toledo & Ohio Central, a parallel line, and the Kanawha & Michigan, which connects it and the C. & O. C. with the West Virginia coal fields. The Hocking Valley itself has been controlled since June, 1903, by a community of interest of trunk line railroads. In that year, $6,924,200 of its outstanding $11,000,000 common stock was sold through J. P. Morgan & Co. to the following five railroads, each of which holds the interest stated: Pittsburg, Cincinnati, Chicago & St. Louis, two-sixths; Baltimore & Ohio, Chesapeake & Ohio, Lake Shore & Michigan Southern and Erie, one-sixth each. Thus control of the two north and south coal carrying lines is, from the trunk line standpoint, in safe hands. Before last year the Hocking Valley met almost uniformly unfavorable conditions; the depression in the iron and steel industry slackened the demand for coal, and the company suffered severely from the masters' and pilots' strike on the great lakes, which came at what should have been the most active season of the year. The traffic of the road is almost entirely in coal from West Virginia and southern Ohio to the lower lake ports, and return shipments of mineral ore to the iron furnaces. The unfavorable conditions in 1904 reduced the total freight traffic from 8,262,816 tons in 1903 to 6,977,163 tons, the bulk of the decrease being in the mineral tonnage. The past year, ending June 30, 1905, has shown an increase, but not a sufficient increase to bring the figure back to the high of 1903. The number of tons of freight carried for the year was 7,810,545 tons. The tons of freight carried one mile were 1,053,094,815 in 1903, 885,937,215 in 1904 and 998,047,025 in 1905. The average haul of freight during the three years has varied less than one mile, being about 127 miles, which shows the uniform character of the company's tonnage.

The Hocking Valley has for several years been notable in the size of its train load. In the first four months of operation after the reorganization of the Columbus, Hocking Valley & Toledo, ending June 30, 1899, the average train load was 522 tons. In 1900 the figure was raised to 646 tons, a remarkable increase. In 1901 the average number of tons carried was 645 on the entire line, 195 on the river division and 686 on the main line. During the next year there was another large increase to 678 tons on the entire line, 230 on the river division and 713 tons on the main line. These are the largest figures in the company's history. In 1903 the figure for the entire line had dropped to 622 tons, with 230 tons on the river division and 654 tons on the main line. In 1904 there was a further drop to 554 tons on the entire line, 245 tons on the river division and 577 tons on the main line. During the past year the average train load for the entire line increased to 581 tons, with 237 tons the average for the river division and 601 tons for the main line. These are all large train loads, and the average of 678 tons in 1902 is particularly noteworthy. This was brought about no doubt by the abundant prosperity, especially in the iron and steel trades, in the latter half of 1901 and the first half of 1902. Apparently, the Hocking Valley can be most economically operated only when a maximum of traffic is available, for there has probably been no decrease in the efficiency of the motive power since that time.

The average amount received per mile from each ton of freight during the past year was 4.74 mills, against 4.96 mills in the preceding year, 4.51 in 1903 and 4.28 mills in 1902. The earnings per mile run by freight trains were $2.75 in both 1905 and 1904, against $2.81 in 1903. The passenger earnings of $764,057 are small compared with the $2,743,866 coal earnings and $1,985,573 freight earnings. One great reason for this is the short average distance traveled, which is 19.51 miles, yet this is an increase from the figure for 1904, which was 17.65 miles. It is easy to see how many more passengers a road like the Hocking Valley must carry to make its passenger earnings even up with those of a western road. Besides this handicap, the decrease of $67,571 in passenger earnings is stated to have been mainly due to new and increased competition of parallel electric lines. The tonnage statistics show that out of a total of 4,761,392 tons originating on the road, 3,856,074 tons were bituminous coal. Out of the total tonnage carried (7,810,545 tons), 5,111,921 tons were bituminous coal. The only other important products from the tonnage standpoint are coke, ores, stone and sand, iron and cement, brick and lime, all low-grade traffic.

The gross earnings of the property were $6,013,215 against $5,725,483 in 1904, an increase of $287,732, and the net earnings, $1,945,313, against $1,872,863 in 1904, an increase of $72,451. An unexpended balance of $243,455 from previous sales of first consolidated 4 per cent. mortgage bonds was expended, $20,772 for additions and improvements, and $222,683 in part payment of the principal of equipment notes maturing. There was charged to "cost of road and property" $92,615 for additions and improvements. From the equipment depreciation fund, amounting to $396,878, included in operating expenses and set aside for the renewal of equipment, there was expended $179,738 for the purchase of new equipment and for rebuilding. On the Toledo Division and on the Hocking Division 23 miles of 80-lb. rails were laid, a total rail renewal for the year of 4,700 tons.

On the whole, the road seems to have been well maintained, and a satisfactory traffic is at hand. With the present great prosperity in iron and steel, the earnings of the Hocking Valley should keep pace. On account of the limitations of its natural situation it can never be a great road, but as long as there is coal in West Virginia and iron ore in Michigan it will have a place in the industrial development of the country.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	647	632
Coal earnings	$2,743,866	$2,605,316
Freight earnings	1,985,573	1,789,722
Passenger earnings	764,057	831,628
Gross earnings	6,013,215	5,725,483
Maint. way and structures	651,206	590,360
Maint. of equipment	1,293,405	1,171,769
Conducting transportation	1,800,768	1,765,606
Operating expenses	3,860,438	3,646,789
Net earnings	2,152,776	2,078,693

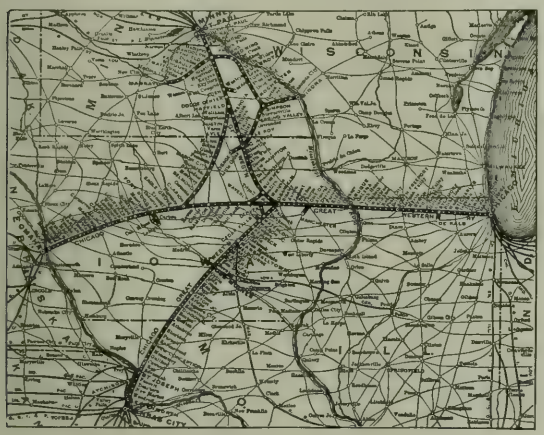
Chicago Great Western.

The Chicago Great Western has a line from Chicago west to Oelwein, Iowa, from which point three lines run, one northwest to Minneapolis and St. Paul, a second west to Omaha, and the third southwest to Kansas City. Until within the past two or three years only the lines to Minneapolis and St. Paul and to Kansas City were in existence, with few branches, and the company confined itself to through business and the traffic originating on its main line. The lines in 1901 formed, roughly, a regular figure Y, with Oelwein as the center. In 1901 an agreement was made with two syndicates which had acquired control of the Mason City & Fort Dodge Railroad, then operating a line from Mason City to Fort Dodge, Iowa, 72 miles, by which that road should be extended north from Mason City to a connection with the Chicago Great Western's Minnesota line, east from the nearest point on the Mason City & Fort Dodge line to a connection at Hampton, Iowa, with an extension of the Chicago-Oelwein line; and west from Fort Dodge to Omaha and to Sioux City. The lines mentioned under these agreements, with the exception of the Sioux City connection, were built and the transactions between the Chicago Great Western and the syndicates which built

the lines have been closed. The Omaha connection was opened in November, 1903.

The capital arrangements of the company are modeled on the English plan. The securities of the Chicago Great Western proper consist of 4 per cent. debenture stock, which partakes of the nature of both stock and bonds, 5 per cent. preferred "A" stock, 4 per cent. preferred "B" stock and common stock, with no bonds. The only mortgage indebtedness consists of $8,366,917 first mortgage 4 per cent. bonds on the Mason City & Fort Dodge. The company is said to be the only important system in the country controlled abroad. The importance of the foreign control is shown by the powers of the London Finance Committee, whose veto on any action of the directors involving the borrowing of money, the issue of new securities and all expenditures save for operating expenses, is final.

During the fiscal year ending June 30 the average mileage operated was 818 miles. This is a decrease of 56 miles from the figure for the previous year, this amount having been transferred to the Mason City & Fort Dodge, which now operates 386 miles of line. In the agreements made with the Mason City & Fort Dodge company at the time of its acquisition it was provided that although the line should be operated as part of the Chicago Great Western, separate accounts should be kept of the earnings and expenses of each line. Out of the net earnings of the Mason City & Fort Dodge the Chicago Great Western agreed to pay the coupons of bonds issued by that company, the surplus of net earnings to belong to the Chicago Great Western. All of the stock of the Mason City & Fort Dodge is in the possession of the Chicago Great Western, having been exchanged for stock of the latter company, share for share. Practically similar arrangements are made with the Wisconsin, Minnesota & Pacific Railroad, another proprietary line which operates 271 miles of branches in Minnesota.



Chicago Great Western.

In the last fiscal year the gross earnings were $7,377,711, a decrease of $644,963 from the preceding year. At the same time the net earnings ($2,254,618) increased $136,000, or 6.4 per cent. This increase, however, would have been a decrease if there had been proper expenditures for maintenance. The decrease in gross earnings was very large in July and August, 1904, and continued until May, 1905. In May and June the earnings showed increases. Taking the system as a whole, including the two subsidiary companies, there is a mileage of 1,467 miles operated. Gross earnings were $9,519,111, a decrease of $118,999, and net earnings $3,041,586, an increase of $367,653.

There has been considerable criticism which is reflected in the current price of the company's securities, of its financial policy both as regards capital and current expenditures. This is borne out by the maintenance figures of the report. Maintenance of way, for instance, for which the company spent in 1904 about $1,000 per mile of road, during the past year dropped to $890 per mile on the 818 miles operated. The figure for the preceding year was based on 874 miles. Maintenance of way expenditures on the proprietary lines do not at all help to explain this low figure per mile. On the Mason City & Fort Dodge maintenance of way figures show $364 per mile in 1905 against $351 per mile in 1904. As this line includes most of the Omaha extension the figure seems entirely too low. On the Wisconsin, Minnesota & Pacific (branch lines) maintenance of way was about $445 per mile in both 1905 and 1904. Thus the maintenance of way expenditures on the new main line extension to Omaha were less in both years than on the branch lines in Minnesota. The average figure for the whole system if taken together would thus be considerably less than the Chicago Great Western figure of $890 per mile, which in itself, for a freight road with a density of 885,000 tons of freight carried one mile per mile of road, and all of its mileage but 20 miles main line mileage, is decidedly low. For maintenance of equipment (repairs of locomotives) the company spent $1,478 for each of the 265 locomotives owned. Repairs of freight cars figure out at $42.50 for each of the 7,235 freight cars, and repairs of passenger cars $737 for each of the 148 passenger cars. On the other hand conducting transportation figures show an improvement for the year. In 1904 conducting transportation was 60.40 per cent. of the total expenses, and, with general expenses, 49.95 per cent. of the gross earnings, both very large figures. The past year conducting transportation took 59.96 per cent. of the total expenses and with general expenses amounted to 47.31 per cent. of the gross earnings. In this connection it must be remembered that each year the gross earnings contained a little over $100,000 received as surplus from proprietary companies. Conducting transportation, not including fuel for locomotives, was 43.90 per cent. of the total expenses in 1904 and 44.44 per cent. in 1905.

During the past year additions and improvements to the permanent plant were made at an expenditure of $713,574, all of which apparently was charged to capital account. Of this sum, $79,296 was for ballasting heretofore unballasted track.

On the Chicago Great Western proper, freight earnings, which were $5,096,543, decreased $714,516, or 12.31 per cent. from 1904. Passenger earnings at the same time increased 2.27 per cent. There was a decrease of 15.85 per cent. in maintenance of way expenses; 12.35 per cent. in maintenance of equipment; 18.30 per cent. in cost of fuel for locomotives; 12.17 per cent. in other conducting transportation expenses, and 5.20 per cent. in general expenses, an average of 13.23 per cent. of decrease.

The number of tons of revenue freight carried was 2,816,707, which is practically the figure for 1904. There was, however, a decrease of 36,341 tons in the number of tons carried one mile per mile of road. The average haul of each ton decreased from 285 miles to 257 miles, or nearly 10 per cent. The average amount received for each ton of freight decreased over 12 per cent. One reason for the better showing made in conducting transportation is the increase in the average revenue train load, which was 296 tons in 1905, against 272 tons in 1904, an increase of 9 per cent. The average paying load to each freight engine mile was 253 tons against 225 tons in 1904, an increase of 29 tons, or nearly 13 per cent. The number of revenue passengers carried was 2,009,022, an increase of 70,682 over 1904. The number of passengers carried one mile per mile of road increased from 91,846 to 100,563 in 1905. The earnings per passenger train mile increased over 8 per cent., from 80.49 cents in 1904 to 87.06 cents in 1905. The average number of passengers carried was 35, an increase of 3, or 9.37 per cent. over the preceding year. The mileage of locomotives employed in helping passenger trains increased 189 per cent. over the preceding year, and the mileage of locomotives employed in helping freight trains over 35 per cent. Apparently either the efficiency of the motive power was less or the increased train load was obtained by a large use of helpers on the worst grades. The figures for car mileage do not show up well, there having been an increase of 8 per cent. in the mileage of empty freight cars east, of 13.29 per cent. in the mileage of empty freight cars west, and an increase of 34.88 per cent. in the average number of empty cars per train. No classification of freight traffic is given nor are any detailed figures for the Mason City & Fort Dodge or the Wisconsin, Minnesota & Pacific included in the report.

Critics of the company's capital expenditures, already referred to, show that on the recently built lines the ratio of capital issued by the parent company to expenditure for building was about 3 to 1. As already explained, the extensions of the Mason City & Fort Dodge to connect with and extend the Chicago Great Western were built by two syndicates. In return for the new lines turned over by the syndicates and the issuing of stock by the Mason City & Fort Dodge, the Chicago Great Western issued corresponding amounts of its common and preferred "B" stock, which were or still are to be sold by the syndicate managers, and also guaranteed the $8,366,917 first mortgage bonds of the Mason City & Fort Dodge. The *Wall Street Journal* has figured that from the standpoint of the Chicago Great Western there were $34,089,034 of securities issued to the syndicates, who made an average profit of 15 per cent., in return for $11,575,416 cash expenditure on the new lines, or an excess of capital over cash expended of $22,513,618, or 200 per cent. This seems a most extravagant method of financing, especially with a profit and loss surplus of only $213,075, and can only be explained on the English theory of turning over all profits at once to the security holders while providing for all new expenditures by issues of additional capital. This course is further carried out in the recent vote of the stockholders (Sept. 7), to increase the preferred "B" stock by $14,000,000 and the declaration by the London Finance Committee of a 5 per cent. dividend payable in February, 1906, on the preferred "A" stock. Whether this system, if further carried on, will prove successful,

or even safe, for this American railroad, perhaps the weakest in its highly competitive territory will be interesting to observe. The issue of new securities cannot be carried on forever—the capital stock has been increased from $52,000,000 in 1899 to $91,000,000 in 1905, with an actual decrease of over 100 miles in the mileage operated—and there are over $7,000,000 notes maturing during 1908 and 1909. However these are to be met, current expenditures for maintenance must soon be increased if the road is to hold its share of competitive business.

The principal statistics of operation for the Chicago Great Western proper follow:

	1905.	1904.
Mileage worked	818	874
Freight earnings	$5,096,543	$5,811,059
Passenger earnings	1,820,564	1,780,151
Surplus earn'gs, proj. lines	103,886	100,889
Gross earnings	7,377,711	8,022,674
Maint. way and structures	728,015	865,142
Maint. of equipment	904,554	1,032,007
Conducting transportation	3,071,693	3,565,096
Operating expenses	5,123,093	5,904,057
Net earnings	2,254,618	2,118,617

Denver & Rio Grande.

The Denver & Rio Grande occupies most of Southern Colorado and has a through line from Denver and Pueblo to Salt Lake City and Ogden, Utah. The Missouri Pacific meets it from the east at Pueblo and thus it becomes part of a through trans-continental line. Its lines reach most of the important mining districts in Colorado. Including the Rio Grande Western it operates 2,470 miles of line, of which 907 miles are narrow (3 ft.) gage. Thus, in addition to its 1,563 miles of standard gage lines, it operates more narrow gage track than any other railroad in the country. The Denver & Rio Grande Railway was incorporated in 1870; right of way was granted by act of Congress in 1871, and track laid between Denver and Colorado Springs (75 miles) before the end of the latter year.

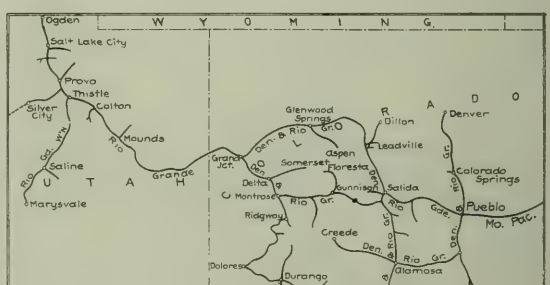
For a year, from December, 1878, the line was operated by the Atchison, Topeka & Santa Fe and also by a receiver, pending legal proceedings to set aside an alleged lease to that company. The result of the contest, which involved possession of the Grand Canyon of the Arkansas, was an agreement in March, 1880, that the Atchison, Topeka & Santa Fe should not for 10 years build through any portion of Colorado west of the Denver & Rio Grande, nor through any portion of New Mexico north of the 36th parallel and west of the summit of the Spanish range; also, that the Denver & Rio Grande should not for the same length of time push its lines into Colorado east of this same north and south line, or to Trinidad, or into that part of New Mexico east of the Spanish range or south of the 36th parallel, except in the western part of New Mexico. By the middle of 1883, the length of line had been increased to 1,644 miles (all narrow gage) by the completion of the Denver & Rio Grande Western with 368 miles of line from the Utah border to Salt Lake City and Ogden. This was leased to the Denver & Rio Grande. In March, 1884, default was made on its bonds guaranteed by the Denver & Rio Grande, and in July the road was abandoned by the lessee to a receiver, who immediately took charge.

In July, 1884, the parent road itself defaulted on its general mortgage bonds and was placed in the hands of a receiver. In the same year a representative of a bondholders' committee made an inspection of the road, and found most of it in fair condition. The chief improvements needed were widening of the roadbed over much of the line; the substitution of iron bridges for wooden, and especially for pile bridges, ill adapted to the rapid mountain streams of Colorado; ballasting of the road, and the use of 40 or 45-lb. steel rails in place of the 30 and 35-lb. rails with which much of the road was laid. A number of branch lines had been built to serve an insufficient traffic. Six of these, with a total mileage of 496 miles, did not at the time earn their working expenses, to say nothing of interest on their cost. The fixed charges were considered too high for a new line the inefficient condition of the company ascribed to, first, careless management; second, high fixed charges resulting largely from the building of unprofitable lines; and, third, a severe winter and the depressed condition of trade and mining. The expert held that from the nature of the country the road could not expect to be supported from agricultural or stock traffic, but must expect to depend largely on mines, and its earnings must therefore fluctuate considerably with the changing conditions of the mining industry. The Utah line of the Denver & Rio Grande Western he found in very poor physical condition. This was an expert opinion of the material with which the new company started to make a paying railroad.

In the year in which this examination was made (1884) gross earnings were $5,552,104, a decrease of $1,003,675, or over 15 per cent. from the figure for the previous year. Net earnings were 1,541,323, a decrease of $826,536, or 35 per cent. Net earnings per mile had decreased 36 per cent. In 1885 a new company, the Denver & Rio Grande *Railroad* Company, was organized as successor. The Denver & Rio Grande Western was not at that time re-consolidated, but was itself reorganized in 1889 as the Rio Grande Western. In 1901 control of the Rio Grande Western was acquired by the purchase of 100,000 shares of its common and 75,000 shares of its preferred stock, $20,750,000 D. & R. G. preferred stock being issued to provide the necessary funds.

In 1901, including both roads, there were 2,121 average miles operated; gross earnings were $11,474,871; net earnings were $4,684,942; gross earnings per mile were $5,410, and net earnings per mile, $2,209. Two years later came the panic of 1893, when, with 52 more miles of line, the gross earnings dropped to $8,577,362 and net earnings to $3,227,798, or $1,485 per mile. Since that time, the record of the road has been one of steadily increasing prosperity. In the fiscal year ending 1898 gross earnings had come to be again considerably over 11 millions and net earnings over 4½ millions. For the next five years gross earnings were respectively, $12,623,236; $14,756,683; $16,359,610; $17,036,828, and $17,304,559. This last figure, for the fiscal year ending 1903, is the largest in the history of the road. Net earnings similarly increased from $4,618,438 in 1898 to $4,828,260; $5,554,835; $6,012,474; $6,705,286, and $6,664,709 in the fiscal year of 1903. Then in 1903-1904 came the severe labor troubles in the mining camps of Colorado which quickly showed their effect in a shrinkage of $883,388 in freight revenue, the loss being almost wholly on the D. & R. G. proper, where the disturbances occurred. This broke the uninterrupted record of increases in earnings.

For the year just closed net earnings were the largest in the history of the country, amounting to $6,862,547 for the 2,420 miles operated, or $2,836 per mile of line. Although the gross earnings ($17,031,507) were not as large by nearly $300,000 as in 1903, the reduction of $460,889 in expenses from the 1903 figure more



Denver & Rio Grande.

than compensated for the difference. Gross earnings increased $585,072, or 3.56 per cent. over 1904, and net earnings, $474,555, or 7.43 per cent.

After all charges against income, including a 5 per cent. dividend on the $45,600,000 preferred stock, $120,000 was contributed to the renewal fund and a surplus of $562,452 remained from the year's operation. From this surplus, an appropriation of $133,915 was made for betterments and $150,000 was devoted to the purchase of 10 standard-gage freight locomotives, leaving a final surplus to be carried to profit and loss of $278,537. During the year, three branches amounting in the aggregate to 16 miles were put in operation, or acquired. It is the object of the management to have the entire main line from Denver to Ogden laid with 85-lb. rails. Most of this work between Denver and Grand Junction has been completed, the lighter rail released being used on branches. During the next fiscal year it is proposed to replace with 85-lb. rail nearly all of the 140 miles of 65-lb. rail still remaining in the main track of the Rio Grande Western. During the year 20 miles of 30-lb. rail on the Crested Butte branch of the Third division were strengthened with 65-lb. second-hand rail transferred from the main line.

Freight earnings were $11,932,420, an increase of $534,315, and passenger earnings, $4,039,418, an increase of $80,166. Express, mails, rents, and miscellaneous earnings amounted to $1,059,670. In maintenance of way expenses, which took $1,629,172, there was a decrease of $162,889 from the preceding year. Expenses for maintenance of structures are reported separately and amounted to $369,323. There was an increase in maintenance of equipment payments of $112,004. The figure for the year is $2,031,523. There was also an increase of $163,460 in conducting transportation, on which $5,632,606 was expended. The total expenses increased $110,517 over the preceding year. The percentage of operation decreased from 61.16 per cent. to 59.71 per cent., between which range the figures

for the past ten years. Among the detailed expenses the largest increase of any is in fuel for locomotives, which increased $89,647 over 1904. This is surprising in view of the large decreases in this item reported by most of the companies which have recently issued annual statements. The next largest increase is in repairs and renewals of freight locomotives, which increased $53,754. Repairs and renewals of passenger locomotives at the same time increased $23,229, and of switching locomotives, $43,542. There is a large increase ($49,103) in payments for injuries to persons, from $68,230 in 1904 to $117,333 in 1905.

The improvements during the year, for which $244,733 was expended on the D. & R. G. proper and $80,281 on the R. G. W., a total of $325,015, were charged, $90,223 to income and $154,510 to capital account on the D. & R. G., and $43,692 to income and $36,590 to capital account on the R. G. W., a total of $133,915 charged to income and $191,100 to capital during the year. The largest items in the freight traffic, as was to be expected, are products of mines. Bituminous coal amounted to 2,399,081 tons, or 34 per cent. of the total tonnage; and precious ore to 1,953,666 tons, or 27 per cent. The first of these items furnished $2,385,765 of revenue, or 20 per cent. of the total; and the latter $1,974,286, or 17 per cent. of the total. These figures show that, roughly, the average revenue received from the carriage of these two most important commodities was one dollar a ton. Coke amounted to 7 per cent., stone, sand and clay to 9 per cent., and lumber to 3 per cent. of the total tonnage, the latter furnishing 5 per cent. of the total revenue. Statements of the passenger and freight business are given for each month of the year, which show that in the past year the heaviest freight shipments were in November and the heaviest freight receipts in October, while most passengers were carried in June and passenger receipts were the largest during August.

The revenue tons of freight carried were 7,166,838, against 6,960,992 in 1904. With this increase of over a million revenue tons carried there would seem to have been greater efficiency in loading, for the loaded car miles decreased from 53,511,776 to 53,254,941. On the other hand, the engine miles, excluding switching and work train mileage, increased from 5,321,904 to 5,515,470. The average train load was 206½ revenue tons, a slight decrease from the preceding year. Freight earnings per mile of road increased from $4,753 to $4,931, and passenger earnings from $1,651 to $1,669 per mile.

The average amount received for carrying a ton of freight one mile was 1.34 cents. This is a high figure and is responsible for high freight earnings per mile of road with the comparatively low freight density of 368,353 ton miles per mile of road. Had the Hocking Valley, whose report is reviewed in another column, received this average rate of 1.34 cents per ton mile, its freight earnings would have been increased by $9,000,000, or over 200 per cent. Evidently the high average rate received is in large measure responsible for the Denver & Rio Grande's prosperity.

The fact that the Denver & Rio Grande is a mountain road is strikingly brought out by the figure for the average number of engines per train, which is 1.28 engines for freight and 1.18 for passenger. The average number of cars in freight trains was 18.67 and in passenger trains 6.18. The average haul of each ton of freight was 124 miles against 143 miles in the preceding year. The average distance traveled by each passenger was 140 miles, an interesting figure, again in comparison with the Hocking Valley with its average passenger journey of less than 20 miles.

At the close of the fiscal year, about 14 miles of track had been laid on a 47 mile line southwest from Durango, near the southwest corner of Colorado, to Farmington, New Mexico, at the junction of the San Juan and Las Animas rivers. As provision for such an extension was made in the charter of the company, the line was built directly by the Denver & Rio Grande. Track laying was completed early in September. Farmington is the principal town in these river valleys, which are growing farming communities. The expenditure for this line is estimated at $750,000, to provide for which and also for additional facilities, $1,200,000 of $5,600,000 preferred stock already authorized was issued. During the months of May and June very considerable damage was done by floods, which at times caused an entire suspension of local traffic on some of the narrow gage lines.

The proposed Western Pacific Railroad is considered in detail by President Jeffery. The building of this line he justifies for two reasons: First, because of the control of the present western connection by competitive interests and, second, because of the size and rapid growth of Pacific Coast traffic. As long as the Central Pacific between Ogden and San Francisco was not controlled by competing interests the Denver & Rio Grande was in a position to receive its full share of the through traffic, which it did for many years. One of the main reasons which influenced the management to acquire the Rio Grande Western was the closer relationship and freer interchange that would be established with the San Francisco line of the Central Pacific. Subsequent events disappointed these hopes, for the Central Pacific was acquired by Union Pacific interests, and this led to unexpected restrictions on interchange and more especially, unlooked for impediments in the way of securing traffic in territory reached by the Southern Pacific. On this account and also because of the rapid development of the commercial, agricultural and industrial interests on the Pacific coast and the increase of commerce with the Philippines, China and Japan, the management was led to investigate the feasibility of an independent line from either Salt Lake City or Ogden to San Francisco. Careful investigations and surveys were made by the Denver & Rio Grande, for the purpose of determining the best available route. These engineering efforts were successful beyond expectation and the main line of the new Western Pacific has now been definitely located. Through the Sierra Nevadas, this has a maximum grade of one per cent. in both directions and lighter grades on both sides of the range, with satisfactory alinement throughout. Mr. Jeffery states that in general desirability and advantages this affords a route superior to any existing line to the California coast. The main line between San Francisco and Salt Lake City, where it will connect with the Rio Grande Western, is to be built according to trunk line specifications, and laid with 85-lb. rails. The capital stock of the Western Pacific, at present $50,000,000, is shortly to be increased to $75,000,000, of which the D. & R. G. and R. G. W. will hold two-thirds or $50,000,000. Financial arrangements for building the road were completed in the last three months of the fiscal year by the sale of $50,000,000 first mortgage 5 per cent. 30 year gold bonds. The proceeds will, it is estimated, cover the cost of the main line, terminals and equipment to the amount of $3,000,000. The President of the Denver & Rio Grande has been elected President of the Western Pacific. The Rio Grande Western undertakes to advance additional funds if the proceeds of the first mortgage bonds of the Western Pacific shall prove insufficient to complete the main line, receiving for any such advances second mortgage 5 per cent. bonds of the Western Pacific; the Denver & Rio Grande and the Rio Grande Western jointly agree to make up any deficit in the earnings of the Western Pacific necessary to meet its operating and maintenance expenses and taxes, and, after completion of the main line, which is expected to be in 1908, the interest on its $50,000,000 first mortgage bonds. Thus control of the Western Pacific has been acquired without any immediate money outlay and with only a contingent liability for the future.

The Western Pacific is, of course, the much heralded Gould Pacific connection and is to interchange trans-continental traffic with the Gould roads further east. Assuming, as Mr. Jeffery says, that it will be a better line than any existing line to the California coast, the Gould through route must meet the handicap of the Denver & Rio Grande's heavy country and steep grades. Westbound its limiting gradient is now 2.40 per cent., and eastbound, 4 per cent. The distance over the D. & R. G. from Pueblo, the junction with the Missouri Pacific, to Salt Lake City, the junction with the new Western Pacific, is 624 miles. By the Union Pacific from Cheyenne, almost directly north of Pueblo, to Ogden, is 485 miles. From Denver to Salt Lake by the Denver & Rio Grande is 742 miles; from Denver to Ogden by the Union Pacific is 591 miles. The Western Pacific end of the line will have to be considerably better than the present Central Pacific in order to compensate for these disadvantages. It is probable, of course, that before the Western Pacific is finished the Denver & Rio Grande will prepare for increased trans-continental traffic by improvements to its line. The mountains of Colorado, however, can never be improved away and will always be a handicap. The necessity of paying the first three years' interest on the Western Pacific bonds out of capital will reduce the amount of money available for building that road by nearly $9,000,000, which, with the discount on the bonds at the time of sale, will leave only about $37,000,000 cash available. For the line as projected this seems too small an expenditure. There is also to be reckoned with for the D. & R. G. the threatened competition of the Denver, Northwestern & Pacific, the "Moffat" road already in operation for more than 100 miles from Denver toward Salt Lake. If this road is carried through and a projected two and a half mile tunnel bored through the mountains of the continental divide so as to give it a limiting grade of 2 per cent., the Denver & Rio Grande may well fear it as a competitor. It seems fairly sure that the Western Pacific will eventually be a profitable investment, especially as it will open up considerable new country, but that it will at once take care of its own bonded indebtedness seems not so sure. Whether the credit and resources of the Denver & Rio Grande will be sufficient to pull it through any such lean years at the start will be for the future to make clear.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	2,420	2,398
Freight earnings	$11,932,420	$11,398,104
Passenger earnings	4,039,418	3,959,252
Gross earnings	$17,031,507	$16,446,435
Gross earnings per mile of road	7,038	6,858
Maint. way and structures	1,998,494	2,174,828
Maint. of equipment	2,031,523	1,919,519
Conducting transportation	5,632,606	5,469,146
Operating expenses	10,168,961	10,058,444
Operating expenses per mile	4,202	4,194
Net earnings	6,862,547	6,387,991
Net earnings per mile	2,836	2,664

TRADE CATALOGUES.

Air Compressors.—An improved Cincinnati air compressor is described in the 32-page bulletin, L 508, published by the Laidlaw-Dunn-Gordon Co., New York. This compressor is characterized by a new and simple air-valve mechanism by which the elasticity of the poppet valves is combined with the quiet action, efficiency and high-speed qualities of positively moved valves, permitting the machine, in all sizes, to be directly connected without gears or belts to electric motors and gas engines. The adaptations of this compressor to different methods of driving and to different types of steam ends, such as simple and compound, Corliss and Meyer-gear, etc., are shown by numerous illustrations. The Cincinnati gear is applied to machines for all pressures, including those for 1,000 lbs. per sq. in. and above for liquefying carboni-acid gas and charging compressed air locomotives.

Machine Wrenches.—The Billings & Spencer Co., Hartford, Conn., sends a new list of its drop forged machine wrenches, with many illustrations and tables of sizes, shapes and prices for ordering. Among others the models include the following kinds of wrenches: Standard machine, double-end for standard hexagon nuts, new line drop forged 15 deg. angle end, S 22½ deg. hexagon, double-end 22½ deg. angle, straight double-end, 15 deg. angle double-end, 22½ deg. angle double-end S, new line straight single-end, 15 deg. angle single-end drop forged of steel, special machine, general service, double head tool post, drop forged steel pin, "B. & S." adjustable spanner, and a collection of 45 miscellaneous drop forged wrenches.

The Bangor & Aroostook Railroad, with its 400 miles of track leading through the heart of Northern Maine's fishing and hunting region, takes pains to inform people that the hunting season for deer in Maine is October 1—December 15; for moose, October 15—December 1, and for ruffed grouse, September 15—December 1. Concerning the deer industry in Maine, although several thousand are killed each year, the B. & A. people think that the wild herd is not decreasing; also that the number of moose is certainly increasing in that region. On these subjects and others, they publish a small book with about 150 photographs, and this can be obtained from the passenger agent at Bangor for 10 cents a copy.

Pneumatic Tools.—Catalogue F of the Cleveland Pneumatic Tool Co., Cleveland, Ohio, just issued, is 6 in. x 9 in. and has 63 pages, showing the pneumatic devices of this company. Twenty styles of stone and scaling hammers, light and heavy chipping, caulking, beading and long and short stroke riveting hammers are illustrated by half-tone views, and the principal characteristics of each enumerated. Sectional drawings are also given to show the construction, accompanied by lists of parts. "Cleveland" drills are similarly illustrated and described. Instructions for the use and care of the tools are given, and a number of engravings from photographs showing the tools in use. Bowes hose couplings and pneumatic holders-on are other devices included.

An Instrument for Measuring the Wear of Tires.—C. G. Bacon, Jr., New York, sends a pamphlet descriptive of the Bacon tire indicator. Illustrations and a detailed description of this instrument which is used for recording the wear on tires, is given. The device complete weighs but 20 lbs. The proper method of using the instrument and numerous diagrams made with it are shown.

Machine Tools.—The Gisholt Machine Co., Madison, Wis., send pages 33 and 34 of its loose leaf catalogue. These pages contain a brief description and illustration of the company's new foundry, the main building of which covers an area of 120 ft. x 240 ft., the equipment of which throughout consists of the most modern foundry appliances.

Manila Rope.—The C. W. Hunt Co., New York, sends a leaflet and price list of its plumbago laid manila rope. A table containing the proper working loads and diameters of sheaves and pulleys to be used for hoisting rope is given, and a small sample of the lubricating plumbago which is used in making the rope is enclosed.

CONTRIBUTIONS

Advertising by Catalogue Cards.

Chicago, Sept. 13, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In connection with the editorial on "The Use of the Catalogue," in your issue of August 4th, may I suggest a larger use of the printed catalogue card on the part of those who send out the catalogues? A printed catalogue card will in many cases simplify the cataloguing of the manufacturer advertising, so that he may be more certain that the buyer has such a ready reference help. In most instances it will be well to prepare a set of cards having at least enough titles to make sure that the main lines and any new or novel line shall be indicated.

E. G. ROUTZAHN,
Secretary Bureau of Civic Co-operation.

A Lathe for Turning Journals with the Wheels in Place on the Axle.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Among all the special machines for railroad shops I have never seen a special lathe for turning down cut journals with the wheels on. There is, I think, a considerable amount of this work to do on every important railroad, and it seems to me that a lathe for this purpose and without any unnecessary complications would find a ready sale, as it certainly could be put upon the market at a considerable less price than the standard engine lathe, which we use at present and which is constructed with a view to handling any piece of work from 4 in. to 10 ft. between centers and from 1 in. to 42 in. in diameter. These machines are provided with very numerous changes of speed and feed and full screw cutting apparatus. A lathe for turning journals should have a capacity to swing 38-in. wheels and to true up journals from 3 in. to 6 in. in diameter and from 7 in. to 12 in. long. The guide or ways for the tool carriage could be attached, or a part of the tail stock. No more than two changes of speed would be needed, so that back gear could be dispensed with. Two feeds would also be sufficient.

It would not be necessary to make it a double ender, as ordinarily only one journal is cut on an axle. It should be provided with a crane for handling the wheel and axle.

BEN JOHNSON,
Superintendent Machinery, Mexican Central Ry. Co., Aguascalientes, Mexico.

[A lathe made by the Draper Machine Tool Co., Worcester, Mass., and specially designed for truing up journals when the wheels are in place on the axle was described in the *Railroad Gazette*, September 1, page 66, General News Section.—EDITOR.]

Electrically Controlled Train-Brakes.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Of course you know my early interest in electrically controlled brakes, and therefore I trust you will pardon this letter. In the New York *Sun* of September 14th, referring to the investigation by the State Railroad Commissioners regarding the Elevated Railroad accident of September 11, General Manager Hedley is quoted as follows:

Q. "How many cars were there in the train?"

A. "Six. Four motor cars and two trailers. The second, a trailer car, left the track, and its north end (rear end) went into the street first."

Now, I wish to ask in considering this accident, if you are doing so for the benefit of the *Railroad Gazette*, that you bear in mind what we did at Burlington with the electrically controlled air-brake, and also what was done by Westinghouse with his ordinary air-brake, with the addition of a few electrically actuated valves.

As I look at this Elevated Railroad accident, it appears to me something as follows: The motorman hit that curve at pretty good speed, evidently believing he had the right of way for Ninth avenue. The instant he struck the curve he applied the brake. The first car was retarded by the curve itself, and in addition the brake applied to the first car for a short space of time ahead of its application on the following cars; with the result that the second car was retarded at the front end by the motor car, and was being pushed from the rear end by the remaining four cars, three of which were motor cars, on which the air-brake had not yet applied. Of course, it only takes a very short space of time for the brake to apply from one car to the next, but it does require an appreciable length of time.

Had the brakes been operated or controlled by electric valves, even if only one valve at the rear end of the train, then the rear portion of the train would have been retarded just as much as the front, and there would have been a tendency to hold back the rear end of the second car, instead of the tendency, due to the momentum of the rear cars, to crowd the second car off the track.

When I think of the remarkable progress made in electrical matters since those early efforts at Burlington, it does seem strange that this agent should not be brought into play in those conditions where a small fraction of a second is supremely important, namely, in emergency stops on railroads. Here we have trains running up and down the Elevated road with electricity as the motive power, and air for the purpose of applying the brakes. Without changing that brake in the least, but leaving it as it is, simply add to it an electric switch and magnet to release the air from the different cars simultaneously, and you will have a brake which will work quicker, stop the train in shorter distance, and avoid shock and jar; and in going around a curve you would, I

think, avoid the terrible accident that happened last Monday on the Manhattan.

I am not seeking notoriety, do not want any advertisement, and do not want my name quoted in this connection. I am not trying to do business in brakes, but I am simply calling your attention to these palpable facts. X. Y. Z.

E. B. Phillips.

Mr. Elijah Brigham Phillips, for fifty years closely identified with the railroad interests of the country, died at his home in Brookline, Mass., September 14, at the age of 86. He was born in West Sutton, Mass., and was descended from the first settlers of the Bay Colony in the sixth generation from George Phillips, the first pastor of Watertown, and Rev. Richard Mather, of Dorchester, and Rev. John Cotton, of Boston. He was a great grandson of General Artemus Ward, the first commander of the American Army. At the age of nineteen Mr. Phillips began his railroad career as a receiving clerk at the freight station of the Boston & Worcester Railroad (Boston & Albany); and he and one other man were able to do the work for the office, which handled all the railroad commerce which Boston then had with the country to the west of it. This was in 1838, before the Western Railroad had been finished as far as Springfield. To-day the similar work requires a force of several hundred.

Elijah Brigham Phillips.

Promotions followed until he was given charge of the freight business of the company in Boston. In the summer of 1852, when master of transportation, he resigned and went to the Toledo, Norwalk & Cleveland as superintendent. In 1858 Mr. Phillips was recalled to Massachusetts to become superintendent of the Boston & Worcester. This position he filled during the years of the war, when troops and supplies were conveyed in large quantities from Boston, which was the mustering point for Eastern New England.

In 1865 Mr. Phillips again went West, being chosen president of the Michigan Southern & Northern Indiana, then one of the largest in point of mileage in the United States. In December, 1870, Mr. Phillips, with Charles L. Colby, of Boston, formed the Phillips & Colby Construction Company for the purpose of building the Wisconsin Central.

From 1874 for a time he made his home in Milwaukee, where he removed from Chicago, intending to rest a year, but he shortly afterwards was appointed by the United States District Court for Southern Illinois receiver of the Grayville & Mattoon. Upon his election, June, 1879, to the presidency of the Eastern Railroad Company of Massachusetts for a second time he removed from the West to Boston. In this office he spent three and one-half years, increasing the prosperity of his company. The road was leased to the Boston & Maine, and Mr. Phillips went to the Toledo, Cincinnati & St. Louis. In 1883 he was elected president of the Fitchburg Railroad Company; and finally retired from active railroad management in 1890.

His two sons and one daughter all live in Boston: H. A. Phillips, an architect; W. B. Phillips, member of the Boston Stock Exchange, and Mrs. C. A. Page.

Mr. Charles Paine, who scarcely needs an introduction to *Railroad Gazette* readers, has favored us with the following fine appreciation of Mr. Phillips:

The recent death of Mr. E. B. Phillips has ended one of the most useful and brilliant careers in the annals of American railroading, as will appear from the enumeration of the offices which he held and the important results which he accomplished. The writer enjoyed the privilege of serving under him during his term as President of the Michigan Southern & Northern Indiana. That trust was one of the important ones in this country at that time.

He came to the road in the fall of 1865, when it had fairly begun to recover from the dismal financial depression following 1857, and he found a system of 524 miles of main lines and branches, which had been saved from bankruptcy only by the most severe economy in every department, and requiring almost complete reconstruction. Mr. Phillips was then forty-six years old, full of energy, equipped with thirty years of experience in all departments, and with an honest mind, intent only upon the interests of the company. He first went over the main line in the caboose of a way-freight train, stopping at every station and seeing every agent. Very soon he established headquarters, which had been at Toledo, at Chicago. He immediately began substantial improvements. Upon the whole of the air line division there was no masonry, all streams being crossed on decaying timber trestles, as also were all important streams upon the Western division. The substitution of substantial masonry for these was undertaken, also the renewal of the track, which in winter was dangerous from broken rails. Great changes were effected in Chicago; the track which had been built in Clark street, from Twentieth street to Taylor street, was moved to a newly purchased right of way; a joint passenger station with the Rock Island Railroad, with offices for both companies, upon the site still occupied by their joint depot, was built, so that at the end of three years Mr. Phillips could report that there had been expended out of surplus earnings $3,272,000 for the benefit of the property. Forty per cent. of the rails in the track had been renewed, as also 68 per cent. of the cross-ties. These remarkable results led directly to the consolidation of the road with the Lake Shore, which took place in the spring of 1869—when Mr. Phillips and Mr. J. H. Devereux were appointed Vice-Presidents, each in charge of the main division upon which he had previously been supreme; but this arrangement was not satisfactory to Mr. Phillips, who soon withdrew to engage in contracting.

During his term, Mr. Phillips was distinguished by his familiarity with every detail concerning the road and its branches; he was acquainted with every person of any importance in its employ, and with most of its patrons. The road was just of the right length for him to be able to attend to the whole; and I am still of the opinion, after sixty years of observation, that no better management or discipline has ever been seen in the United States than existed on the Michigan Southern during his administration. His duties required that he should often go to New York, as well as to visit all parts of his road, and during his first year there he traveled more than fifty thousand miles.

In every respect Mr. Phillips was a gentleman. In his relations with his subordinates, patient and reasonable, commanding their respect and hearty co-operation; but he let it be understood that he expected every one to do his entire duty. Towards the public his attitude was very civil, yet he exacted for his company its full rights. He was indeed a just and fearless administrator, of the strictest personal integrity; with an amiable bearing towards his family and those who had won his friendship.

"Great men have lived among us—
Heads that planned and lips that counseled wisdom;
Better—none!"

The Chevalier Anton von Gerstner, interesting to us chiefly by his account of all American railroads at the time he visited this country in 1838, built the first railroad in Austria, "of wood and iron," as it was described, between Budweis and Linz, and worked it with horses. In 1846 an attempt was made to use not steam, but oxen, for the motive power. The Austrian Railroad Museum contains a report on this experiment. It had been hoped to do the freight business between Linz and Budweis with four "mountain draft oxen." But the report says that ox No. 1, just after leaving a station, was taken with nose bleeding, which lasted till evening. This became a common affection; the animals were hard to drive, and all in all, it was concluded that oxen were not suitable for railroad motive power—not even for freight service. A passenger car used on an extension of the same railroad as early as 1835, when it was still a horse railroad, had provision for sleeping berths. This car is preserved in the above museum.

Slide Valve vs. Piston Valve.*

Piston valves in locomotives were used as long ago as 1833, and since that time there have been revivals at various periods; but like some vaccinations, they did not seem to take—until within the last few years. Whether they are to become a fixture and force the D slide valve to the museum remains to be seen. Inquiries of leading roads using large numbers of piston valves, fail to bring out an expression as to which type of valve is doing the better work, the slide or the piston valve. They will say that they are both doing good work when properly designed. There are two types of the piston valve: inside and outside admission. Some are solid and some hollow. It is this modification that brings about the difference of opinion as to their respective merits.

Many broken frames and cylinders have been attributed to the piston valve. Had the trouble been looked into more carefully, they would have found some weak points in the construction, no provision having been made for special relief in case of over-pumping, condensation or careless handling of the engine.

Most modern piston valve engines are of the heavy type with cylinders much larger than were formerly used, and in a great many cases the enginemen have not taken the care of them that they did of the smaller engines; but after the engines have been in service for a while the men become accustomed to them, and the trouble generally disappears. I can see no reason why the frames and cylinders on piston valve engines, if properly designed, are subject to breakage any more than the slide valve engines, if proper provision is made against careless handling. There are four essential points to be considered—cost, maintenance, steam distribution, and fuel economy. There seems to be no question that the first cost of the piston valve is less than the slide valve on simple engines, and where four-cylinder compound types of engines are used, it takes the place of two valves and reduces the motion to that of a simple engine.

With the piston valve we get a better balance of the valve, which makes it easier to handle and decreases the wear and tear on the motion work. With the increased size of engines and steam pressure, the ordinary D balance valve increases in size proportionately, and while we may balance a slide valve in the same ratio as the valves on smaller engines, the difference in the unbalanced surface increases with the size of the engine and this increases the wear on the valve, link motion and eccentric straps, and increases the work necessary on the part of the engineer to handle the engine. This being a fact, I have experienced a great deal of trouble keeping the valves on our slide valve engines square, while on the other hand we do not experience trouble of this kind with the piston valve until after the engine has been out of the shop for a long while and the parts become badly worn. With the use of the inside admission piston valve we do away with the metallic valve stem packing, which means a great saving, as we only have the exhaust pressure on the packing side, and the fibrous packing answers the purpose and lasts a long while. With the slide valve on large engines we can hardly exceed 25,000 miles before the valves need facing, and ofttimes sooner than that. When this has to be done, it means the loss of the use of the engine for a day at least with a cost of $12 to $14 for labor, while with the piston valve if the rings are broken or need attention the valve can be removed, new rings applied in from 30 to 40 minutes, and the engine is ready for service again. No doubt the question will be asked, "Do the bushings ever wear?" Yes, but I have never seen a bushing that will not run from shopping to shopping, and they generally run 200,000 miles without re-boring, which is nearly always done while the engine is in the back shop. Another advantage of the piston valve over the slide valve is the accessibility to its parts. When an engine needs its valves reset after running some time, the port marks on the valve stem become obscured, and possibly the man who is about to do the work has a different tram or wants to get different marks on the stem. With the slide valve engine the machinist has to use the block and tackle and raise the covers of the steam chest before he can make his new marks, while with the piston valve he simply has to remove two plugs on each end of the chest leading directly to the edge of the steam port. This means a saving of time, and time is valuable in a busy shop or roundhouse.

It is claimed by many that what we gain in the maintenance of the piston valve we lose through the leakage of the packing rings. No doubt, there are some leaks through the packing rings in the valve as they or the bushing become worn; but, on the other hand, how many times are slide valves slightly cut and allowed to run in this condition until they wear themselves smooth again? And while they are wearing themselves smooth the engineer will double the amount of oil to the valves and cylinders to prevent the lever from driving him out of the cab.

Another thing in favor of the piston valve is that there are no steam chests to break or gaskets to leak, and all the oil used goes directly to the valve and cylinder. It has been claimed that the piston valve engines ride hard, but often other things are the real cause. Engines set with too much lead will ride hard, or if set too late will cause them to pound. Again, the cylinder and valve may be poorly designed. If it has too little clearance, with a slide valve when compression takes place the valves can rise from the seat and thus relieve compression; but with the piston valve there is no such relief, and this will cause the piston valve engine to ride hard and may do damage unless proper means are provided for relief.

On the other hand, too much cylinder and valve clearance will cause an engine to pound through not having sufficient compression to balance the reciprocating parts, assuming that the cylinder and valve clearance are right. Then a faulty design of piston valve will invariably cause trouble. The inside admission solid valve acts as a piston for each exhaust and takes up the slack in the valve motion, and increases the lead; this is very hard on valve gears and makes the engine ride hard. The difference of pressure on the two ends of this type of valve often amounts to over a ton, for the moment after exhaust takes place the outside admission solid valve becomes unbalanced on the admission side as the steam enters the cylinder, and the high pressure at the opposite end takes up the slack and decreases the lead as the valve gear wears. In the outside admission hollow valve the area of the valve stem unbalances this type to the extent of about 600 lbs. at a 200-lb. boiler pressure, and always in the same direction which causes the engine to go lame as the gear wears. Now with the inside admission hollow valve these defects are absent and the valve is so well balanced that it works easily and requires less power to operate than the slide valve. Tests made by the C., B. & Q. demonstrated that the relative frictional resistance was only about half as much in a piston as in the slide valve.

It is also claimed that the piston valve engine will not run as fast as the slide valve engines. If this is true it is because of faulty design; for an engine intended for fast running the cylinder and valve clearance should be greater than for slow, heavy work. The faster the service the greater should be the cylinder and valve clearance.

Of inside admission piston valves there are two classes, viz.: the solid and built-up types. The solid valves use snap rings, which must of necessity be light section. When steam gets under these rings of light section it causes them to expand into the ports, and unless the corners are well rounded it may cause them to catch and break the valves or rings, or both. On the built-up type the rings may have a heavier cross section and the body of the valve may be cut away so that L-shaped rings may be used, which gives a better admission of steam. Then in case it does break it is only necessary to renew the part that is broken instead of the entire valve. It has also been said that the piston valve engine will not steam as well as the slide valve engine. I can see no reason why this should be so. In regard to the lubrication of the piston valve it has been my experience to find the piston valve much easier to lubricate than the slide valve, and where engines have to drift for a long distance it is found to be a good practice to lower the lever in the quadrant to about half way and to admit just steam enough to the cylinders and valves to carry the oil to the walls of the bushings and cylinders. I think the better practice of oiling the piston valve is to carry the oil to each end of the valve, and as the valve travels back and forth the oil goes directly to the wearing parts. This is done by having a bracket pipe leading to each end of the valve bushing from the main oil pipe. Care must be taken, however, not to drill holes in the bushing so that when the valve is standing in exhaust position at full travel the holes will come in communication with the exhaust port, because then every time the engine exhausts the oil in the pipe would be carried away with the exhaust steam.

With the piston valve we get a much larger port than with the slide valve, and this large opening gives a better admission and release of the steam to and from the cylinder than can be obtained by the slide valve. However, I have been unable to obtain any indicator cards that are comparative; but where the valve gives such a large port opening, both to the steam and exhaust, there seems to be no question but what we get a better admission and release. It has been claimed by some that the steam is wire-drawn on account of the beveled shape of the valve on the admission side; but the increased area of the port overcomes this, as it does not show on indicator cards taken with this style of valve. The modern packing ring is made in an L shape, which gives at least ¼-in. perpendicular opening to the steam port, and helps to give a better admission. With the slide valve the Allen port was introduced to get a better steam admission, and while this did help at a high cut-off, it is practically of no use in starting. While this supplementary port helps the admission of steam to the cylinder, it has no effect upon the release, as these supplementary ports do not come into play while the engine is exhausting. It is also necessary with the Allen ported valve to have the valves set with considerable negative lead in full gear forward motion on account of the lead increasing so fast as the engine is connected that when

*From a paper by L. S. Allen, read at the thirteenth annual convention of the Traveling Engineers' Association, held at Detroit, September 12 to 15.

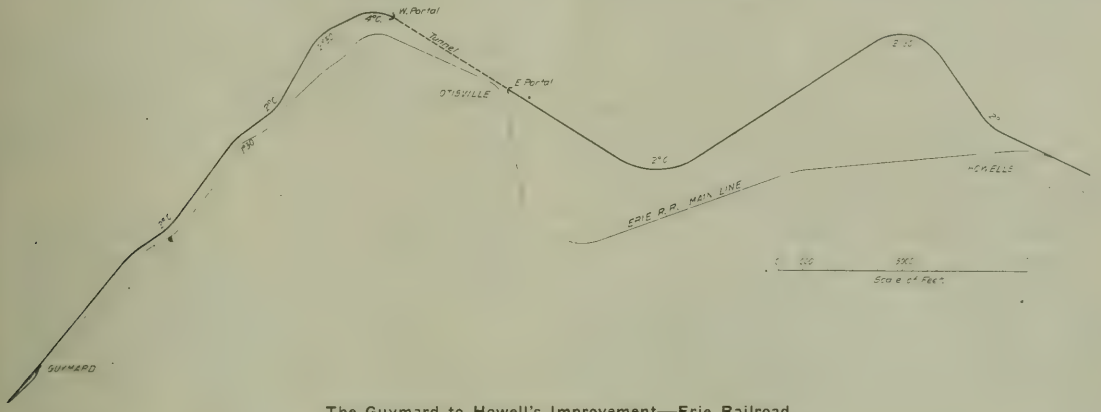
it is in the working notch without this negative lead it would have so much lead as to be a detriment. Consequently, while this port is helpful to a certain extent at high speeds it produces an engine very slow to start a train; while with the piston valve this does not occur as the opening is very large in the corner as well as while hooked up.

There were some piston valves made with the supplementary port, but they have never come into general use, and the only slide valve known to me that provides for a double exit as well as the double entrance for the steam is the Wilson valve, which takes care of both. It seems to me that the existence of these various devices demonstrates the recognized importance of giving the steam the greatest opportunity for rapidly entering and leaving the cylinder, the object being to raise the pressure in the cylinder as near as possible to boiler pressure and decrease the exhaust or back pressure, and thus increase the work done by the engine. With the piston valve we are able to use a shorter steam port than with the slide valve, and as the clearance indicates the area of the port between the valve and piston when on the center, the shorter the port the less the volume of steam to fill from the boiler at each revolution. However, it has not been found practical to use less than 6 per cent. cylinder clearance with the ordinary piston valve. Another feature of the inside admission valve is the protection to the live steam by being jacketed by the exhaust cavities, thus delivering the steam to the cylinder at a much higher temperature than would be done with the slide valve or outside admission engine. This is a very important point, as superheated steam is a recognized economy, and the drier the steam when it enters the cylinders the more work we can get from it.

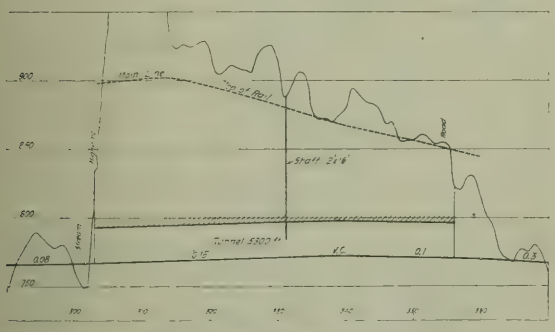
In regard to the economy of the piston valve over the slide valve in the use of fuel, I cannot say that there is practically any difference or should be any difference, unless it should come about through being able to longer keep the valves square; when they are kept square our men will generally try to work them at the highest point of cut-off consistent with the work to be done. Otherwise they will generally work their engines where they sound reasonably square. It was the impression at the recent Washington Railway Congress that a fuel economy of about 10 per cent. resulted in the piston valve over the slide valve. I am not able to produce any figures that would show this; but in summing the total of my personal experience and investigation I think a great deal of the fuel economy, if there is any, in the piston valve comes about through the fact that most engines equipped with the piston valve are of recent date and have a more liberal heating surface than was allowed to many of the slide valve engines of earlier date. I do not wish to convey the idea that all piston valve engines are better than the slide valve engines, but, as I have said before, I think the design of the valve and cylinder has a great deal to do with the performance of the engine. Personally I think that there is only one type of the piston valve that will give good results under all conditions, and that is the inside admission hollow piston valve.

Grade Improvements, Erie Railroad.

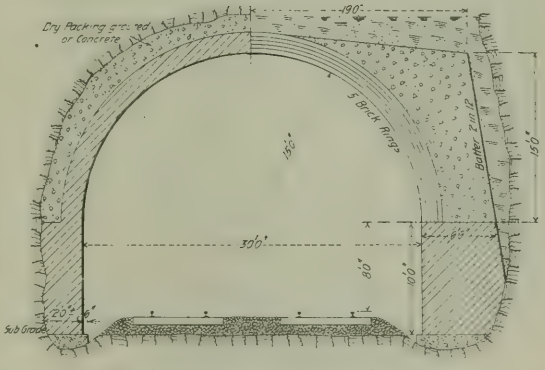
The accompanying illustration shows the location of the 12 miles of new double track on which the Erie Railroad commenced work a few weeks ago. This work lies between Guymard and Howells, and it is the heaviest work in the proposed 40 miles of new road between Guymard and Highland Mills, N. Y., incorporated as the Erie & Jersey Railroad Co. This 12-mile stretch alone will cost upwards of $1,500,000, and the total cost of the 40 miles will be somewhere in the neighborhood of $7,000,000. The line when completed will be used essentially to increase the freight handling facilities of the road, and will practically be used exclusively for this purpose. The new tracks, as shown in the plan, follow about the same route as the present tracks, although in some places the line is nearly a mile distant from the existing road. The length of the new line is practically the same as that of the old. The marked reduction in grade is the important feature. As shown on the profile the greatest difference in elevation between the new and the old lines is near Otisville, at which point the difference in elevation is about 165 ft. At Otisville a tunnel 5,300 ft. long will be driven. It will be of the Erie standard double track section, as shown in the accompanying illustration, having a clear width of 30 ft. to the top of the sidewalls, which are 10 ft. above the sub-grade. The arch has a radius of 15 ft., which gives a maximum clearance of 23 ft. over the top of the rail, which is 2 ft. above the sub-grade. A shaft 14 ft. by 16 ft. in the clear and 150 ft. deep will be sunk near the middle of the tunnel, as indicated in the profile. Work on the tunnel will then be carried on simultaneously from four headings; one at each end of the tunnel and one at each side of the shaft. The contract



The Guymard to Howell's Improvement—Erie Railroad.



Showing Elevation of Old and New Lines and Location of Tunnel at Otisville—Erie Railroad.



Standard Tunnel Section Erie Railroad.

time for the cutting of the tunnel is 18 months. The new eastbound and westbound tracks when completed will have a ruling grade of 0.2 per cent. and 0.6 per cent. respectively. This will compare favorably with the ruling grades on the balance of the New York division, which extends from Jersey City to Port Jervis, N. Y. The ruling grades on this division now are 0.6 per cent. eastbound and 1.3 per cent. westbound, which includes an 18 mile helper grade having a maximum grade of 1.5 per cent. The new road is to be rock-ballasted, and 90-lb. rails will be used throughout. Messrs. Bennett & Talbott, of Greensburg, Pa., are the contractors for the work, which includes the tunnel. For the above information and illustration we are indebted to Francis Lee Stuart, Chief Engineer Erie Railroad.

Investigation of the Elevated Railroad Disaster.

The New York State Railroad Commissioners have begun an investigation of the derailment on the Manhattan Elevated Railroad, New York City, September 11, in which 12 persons were killed, and have held one public hearing (September 13), but have adjourned the inquiry to a future date not yet named. The motorman, Paul Kelly, who ran away, has not yet been found.

The evidence brought out was not conclusive. General Manager Hedley testified that the second car ran off the track 30 ft. from the switch, and, apparently by reason of the pressure of the four cars behind it, it was pushed around so that the north end (the rear end) fell to the street first, the car finally lodging with its south end uppermost and about on a level with the track. Mr. Hedley at once examined the signals displayed on the front of the train to indicate its destination and found them showing Ninth avenue (two white disks). It seems to be agreed that this was the condition of the signals and that, therefore, the signalman's statement that they showed Sixth avenue is not true. The prescribed rate of speed for Ninth avenue trains passing this junction is 25 miles an hour.

Cornelius A. Jackson, the signalman, was called to the stand, but having been arrested on a criminal charge, took advantage of his constitutional right and refused to testify, except to say that the alleged interviews with him which had been printed in the New York papers were not authentic. To his friends, before the hearing, he had said, according to the newspapers, that after the passage of a preceding Sixth avenue train he had left his post of duty for a minute on account of illness and gone downstairs, first looking up the line and deciding that the next train to come was a Sixth avenue train. Jackson wears glasses.

Superintendent S. D. Smith testified that there is a man, called a train dispatcher, in the first story of the tower, on whom the signalman can call in case he is unexpectedly obliged to leave his post. Mr. Smith testified that Jackson had been at this tower since March 7, and had been with the company about ten years, with a clean record. He had been on duty seven hours at the time of the accident. The motorman had been with the company only seven months. He came from St. Louis at the time of the strike last March. He passed the company's examination satisfactorily.

J. S. Doyle, Superintendent of Car Equipment, said that the cars of this train were thoroughly inspected three days before the accident, and had been found in perfect condition. The flanges on the wheels of the leading truck of the wrecked car were found after the derailment in good condition; the axles were not broken and the gage was right.

Chief Engineer George H. Pegram testified that the outer rail of the curve was elevated 3 in. at a point 125 ft. from the switch.

Railway Signal Association.

The September meeting of this association was held at Chicago, Sept. 12. There were two sessions, 40 members being in attendance. Twenty-two (22) new members were elected. It was voted to use a membership badge in the shape of a celluloid button, on which is printed the association name, including "Niagara Falls, N. Y., 1905," and the individual number of each member. This is deemed desirable for the purpose of identification and introduction of members.

The Executive Committee, which had met at Buffalo, Aug. 22, made these recommendations, which were adopted: At the annual meeting (Oct. 10) a vote shall be taken as to the adoption of a permanent badge, samples and designs to be submitted at that time. The publication of a Digest of the Proceedings of the Association, to include all literature since organization to and including 1904, was recommended, and the committee will submit an index of material which it is proposed to use, also an estimate of the cost. The demand for back numbers of Proceedings has been so great as to bring up this question of reprinting.

The work of Committee No. 9, "Definitions and Nomenclature," is to be changed. It was voted that all committees appointed by the association submit definitions used in their reports to Committee No. 9, and the definitions decided on by this committee are to be recognized as standard unless otherwise ordered by the association.

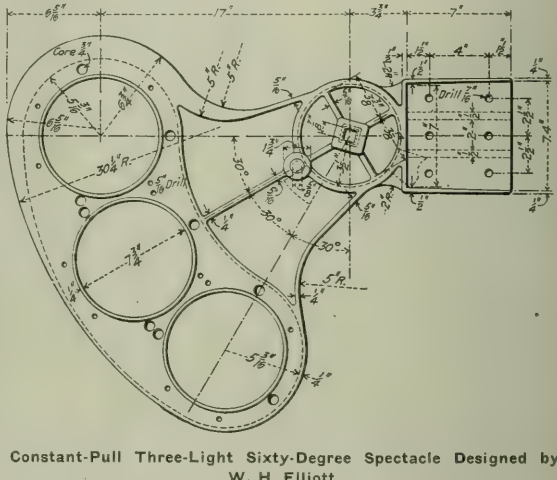
A motion prevailed suspending action on the various definitions which have been presented by Committee No. 9.

Mr. E. L. Reynolds, Electric Storage Battery Co., and Mr. M. E. Smith, Signal Engineer of the D., L. & W., presented letters in reply to Mr. Gladstone's paper read in May as to the cost of primary cells as compared with storage batteries. They quoted figures to show that the saving claimed by Mr. Reynolds in his paper presented at the January meeting was understated.

The association considered paragraphs 15 to 59 and 70 to 72, of the "Standard Specifications," as recommended by Committee No. 8, and, with a number of alterations and suggestions, to bring them up to date, all were accepted and adoptd.

Letter Ballots.—At the meeting of the association held in New York in May, a committee, consisting of Messrs. W. H. Elliott, Azel Ames and A. H. Rudd, was appointed to prepare and submit to the association by a letter ballot the conclusions to be drawn from the paper on the semaphore spectacle by Mr. W. H. Elliott, of the New York Central & Hudson River, which was read and discussed at the meeting. The following conclusions were submitted by the committee to 150 members of the association by letter ballot, the 150 names including all signal engineers and men below that grade in the signal department, all technical editors, and one member from each concern that makes signals:

1. The semaphore signal spectacle must be so designed as to exert an approximately constant force through all positions of the stroke to return the signal to the horizontal position. (See illustration.)



Constant-Pull Three-Light Sixty-Degree Spectacle Designed by W. H. Elliott.

2. With a wire connected signal the constant force exerted on a 6 in. arm by the weight of the spectacle to return the signal to the stop position should be 75 lbs., which is to include the weight of the back-light casting and the balance lever weight.

3. The openings in the spectacle must be so arranged as to allow a continuous light to be shown by the lamp.

4. The size of the opening in the spectacle for the colored glass should be 7¾ in.

These conclusions were approved by the vote taken, as follows: No. 1 by vote of 56 to 1; No. 2, 56 to 4; No. 3, 55 to 2; No. 4, 46 to 11.

The question of the length of the sweep of the signal arm to be recommended by the association was also submitted to letter ballot. Thirty-two votes were recorded in favor of the 60 deg. sweep; six votes for 70 deg.; three for 75 deg.; and seventeen for 90 deg.

Votes were also asked for or against the use, for "proceed," of a semaphore arm inclined upward instead of downward. Twenty-four voted in favor of the upward position and 13 in favor of retaining the present practice (downward).

An announcement of the October meeting will be found in another column.

Timbuctoo may now be reached by the enterprising commercial traveler. The French have built a railroad around the unnavigable lower course of the Niger, and between its terminus and Timbuctoo, 610 miles, two steamboats make fortnightly trips, going up in about four days. A third steamboat is being built to navigate the river for some 250 miles above Timbuctoo.

The Cost of Locomotive Operation.

XII.

BY GEORGE R. HENDERSON.

(*Continued from page* 222.)

RUNNING REPAIRS.

These repairs are quite as difficult of satisfactory interpretation as general repairs, as they follow no general rule of common application. Some engines require work upon them every day, while others need it only at infrequent intervals. In the *Railroad Gazette*, February 19, 1904, Charles H. Fry gave the cost of handling locomotives at terminals for a number of different roads. In some cases the repairs were stated separately, from which we can obtain an idea of this cost. On the Norfolk & Western, for the first six months of 1902, the cost for repairs per engine handled ranged from $0.96 to $1.06, and for the same period of 1903, from $1.20 to $1.37 per engine, on the average. The Mobile & Ohio, for July, 1903, averaged $0.61 for the whole line, though at one point the cost was $1.89. The Wabash System for June, 1903, showed an average of $0.98, different divisions varying from $0.62 to $1.36.

For June, 1903, the Seaboard Air Line showed an average of $1.13 per engine handled. Several other roads, the names of which were not given, show for running repairs $2.83 and $2.50 per engine handled, the latter figure being stated to cover an average of 125 miles run per engine.

These figures indicate that the running repairs will probably cost from one to two cents per mile run, depending largely upon the facilities provided and the cost and quality of the labor employed. Then, of course, it must be remembered that the roundhouse work at some points is much more liberal and thorough than at others, and will be correspondingly increased in cost.

The sum of these two items—general and running repairs—constitutes the total repair cost of the engine. Under the most favorable circumstances, for very light engines, it is not likely to be less than 2 cents per mile run, and, in certain cases, may amount to 10 or 15 cents per engine-mile. This is a wide variation, but the causes which affect this account are very varied, both in kind and intensity.

On one of the northwestern systems, for a period of one month in 1899, a division equipped with the lightest power cost 1.95 cents per engine-mile, general and running repairs being included, while the divisions having the largest engines (20-inch cylinders) cost over 3 cents, the average for the whole line being 3.18 cents per mile, while three years later the average had reached nearly 4 cents per engine-mile. The cost of repairs per 1,000 ton-miles hauled back of tender at this latter period was 19 cents for passenger and 9.5 cents for freight engines, the former costing double the latter, showing the effect of speed and weight of train, the passenger trains being only a little over one-fourth as heavy as the freight trains.

On a road running east out of Chicago in February, 1903, passenger engine repairs averaged 5.60 cents and freight engine repairs 7.22 cents per engine-mile, or 22.88 cents for passenger and 7.73 cents for freight engines per 1,000 ton-miles. In this case the freight trains were over four times as heavy as the passenger trains, which accounts for the freight locomotives costing more for repairs per engine-mile, but less per ton-mile.

A mountain division of a southwestern line showed for January, 1903, 8.25 cents per engine-mile, and 14 cents per 1,000 ton-miles. These were very heavy locomotives, but the train tonnage was only about one-half that of the Chicago road so that while the repairs per engine-mile were only slightly greater, they were nearly double per ton-mile, this indicating the important part played by grades with this account. On the same system, but farther west, engines of the same size and build cost 50 per cent. more, as the water was very troublesome and fuel oil added greatly to the expense of boiler maintenance.

One of the southeastern lines shows as follows:

Year.	Average tons per engine in freight service.	Average cost of repairs: Per freight engine mile.	Per 1,000 freight ton miles.
1897	251.43	6.41 cts.	25.4 cts.
1898	266.17	6.36 "	23.9 "
1899	277.96	6.04 "	21.7 "
1900	279.92	6.05 "	21.6 "
1901	336.11	6.82 "	20.3 "
1902	322.95	5.88 "	18.2 "
1903	302.71	6.54 "	21.6 "

Here we see that the cost per engine-mile is less than the Chicago road, but the cost per ton-mile is much greater. This is evidently caused largely by the physical condition or characteristics of the different roads. The Chicago road is nearly level, and can haul trains three or four times as heavy as on this road, which has very heavy mountain grades, and the cost per ton-mile reflects this condition. We also see that as the cost per engine-mile has an increasing tendency, the cost per ton-mile is decreasing.

Again we have different costs of repairs for different types of engines. One large road operating a number of compound locomotives of different types found that one style cost 13 cents per mile for repairs, while the other type cost only 6 cents, the engines being nearly alike in size. It has also occurred that compound locomotives have cost nearly double (per mile) as much as simple engines, also by spending so much time in the shop, their annual mileage is very much less. This must not be thought to apply to all compounds, as some have given very good service, but as a general proposition it indicates the value of simplicity in minimizing the cost of repairs.

Unit of Cost.—Statistics of the cost of locomotive repairs might be presented in great array, but such figures convey little meaning, without knowing all the existing conditions, and while they may be interesting, they are not very instructive. As we have seen, the cost will depend upon a great variety of facts, and neither the engine-mile nor the ton-mile is entirely satisfactory as a unit. For instance, the engine-mile is practically useless as a basis of comparison between engines of different size, and the ton-mile is equally defective if we wish to compare engines on different grades and alinements.

If the locomotives are similar in weight and power, but operate on different lines or different divisions of the same line, the engine-mile unit will be the most satisfactory for purposes of comparison, but if the size and power are different, and the locomotives run over the same sections of road, then ton-mile statistics will be the most valuable. Thus in searching for a unit for general comparison, we are confronted, not only with the varying size and power of different locomotives, but also the profiles of the roads upon which they operate, and our unit should provide both for the features of engine mileage and ton mileage, as well as conditions of grade, etc.

If we use the tractive force of the locomotive, we have a unit that is a fairly regular function of the size and weight, and it is evident that if the engine is exerting the full tractive force, or only 50 per cent. of it, it is entirely immaterial whether it is hauling 80 cars on a level or 20 on a heavy grade, so long as the engine is exerting the same amount of power.

After studying the question carefully we have concluded that, when exerting a pull on the draw-bar, the cost of repairs will run about one cent per mile per ton of draw-bar pull, or tractive force at the circumference of the drivers. This unit might be termed a "draw-bar ton-mile," or more exactly a "tractive force ton-mile," and must be distinguished from ton-mile of train back of or including the engine. This unit is entirely independent of the rate of grade or curvature, and is merely the force of one ton acting parallel with the rails and at the circumference of the drivers through a distance of one mile. When the lever is in the comer. and the engine is doing its maximum work, the cost of repairs would be proportional to its maximum tractive force, and when the rate of expansion is increased, reducing the available tractive force, the cost would be proportionately diminished. It is not likely that an engine will continuously exert anything like its full power—perhaps not more than 40 per cent.—for the average time that it is working steam. Under such a supposition we should have the cost of repairs per engine-mile about as shown below:

Approximate Cost of Locomotive Repairs per Mile Working Steam.

Maximum available tractive force.		Cost — At full tractive force.	At 40% of max. tractive force.
10,000 lbs.	5 tons.	5 cts.	2 cts.
20,000 "	10 "	10 "	4 "
30,000 "	15 "	15 "	6 "
40,000 "	20 "	20 "	8 "
50,000 "	25 "	25 "	10 "

These figures do not seem unreasonable in the light of our past investigations; but we must also allow for running with the throttle closed, as down hill, for example, when it is certain that there will be some wear on the machinery. This, we think, may be set at one cent per engine-mile. We could then write the estimated cost of repairs after making a reasonable mileage, and which should include both general and running repairs. under ordinary conditions, and with the ordinary types of locomotives, in the form of an equation, as follows:

Let F = maximum available tractive force as found in equation 3, but expressed in tons of 2,000 lbs.

n = average proportion of F exerted throughout the period.

m = miles run for the repair interval,

then cost = n F m + m in cents or = m (n F + 1).....(14)

In order to make clear the application, let us assume an engine of 40,000 pounds tractive force in helper service, where it is worked at full stroke up a grade, and then drops down without using steam. On the uphill portion, n will equal one on the downhill run, n = 0. Consider that the hill is 20 miles long. Then we should have for the cost of repairs necessary for an uphill trip equals

m (n F + 1) = 20 (1 × 20 + 1) = 20 × 21 = ...$4.20

For the downhill trip, 20 (0 × 20 + 1) = 20 × 1 = .. .20

For both trips (one round trip) $4.40

or $\frac{440}{40}$ = 11 cents a mile for the average, which seems to agree fairly well with practice, although a close approximation to any special case could not be expected.

Again, if we have a passenger engine whose tractive force is

10 tons [illegible] which averages 40 per cent. of this during its entire working [illegible] we should expect the repairs to cost (n F — 1) = 4 [illegible] 5 cents per mile.

In text, this formula might be easily remembered as one cent per ton of tractive force per mile plus one cent per engine-mile.

Mr. Virgil Bogue suggests a formula in which the cost of repairs and stores would be equal to .1728 times the tons on drivers, corrected by the proportion of average load to full load. With the general proportions of locomotives wherein the weight on drivers is 4 or 5 times the tractive force, the cost by this rule would be somewhat less than by ours, when the engine was fully loaded; however, as he uses higher percentages for the average power exerted by the engine, the two methods produce results not very far apart.

The most difficult part of the proceeding is to fix upon the value of n in formula 14, but as the rule itself is intended only to give an approximate idea of what the cost of repairs will be, it is not necessary to go to too much refinement. Moreover, as pointed out, the cost will vary greatly when the water or labor conditions are very different, for all of which due allowance should be made as heretofore pointed out. The most useful purpose of the rule is evidently to permit us to calculate the difference in total operating costs, for engines of various sizes over the same division, when we desire to know the relative cost of handling traffic by means of large or small locomotives. In this case, any extra flue or firebox work would probably be a nearly constant addition per mile for either locomotive, so that the difference in cost would be generally unaffected. As stated previously, costs of both material and labor vary so enormously throughout the country, or during a single year, that aboslute values for totals cannot be expected, but fortunately, if our rules are logically deduced, the difference of costs for various methods of operation in the same district can be determined with sufficient accuracy to enable us to find the cheapest speed, loading, etc., for the territory in which we are interested.

The increase in cost of locomotive maintenance and operation due to the larger sizes of the machine now in use is often commented upon as comparing unfavorably with the reduced cost of transportation charges. There is little logic, however, in such criticism. From our analysis, we have seen that it is natural to expect greater fuel and maintenance costs when the engine is enlarged. More work unquestionably requires more fuel, and heavier locomotives will certainly cost more for repairs than lighter ones. We cannot hope, therefore, to greatly increase the size of the power, and obtain large reductions in the cost per ton-mile on these two very important accounts: the cost is sure to be nearly in proportion to the work accomplished by the locomotive, which means that the fuel and repairs per ton-mile in the same service will not vary greatly, although there should be some gain in favor of the larger engines.

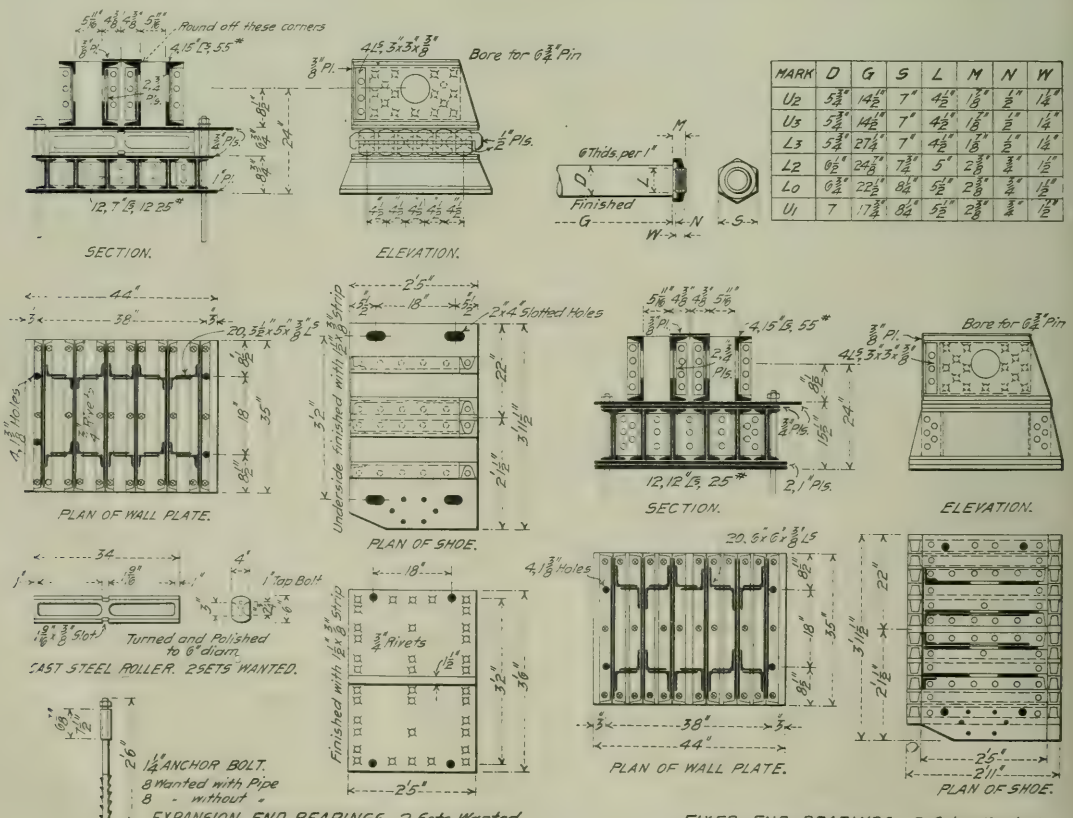
But with transportation charges this is entirely different. Outside of the switching and yard work, a long train requires little if any more labor or men than a short one, particularly since the general introduction of automatic brakes, and this fact alone is sufficient to cause a very considerable reduction in the cost of engine and train crews per ton-mile; thus the transportation accounts benefit at the expense of the maintenance charges, and instead of criticisms, the fact that the total cost of transportation is reduced, reflects credit upon the practice of increasing the power of the locomotives, which alone is responsible for the economical results obtained.

(To be continued.)

Standard Bridges on the Harriman Lines.*

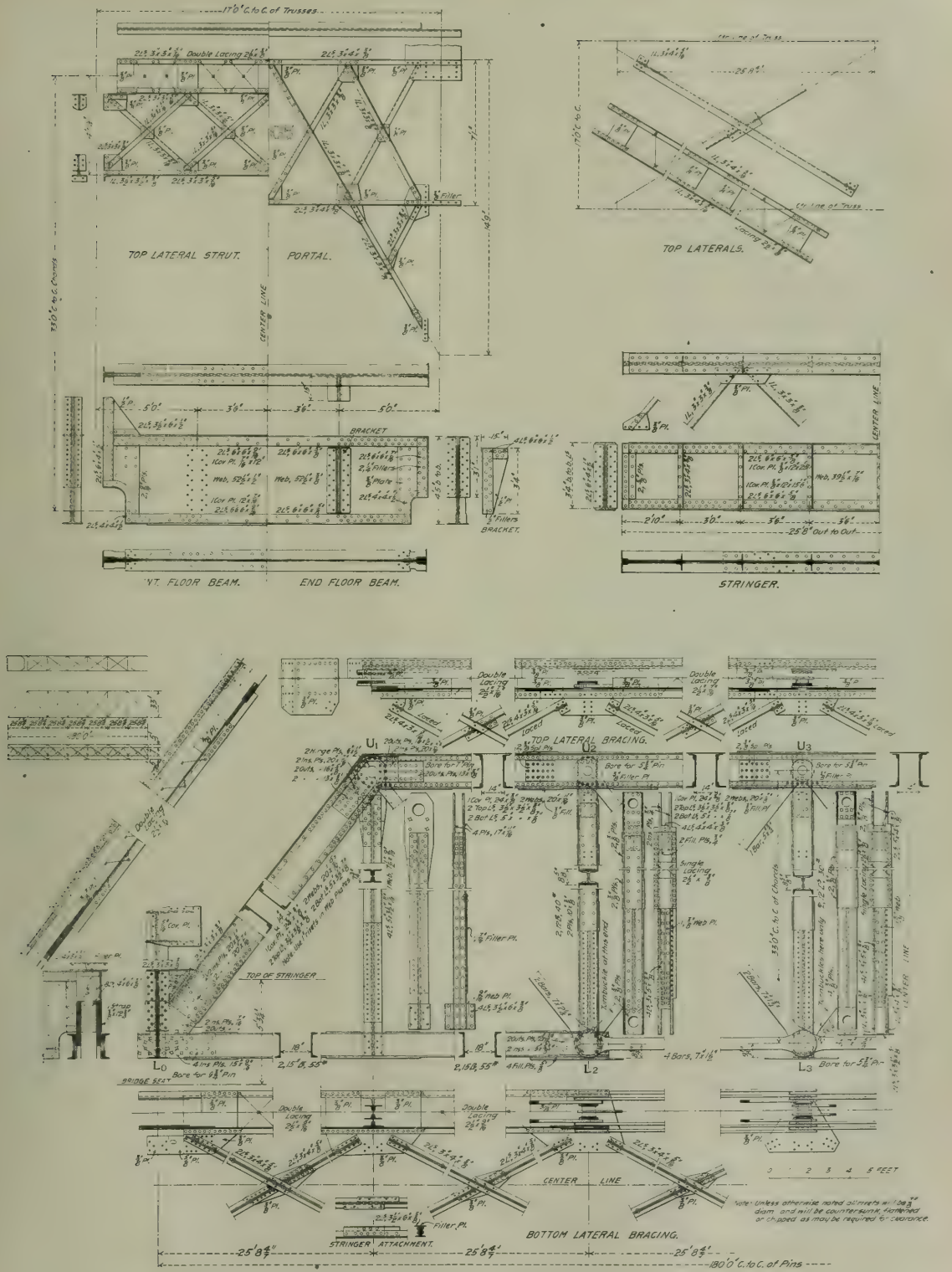
The accompanying drawings show all the details of the common standard 180 ft. span through pin-connected truss bridges used by the Harriman lines. The details are essentially similar in all respects to the 160-ft. span shown Sept. 15, and an extended description is not necessary. The principal difference in the 180-ft. span is that it is made up of seven panels whereas the 160-ft. span has but six panels. The end diagonals and the top and bottom chords are fabricated in a similar manner to those used in the shorter span but are made of slightly heavier material. The end bearings are also of practically the same design as those used for the 160-ft. span. The estimated weight of the 180-ft. span which is shown is 417,000 lbs. against 348,000 lbs. of the 160-ft. span which was shown last week.

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, August 11, 18, 25, Sept. 1, 8, and 15.


Round off these corners
Bore for 6¾" Pin
SECTION.
ELEVATION.
PLAN OF WALL PLATE.
PLAN OF SHOE.
Undercside finished with ½" Strip
Turned and Polished to 6" diam.
CAST STEEL ROLLER. 2 SETS WANTED.
1¼" ANCHOR BOLT. 8 Wanted with Pipe 8 - without "
EXPANSION END BEARINGS 2 Sets Wanted.
FIXED END BEARINGS 2 Sets Wanted.

MARK	D	G	S	L	M	N	W
U2	5⅜"	14½"	7"	4½"	1⅞"	1"	1¼"
U3	5¾"	14½"	7"	4½"	1⅞"	1"	1¼"
L3	5¾"	27¼"	7"	4½"	1⅞"	1"	1¼"
L2	6½"	24½"	7½"	5"	2⅜"	¾"	1½"
L0	6¾"	22½"	8¼"	5½"	2⅜"	¾"	1½"
U1	7	17¾"	8¼"	5½"	2⅜"	¾"	1½"

Details of End Bearings for 180-ft. Through Pin-Connected Span—Common Standard, Harriman Lines.



Details of Trusses and Floor System of 180-ft. Through Pin-Connected Span—Common Standard, Harriman Lines.

Lightening the Work of Enginemen and Firemen.*

First keep up the locomotives. There should be a regular engineer and fireman for each engine if possible and the practice of pooling engines discouraged wherever it is not absolutely necessary on account of shortage of power. Engines should be thoroughly cleaned after each trip. This will be an inducement to the men to take better care of the engines, and will also assist them by making it easier when inspecting to detect any defect that may exist.

On the large locomotives of the present day it is almost, if not altogether, unreasonable to expect the fireman to do very much cleaning in addition to shoveling the coal, and a fireman should be relieved of all cleaning on large consolidated engines, except the cab. This he should be required to keep in presentable condition. He should also be required to keep the boxes of the tender, where the supplies are kept, in a good condition.

The engineers on large consolidation engines should be relieved of the care of the wedges, as it is almost impossible for a large man to get under one of these locomotives when they are out on the road. There is no reason why they should not be required to key the rods where keyed rods are used.

There should be suitable rest houses at all terminals, with washroom, lounging-room and sleeping-room, kept clean, so that the men could take advantage of the time between runs to rest up and be in a better condition for the return trip.

The cab roof should be so arranged as to prevent the water from running down over the sides of the cab and the necks and backs of the engineer and fireman every time they are compelled to put their heads out of the window in a storm. The cab should be provided with a small wing window on each side to protect the eyes when looking ahead in a storm. Such a window could be made of a glass 6 in. x 8 in., framed and attached to the outside of the cab by hinges.

All injector valves should be within easy reach of the engineer or fireman; preferably, both injectors on the right side of the engine. The brake valve and throttle lever should be within easy reach of the engineer when looking ahead outside of the side cab-window. The reverse lever should be located where the engineer can throw it to either extreme without being obliged to get off the seat box. The whistle lever should be within easy reach of the engineer and not require him to stand up to sound the whistle. There should be a hose attachment on the branch pipe of at least one injector to enable the fireman to keep the coal wet and prevent the dust from flying around in the cab. The oil can tray over the fire-door should be so shaped as to shade the eyes of the engineer when the door is open. The lubricator should be far enough below the roof of the cab to give good clearance to the oil can when it is being filled. We have seen lubricators placed so near the roof of the cab that a special can had to be made in order to get at them.

Lubricator feed valves should have a gage to enable the engineer to set the lubricator feeds without having to count the drops. The front cab windows should be large enough to permit of the engineer or fireman passing out through them when necessary, and should be of a good quality of glass in order that they may be able to see accurately any object ahead. There should be a window on each side of the cab to enable them to see the top of the stack at all times. The grate-shaking rigging should be located in the deck of the cab where the grates can be shaken at any time while the engine is running, and the grates should be so arranged as to shake easily. The steam gage and air gage, especially the air gage, should be placed where the engineer can see it at a glance in daytime or night. All cab lights should be so arranged as to throw light on gages and water glass, so that they may be read properly without the engineer or fireman having to leave their seats to do so. Engines should be provided with pneumatic bell ringers and sanders.

The tender of coal-burning locomotives should have a coal space in the shape of a hopper and the rear plate have sufficient pitch so that the motion of the engine will keep the coal working forward within easy reach of the fireman. The manhole on top of the tank should be oblong in order to avoid the necessity of having to stop the engine at exactly the right spot to get the water spout in the hole. All supply boxes should be so arranged as to be accessible from the gangway.

On oil-burning locomotives the handles of the blower, heater, atomizer and firing valves should be on the left side of the cab, where they will not obstruct the room between the boiler-head and the cab and within easy reach of the fireman on the seat box. The valves for controlling the flow of steam to heater box, direct or indirect heater, or to blow dirt out of burner and valve or to drain water out of oil tank, should be placed so they can be operated from either the deck of tender or engine. Provision should be made so that brick or any other obstacle that may form in front of the burner can be removed while standing on engine deck.

Levers to side, front or back dampers should be within easy reach of the fireman. Cable to safety valve in oil tank should pass through cab to outside so it can be reached from either running-board if necessary. We would recommend the use of flexible joints for steam and oil connections between engine and tender.

One of the best labor-saving devices we have found for a long time is the pneumatic fire-door operator. The operating lever is placed in such a position on the deck of the cab that the fireman by placing his foot on it opens the door, and by moving his foot away the door is closed, thus insuring the swinging of the door between shovels of coal and preventing chilling of the flues. A device of this kind should be applied to each locomotive. Where ash-pans have to be cleaned along the road they should be made with drop bottoms, operated from the cab; the practice of crawling under engines on the main track for the purpose of hoeing out the ash-pan is not only inconvenient, but dangerous.

The reason for all these suggestions should be very plain. A train running at 60 miles per hour would travel at the rate of 88 ft. per second; so that while the engineer turns around for the short space of five seconds to apply an injector his train would have run one-twelfth of a mile, and five seconds is not an excessive amount of time to be used in applying an ordinary injector. Everything possible should be done to avoid the necessity of taking the eyes off the road ahead.

The pneumatic sander will pay for itself in a short time in the economy resulting from the saving of sand and the labor at the sand-house, besides the satisfaction in knowing that we are not going to run out of sand half way over the division on account of having to use more sand than is actually needed; not only a waste of sand, but the train hauls harder than if but a slight sprinkling of sand were used.

*From the report of a committee, D. D. Kesler, chairman, made to the thirteenth annual convention of the Traveling Engineers' Association, held at Detroit, Sept. 12 to 15.

The Waterways of Canada.*

At the present time great schemes for the development of the natural resources of the Dominion are in progress and in contemplation. These schemes include the construction of a new trans-Continental railway, and of other new and important railroad communications; the development of the waterways between the great lakes and the Atlantic; fuller utilization of numerous sources of water-power for industrial purposes and for the production of electrical energy; as well as many other methods of increasing and transporting the natural products and the growing manufactures of this marvellous country. No engineer who visits Canada can fail to be impressed by the enterprise and courage with which the government and private associations are facing these and other great problems, upon the solution of which depends the making of a nation. When it is remembered that the total population of Canada, with its immense extent and wonderful possibilities, is only about 5½ millions of people, the scale and cost of these great engineering works seem even more remarkable.

Our visit gave only a glimpse of what has been well described in the sentence: "The profound penetration and permeation of the country by waterways is the great characteristic of Canada." We saw something of Lake Ontario and Lake Michigan, and passed the southern end of Lake Huron. We saw the Ottawa river from Parliament hill, and had a most interesting day on the St. Lawrence, when the City of Montreal provided a steamer to convey us through the Soulanges canal, and back through the famous Lachine rapids. But we had no indication of the magnitude of the great lakes and rivers, or of the canals that have been constructed to communicate between the lakes and the Atlantic. The extent of the shipping and trade of the lakes is hardly realized here, or the importance attaching to possession of traffic from the lakes to the open sea. On the other side this is well understood, and the competition is keen between the United States and Canada. On the improvement of the Erie canal it is proposed by the United States to spend about 20 millions sterling. The Canadian Government, about the time of our visit, decided to spend £50,000 on surveys and investigations as to the probable cost of making a new waterway 22 ft. deep from Georgian bay, on Lake Huron, by the Ottawa river, to Montreal. This would be the shortest distance (425 miles) from the lakes to Montreal, the port lying furthest up the St. Lawrence to which ocean-going ships proceed. By existing routes the shortest distance from Sault St. Marie to Montreal is 950 miles; the new canal would reduce this to 610 miles. The magnitude of the shipping passing through the canals at Sault St. Marie may be judged from the statement that so long ago as 1889 the aggregate tonnage approached 7¼ million tons, and exceeded the corresponding tonnage for the Suez canal by nearly half a million tons, although the navigation was open only 234 days in the year. In 1903 the traffic rose to 14,000 vessels, of 27¾ million tons; and in 1904 to 12,200 vessels, of nearly 24½ million tons. The Canadian authorities are clearly well advised in endeavoring to improve the communication of such a traffic with

*Extract from Sir Wm. Henry White's report to the Institution of Civil Engineers on "The Visit to the United States and Canada."

the sea *viâ* the St. Lawrence, and the results of the surveys of the Georgian canal will be awaited with interest.

The Soulanges canal, which we visited, forms part of the St. Lawrence navigation. It is 14 miles long and has five locks, with a total rise of 84 ft. The locks are 280 ft. by 45 ft., with 15 ft. of water on the sills. The locks and sluice-gate mechanism are operated by electric motors, and the locks can be filled in five or six minutes, through cast-iron pipes 30 in. in diameter, passing through culverts in the side-walls. The breadth of the canal at the bottom is 100 ft., and at the water-surface 164 ft. About £1,350,000 has been spent upon its construction and equipment. The electrical equipment is worked by water-power, the head being 20 ft.; the total output is about 530 k.w. The canal is lit by 219 2,000-candle-power arc-lamps, placed 480 ft. apart, so that the navigation proceeds night and day. Electric power is also used to operate locks and bridges. There are seven bridges of 180 ft. span, each weighing about 100 tons.

Another work of which we had particulars given us by the Resident Engineer as we passed near its route, was the Richelieu and Trent canal, which will join Georgian bay on Lake Huron to Lake Ontario. The route is about 200 miles long, about 20 miles being canal. It embraces a hydraulic lift-lock, 140 ft. by 33 ft. by 8 ft., the rise being 65 ft. The fundamental idea of the promoters is to bring grain and other freight in large lake steamers to Georgian bay, then to transhipment into barges of considerable size which will pass through the canal to a sheltered port on Lake Ontario, from which place groups of barges would be towed to Montreal, and their cargoes transferred to ocean-going ships.

As to the St. Lawrence itself the navigable channel to Montreal for large ships has a minimum width of 300 ft., extending to 550 ft. at the curves; and it is expected that a depth of 30 ft. throughout will be obtained next summer. Extensive works are also in progress for the improvement of the port and for increased accommodation for large ships.

The Traveling Engineers' Convention.

The Traveling Engineers' Association held its thirteenth annual convention at the Cadillac Hotel, Detroit, Mich., on the four days from September 12 to 15, inclusive. The attendance was 210 members, the largest in five years. President J. D. Benjamin was in the chair, and in his address urged that the closest co-operation be maintained between the traveling engineers and the enginemen and the officers of the transportation department in order to secure the maximum results from each and every locomotive. Referring to new devices to improve the performance and efficiency of locomotives, special mention was made in favorable terms of superheated steam and of mechanical stokers. The association was declared to be in healthy condition and steadily growing.

The Secretary reported 71 additions during the year and a present membership of 532. The Treasurer's report showed total receipts for the year of $2,531, and a balance on hand of $500.

Hon. John B. Corliss, Congressman from Michigan, addressed the convention during its first session.

Abstracts of some of the papers discussed at the convention will be found in this issue, and others will be given from time to time. The present officers were re-elected. A committee on subjects for the next convention was appointed, and will report during the year. The next meeting will be at Chicago.

EXHIBITS.

American Locomotive Equipment Co., Chicago.—Blueprints, catalogues, etc., showing the Wade-Nicholson hollow-arch for locomotives, the Sarver valve, etc.

Webb C. Ball Watch Co., Cleveland, Ohio.—Ball official standard railroad watches.

S. F. Bowser & Co., Fort Wayne, Ind.—The Bowser oil cabinet, self-measuring pump-tank, etc., and prints and catalogues showing proper equipment of oil houses.

Crandall Packing Co., Palmyra, N. Y.—Samples of throttle-valve and air-pump packing, catalogues, etc.

Crane Co., Chicago.—The Crane locomotive safety valve and removable spring disc; also globe and angle valves.

Detroit Lubricator Co., Detroit, Mich.—Three sizes of bull's-eye type lubricators, Nos. 21, 31, and 41, of three, four and five feeds; also sectional lubricator to show construction.

Detroit Seamless Steel Tubes Co., Detroit, Mich.—Samples of locomotive boiler tubes.

Joseph Dixon Crucible Co., Jersey City, N. J.—Dixon graphite products for locomotives, including air-brake and triple valve grease; also polishing graphite for locomotive front-ends and lubricating graphite.

Fuel Protector Co., Jackson, Mich.—Catalogues showing the application of this company's fuel protector.

Garlock Packing Co., Palmyra, N. Y.—Air-pump and throttle-valve packing. Metal packing for locomotive piston rods.

Jenkins Bros., New York.—Jenkins gasket tubing for steam joints, Jenkins' '96 packing, etc.

Michigan Lubricator Co., Detroit, Mich.—"The" Bull's-eye five-feed lubricators for superheater boilers for balanced compound locomotives; also four-feed, triple-feed and double-feed lubricators.

Steel Mill Packing Co., Detroit, Mich.—Samples of "Safety" plastic metallic packing for locomotives and stationary engines.

The longest railroad route in India, from Bombay to Calcutta, is 1,401 miles long, made up of parts of different railroads. Over this route there is one through train daily, which takes 45 hours, going thus 31 miles an hour. The fastest Indian train runs from Calcutta to Allahabad, 564 miles, in 16 hours, or 35 miles an hour.

The Chicago Freight Terminals of the Chicago & North-Western.

(*Continued from page 252.*)

It is easy to see that to assemble the cars from the different freight houses into trains and to get the trains out of Chicago and on their respective divisions is no simple matter. The task is further complicated at present by track elevation which is under way in the Western avenue yards. Ordinarily these are the classification yards for the Galena division and trains over that division are made up there, but owing to the elevation work this for the past few months has had to be done at 40th avenue, though in a few cases trains run directly out of Wood street. As already explained, the State street house and the Grand avenue house which are in the same general section of the city, handle practically all l. c. l. freight in and out for the Galena division, and for the Wisconsin and Michigan divisions respectively. Loaded cars from State street run straight west, normally to Western avenue, at present to 40th avenue, where they are made up into trains. From Grand avenue, on the other hand, loaded cars run out via Clybourn Junction and the Wisconsin division to Mayfair, thence south (except three trains which run solid from Grand avenue) to 40th avenue, where they are classified into trains for the road. This seems a roundabout course but is necessary in order to relieve the most crowded section of the road.

Cars are transferred between all the different yards and freight houses in the Chicago terminal by transfer trains. Each of these has a crew of five men, engineer, fireman, conductor or, as he is called, engine foreman, and two brakemen. There are 16 such transfer crews. The transfer trains cover all parts of the terminal. All transfer switching is reported on the accompanying form (Fig. 7).

There are seven regular time freights westbound on the Galena division: first 119, second 119, 117, 121, first 127, second 127 and 113. First 119 is the Denver and Pacific Coast freight, and runs directly out of Wood street. It takes merchandise, perishable freight and livestock from Chicago for Peoria, Ill.; merchandise for the Anamosa line and from Carroll to Audubon, and merchandise, perishable freight, livestock and coarse time-freight for and via the Union Pacific. Second 119 is made up at State street yard and takes the cars from State street and the surplus from Wood and Sixteenth streets. It carries merchandise, perishable freight, livestock and coarse time-freight for and via Carroll, including the Sioux City division west of Carnarvon and Arcadia to Logan inclusive, for and via Council Bluffs, and for and via Missouri Valley, including Omaha local. No. 117, the Iowa Time Freight, runs out of Wood street. These three trains and No. 121, the Illinois & Northern Iowa Freight, are given not to exceed 1,050 tons out of Chicago. They are due to leave 40th avenue for the road between 6.39 (first 119) and 7.25 (121). The other three time-freight trains on the Galena division are first and second 127, Iowa Time Freights, which leave 40th avenue at 12.10 and 12.20 a.m., and 113, a new train created August 20, another Iowa Time Freight, which leaves at 12.45 in the afternoon and takes cars for points west of the Mississippi river from Chicago, taking coarse time-freight in preference. Before finally making up 113 in the 40th avenue yards the yardmaster at Chicago is advised by the despatcher of the number of tons of time-freight to be picked up at "J. N." tower (between Melrose Park and Elmhurst) where there is interchange with the Chicago Junction, Chicago Terminal Transfer and Indiana Harbor belt lines, and at West Chicago and De Kalb. He then makes up the train so that the tonnage, including cars picked up at those points, will not exceed 1,350 tons. With the exception of the two trains which run out of Wood street, all Galena division trains are regularly made up at Western avenue, but at present at 40th avenue, owing to the track elevation work.

On the Wisconsin division, 581, the Minnesota Time Freight, corresponds to 119 on the Galena division. It runs directly out of Grand avenue, leaving at 8.09 p.m., and takes time-freight for points on the Madison division between Elroy and Winona and for all points west of Winona, and local merchandise for points on the northern Wisconsin division between Janesville and Oakfield and fills out if necessary with through loads for this territory. At Mayfair, No. 581 picks up cars of perishable goods from the 40th avenue yards. The first St. Paul Time Freight, 1st No. 583, takes time-freight from Grand avenue, Wood street, Sixteenth street and 40th avenue for and via Elroy, Wis.; also time-freight for Madison or points west. Second No. 583 takes all time-freight for or via Elroy that cannot be handled on first No. 583, local merchandise for Beloit, Harvard and points on the Kenosha division between Harvard and Kenosha, and fills out with through loads for this territory. It also takes time-freight for points west of Elroy received too late for No. 581 or which that train cannot handle. There is another time-freight (No. 585) on this division. With the exception of No. 581, all these trains are made up at 40th avenue, whence they run north to meet the Wisconsin division at Mayfair.

On the Milwaukee division, 287, the Iron Range Time-Freight, which runs directly out of Grand avenue, is the corresponding fast train to 119 and 581 on the other two divisions. Like all the

through Milwaukee division freight trains, it runs over the cut-off or third track to Lake Bluff. It takes all time-freight from Grand avenue for points on the northern Wisconsin division between Fond du Lac and Green Bay and for points on the Peninsula division between Green Bay and Crystal Falls via Powers and time-freight for points on the Ashland division between Lake Shore Junction and Kaukauna, besides picking up at Milwaukee time-freight for points on the Peninsula division between Green Bay and Crystal Falls. No. 289, the Copper Range Time-Freight, carries time-freight from Wood street, Sixteenth street, 40th avenue and Grand avenue for points on the Northern Wisconsin division, Fond du Lac to Green Bay, all stations on the Ashland division north of Oshkosh and stations on the Peninsula division, Green Bay to Michigamme, and picks up time-freight for Milwaukee for stations on the Peninsula division between Powers and Michigamme. Other time-freight trains, Nos. 285, 281 and 283, all Milwaukee Freights, are made up at 40th avenue. The only train on this division other than No. 287 which is made up at Grand avenue is No. 731, a way freight which runs via Clybourn Junction, Mayfair and the Evanston cut-off to Milwaukee.

forces to return to Western avenue, leaving the 40th avenue yard for the Wisconsin and Milwaukee divisions alone, as before. In considering the present arrangement of the yard it will be simpler to speak of these two divisions together as the Wisconsin division, which, as already explained, they are called on working time-tables. The plan shows the normal operation of the yard when it is occupied by the Wisconsin division only. As the plan shows, the yard is built on a double curve, at the south end of which is the junction with the Galena division and at the north end the beginning of the freight connection to Mayfair. West of this, but not shown on the plan, are the yards of the Belt Railway of Chicago. On the southwest side of the yard are the extensive West Chicago shops, one of the largest railroad shop plants in the country. The odd numbered tracks are on the north side and the even numbered on the south side of the yard. Under the present temporary arrangement the Galena division occupies tracks 41 to 85 (odd numbers), the Wisconsin division retaining tracks 1 to 39 (odd numbers) and 2 to 70 (even numbers). Tracks 67, 69 and 71 are Galena division receiving tracks for road trains and transfers. Tracks 1, 3, 5 and 7 serve the same purpose for the Wisconsin division. Tracks 48 and 50

900 10M 7-19-05

Chicago & North Western Railway Co.

SWITCHMEN'S TRANSFER TRIP REPORT.

Engine No._____ Date_____ 190

OUT TRIP.

Left_____ (Name of Starting Yard.) Time_____

Ar._____ (Foreign Road or Yard.) Time_____

IN TRIP.

Left_____ (Foreign Road or Yard.) Time_____

Ar._____ (Home Yard.) Time_____

Foreman.

INSTRUCTIONS.

Foremen of engines must fill out this blank for each trip made to and from a foreign road or between different yards of this Company.

All blank spaces provided hereon must be filled out.

The initials and number of each car handled, whether empty or loaded, and the track or road from and to, must be entered in the space provided therefor.

All delays must be entered hereon, giving full particulars in each case as to time delayed and the cause of same.

When runs are made hauling full trains in each direction, one blank will be used for the out trip and another for the in trip.

At the end of each trip this report must be sent to the Agent.

GIVE FULL PARTICULARS.

Delayed_____

Foreman.

Chicago,_____ Engine No._____

CAR INITIAL	CAR NO.	EMPTY X	FROM	TO

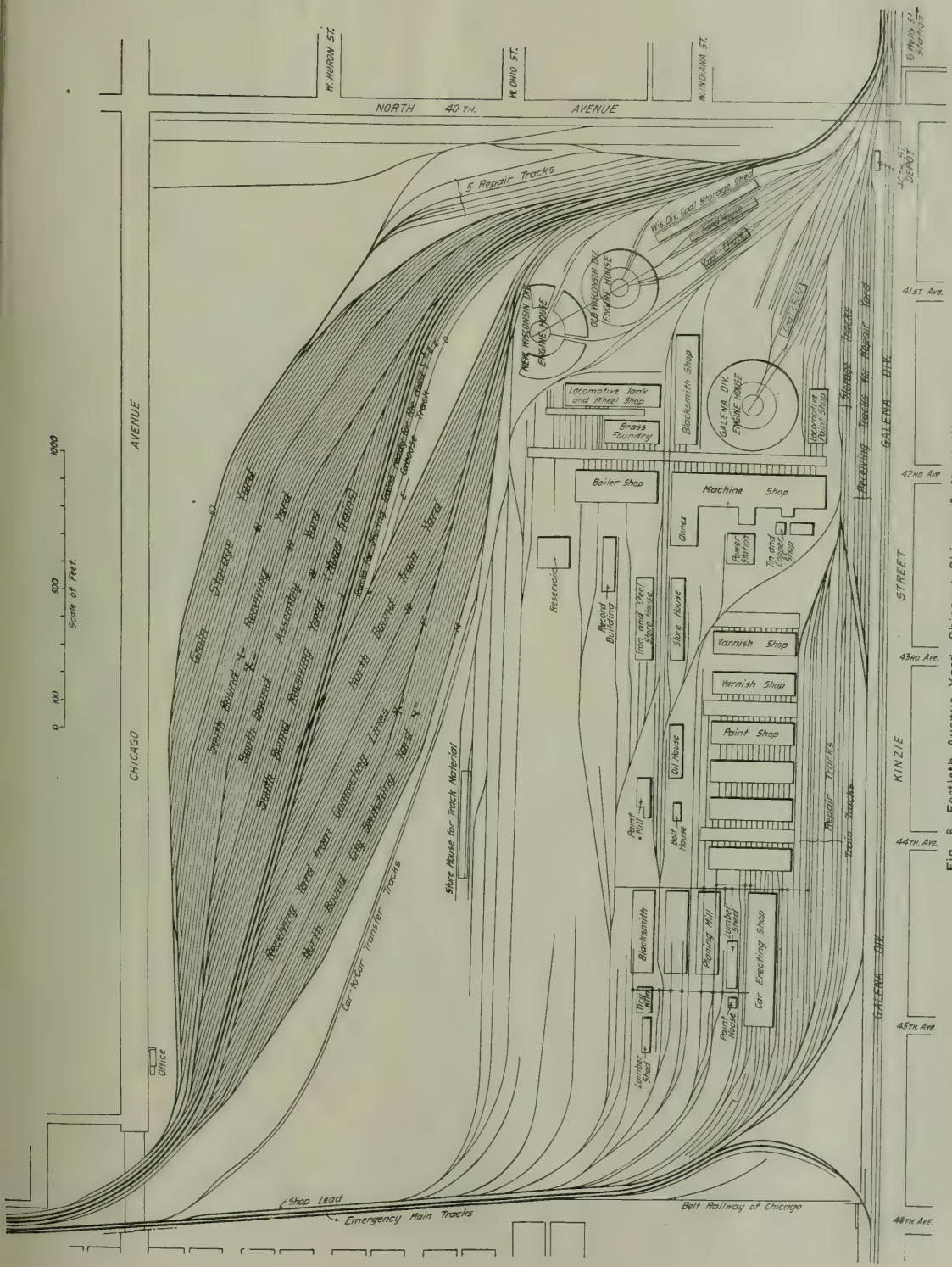


Fig. 8—Fortieth Avenue Yard, Chicago; Chicago & North-Western.

passenger trains would be sent out of Chicago by way of Clybourn Junction and Mayfair.

The Wood street yard, shown in Fig. 9, was built in 1892 when poling yards were in vogue. At that time the north track shown in the plan next to the C. & N.-W. westbound main track was used as the poling track. At present, poling no longer being used, the yard is an ordinary "break-up" yard. The plan shows the situation of the yard relative to other railroads. On the north are the main tracks and a yard of the Chicago Terminal Transfer Railroad and on the south the main tracks and a yard of the Chicago, Burlington & Quincy. This relative position of tracks continues east two miles to the Sixteenth street freight house. The markings on the plan show the general arrangement and operation of the yard. The method of handling cars through the freight house has already been described. A special track is set aside for the cars of each interchanging foreign road. When there are enough cars for a foreign road for a trip, they are handled by transfer train to the foreign road. For example, a train for the Baltimore & Ohio is usually hauled out of the yard every night. The Wood street yard has a capacity of 2,200 cars and about 17 miles of track.

Between Melrose Park and Elmhurst a new yard (Fig. 10) is being built as part of a much more extensive future plan. This is on a straight and level stretch of track about a mile and three-quarters long. The yard shown on the plan represents the work which will be done this year. With the exception of the two original main tracks, this is all new work since this spring. Melrose Park station is a short distance east of the end of the map and Elmhurst is about a mile west of the west end. At the east end of the yard there is to be a connection on each side with the Chicago Junction Railway and the other two belt lines which run over its tracks. This is a road yard and in considering its plan it must be remembered that the North-Western runs its trains left-handed. The entrance to the westbound yard is a ladder track running into 19 yard tracks. At a point not very far west of the ladder track these divide into two groups of 10 and 5 tracks respectively. At the crossing of the present highway, which is to be sufficiently elevated, it is proposed to build eventually a westbound hump and fill the space to the west, south of the present main line, with a large westbound classification yard. The proposed plan for the eastbound tracks is similar. The eastbound hump will probably be placed near the scales shown on the plan near the middle of the yard. The receiving tracks at the west end will then be added to and a number of additional classification tracks built at the east end. When the yard is finally completed according to the proposed plan it will have a capacity of at least 4,000 cars. These plans, of course, are not all definitely decided on, but suggest possible developments. The yard which is being built this year is to have 17 miles of track and a capacity of 2,000 cars. Here will be set out empty cars for the three belt roads already mentioned and dead freight awaiting delivery. The eastbound yard will also relieve the congestion within the city by handling the large shipments of grain from the west which often come very much bunched together, as many as 1,200 cars of grain sometimes coming in over the Galena division within two days' time. A mechanical interlocking plant is to be erected at the Elmhurst end and a Taylor all-electric plant in the middle of the yard. It is desired to finish the work shown in the plan before the first of October. A force of 1,250 laborers is at work and every effort is being made to hurry the yard to completion.

The yard forces employed in the Chicago terminal district include about 700 men. Of these, about 250 are enginemen (switching). On

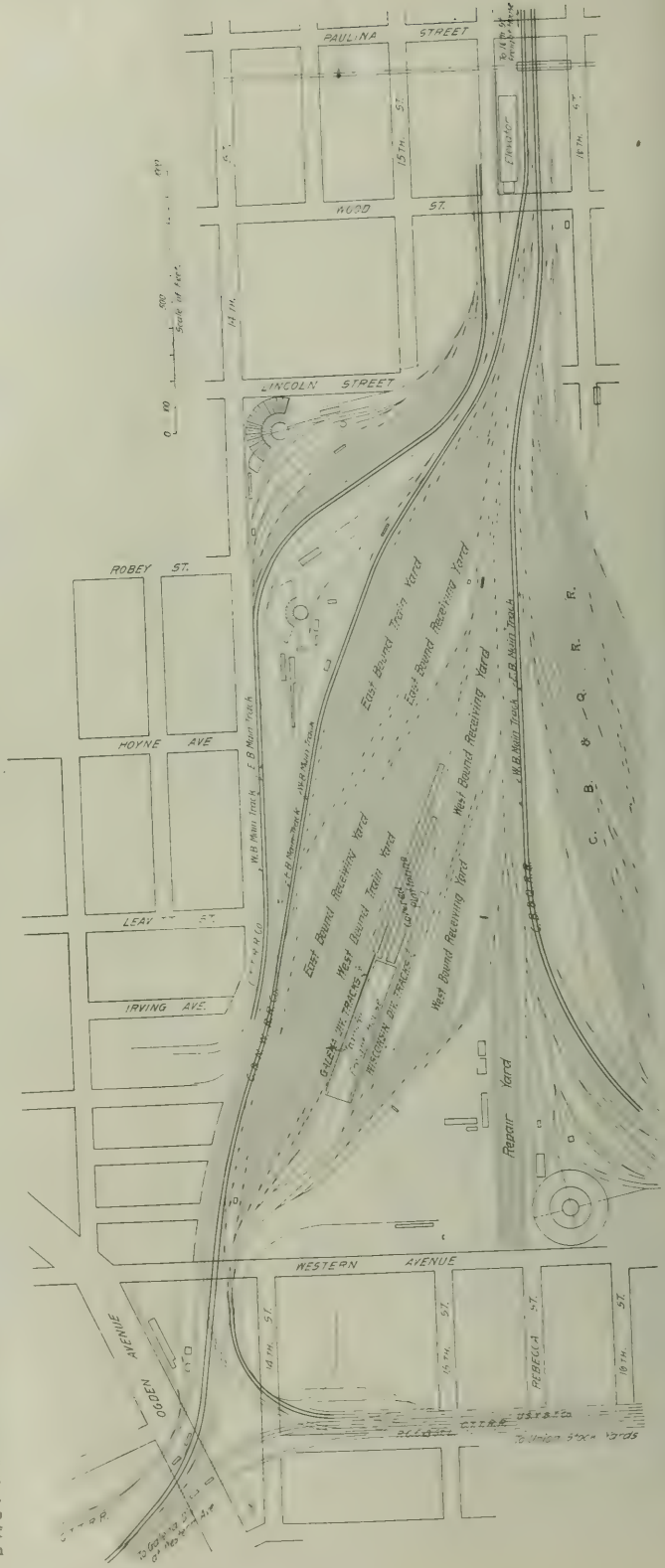


Fig. 9—Wood Street Yard, Chicago; Chicago & North-Western.

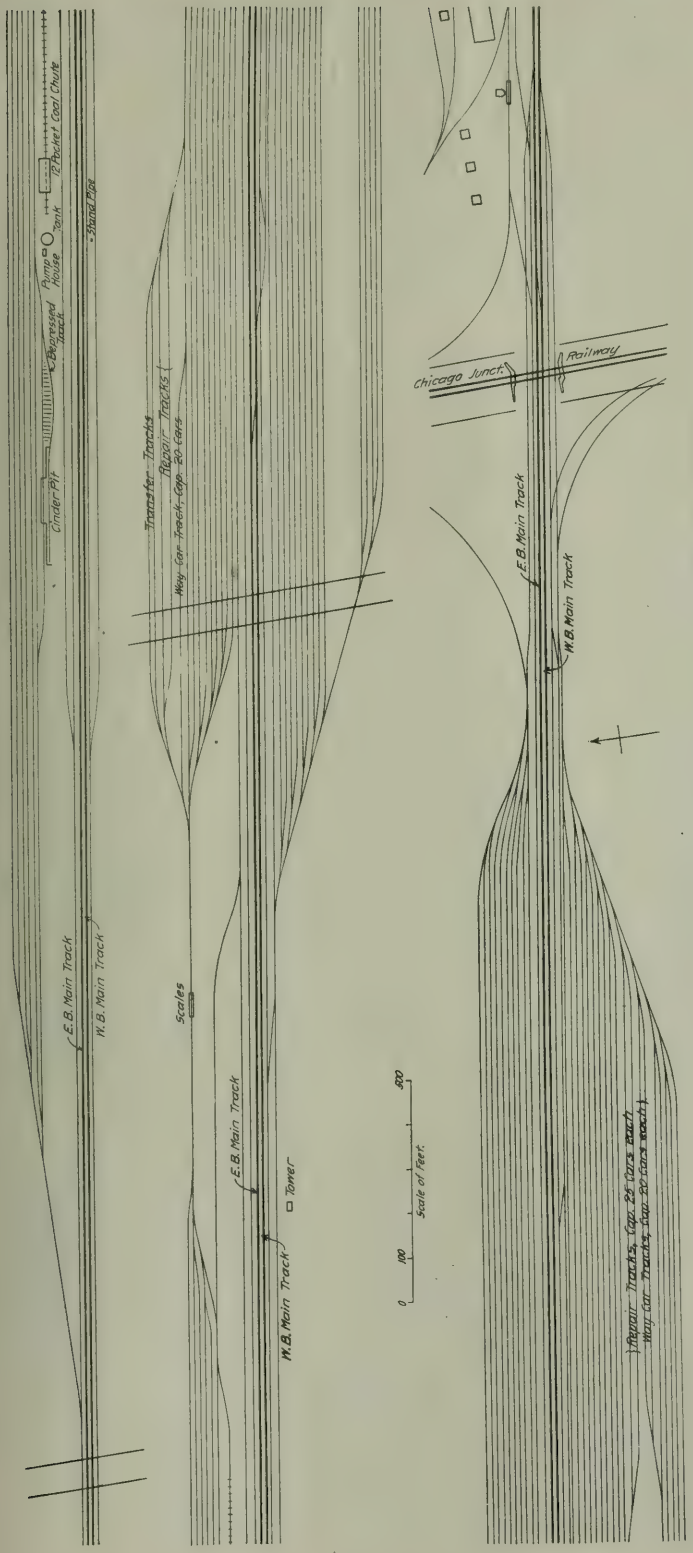


Fig. 10—New Yard at Melrose Park, Galena Division; Chicago & North-Western.

a basis of ten hours' service equaling an "engine," there are 105 engines worked in the terminal territory. Of these, 60 work days and 45 work nights. This requires about 70 actual engines, including those in the shops at any one time. The engine crews consist of an engineman, fireman and three or sometimes four switchmen to each engine. There are 24 yardmasters employed (including general yardmasters, yardmasters and assistant yardmasters), 40 switch tenders and 80 yard clerks or markers. In the 40th avenue yard there are 34 engine crews, 17 working days and 17, nights. Eight of the 16 transfer crews work out of 40th avenue. The Wisconsin division yard force there is composed of one general yardmaster, 11 yardmasters and assistant yardmasters, 24 yard clerks, four train clerks and eight switch tenders. This includes both day and night forces. It does not include the office force (five men) of the Trainmaster of Freight Terminals, whose office is in the former 40th street depot shown on the map at the junction of the 40th avenue yard with the Galena division, nor the agent's force at 40th avenue, which includes 18 general (bill) clerks, whose whole time is taken up in billing out the cars.

In the Chicago territory the Chicago & North-Western participates in the reciprocal switching agreement. This is an arrangement between the railroads on non-competitive business for a uniform switching charge of $3 a car. For instance, the North-Western will switch a car from New Orleans for the Illinois Central to one of its industries at that rate. If, however, the Illinois Central delivers to the North-Western a car from some point in Iowa reached by the North-Western, the reciprocal rate does not apply, but a rate of from $6 to $8 a car is charged. Thus the location of industries determines the routing of much competitive business. A Milwaukee firm, for example, which ships to an industry in Chicago reached only by the North-Western would hardly find it profitable to ship by any other line. If it should ship by the Chicago, Milwaukee & St. Paul, the $6 to $8 switching rate would apply, and this would make the total rate very much higher than the rate by the North-Western. The favorable situation therefore of the North-Western, which was the first road into Chicago and in a sense had its choice in locations, is effective in directly giving to it a large amount of what would otherwise be competitive business. Ordinarily there are regular published switching rates between all points in the terminal district, from a minimum of $3 a car between nearby points to $8 a car for switching to Des Plaines. In such service the Chicago & North-Western does not receive freight as a common carrier, but acts simply as the agent of the company or party from whom the property is received to perform the switching service only. Just at present, owing to the extra congestion caused by the track elevation, these regular switching rates have been annulled and the company endeavors to do as little switching service as possible. To take the place of the switching tariff between points such as Des Plaines, Mayfair or Evanston, a regular freight tariff was issued July 16, giving the rates per 100 lbs. for car load lots of different commodities between Chicago and 30 such outlying switching points. These vary from 5¼ cents per 100 lbs. on granite and marble, with a minimum weight of 28,000 lbs., to 1 cent per 100 lbs. for cinders, slag and paving brick, with a minimum weight of 60,000 lbs. The rate of $3 a car for car-load freight between the railroads in the reciprocal switching agreement and industries which have their own private tracks on the North-Western's terminal, still applies. When such interchange is with belt lines there is an additional charge of $3 a car to cover the belt charge on loaded and empty cars.

With the completion of the final plan for the Melrose Park yards the Chicago & North-

Western will [illegible] although probably a crowded, yet an effective system of terminal arrangements in Chicago. Unfortunately, in the central part of the city it is almost impossible to handle the existing business. Land is so costly that the present arrangements will probably be used until such time as increased traffic makes it absolutely necessary to increase facilities at whatever cost. The completion of the track elevation work and of the Melrose Park yard should greatly relieve most parts of the Chicago terminal. It is then planned to make up and separate all Galena division freight trains, with the exception of the regular time-freight trains, outside the city, thus relieving to a very great extent the Western avenue yard. The 40th avenue yard, relieved of its temporary occupancy by the Galena division, seems capable for some time at least of handling the business of the Wisconsin and Milwaukee divisions. The completion of the air line low-grade third and fourth tracks all the way to Milwaukee will divert most of the freight and through passenger traffic from the present Milwaukee division, which will be left free to handle the increasingly large suburban business. If all freight trains from those two divisions had to run directly into Grand avenue it is doubtful if the road could be successfully operated, but by the present system of bringing such trains into the city by the back door, the situation has been greatly relieved. What will happen to the terminals of any of the Chicago roads if the city and the traffic keep on growing as they have for the past 20 years is problematical, but whatever changes are to come, the Chicago & North-Western cannot fail to profit by its present exceptionally favorable terminal situation.

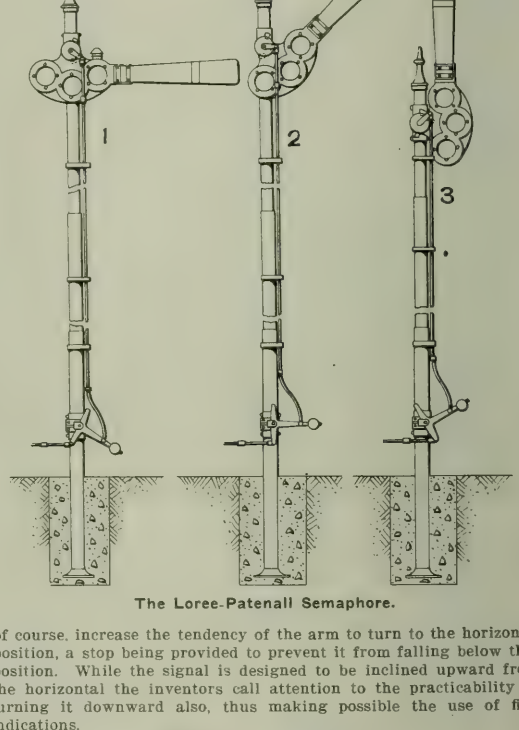
American Locomotive Company.

The report for the year ending June 30, 1905, being the fourth year of the company's existence, shows gross earnings of $24,150,201, a decrease of $8,918,550 as compared with 1903-1904. This falling off was expected, and, indeed, warning was given of it in the report for last year. The reason is the depression in general business which existed throughout the country from the fall of 1903 to the fall of 1904, this affecting particularly the amount of railroad equipment ordered during that period. It must be understood that up to June 20, 1904, the company was working on old orders received prior to this depression, so that the effects of it did not show in the report for that year, but are evident in the diminished output during the fiscal year just closed. The manufacturing, maintenance and administrative expenses, $19,796,533, show a corresponding decrease, $7,608,452, making the net earnings $4,353,668, a decrease of $1,310,098. As in former reports, this figure for expenses includes, besides the direct cost of manufacture, all indirect charges against production, a depreciation charge of 20 per cent. of the book value of patterns, dies, etc., and an adjustment of the original price of material in stock to its present market value. The interest on bonds of constituent companies, bills payable, etc., amounted to $112,186, and the regular 7 per cent. dividend on the $25,000,000 preferred stock, to $1,750,000, leaving a surplus of $2,491,481. The investment in the Montreal works amounted to $1,883,557, which sum was charged against income, instead of capital account, although it resulted in a permanent addition to property. The net surplus was, therefore, $607,924. During the year there were additions and betterments to the amount of $598,204, which have been charged against the extraordinary improvement and betterment fund of $1,000,000 created in 1904 out of the current surplus of that year. The general balance sheet shows as assets: Cost of property, $45,657,081; securities owned, $3,448,131; convertible assets, $14,680,611; liabilities: preferred stock, $25,000,000; common stock, $25,000,000; bonded debt, of constituent companies, $1,237,500; current liabilities $6,851,507; extraordinary improvement and betterment fund, $401,796, and profit and loss, $5,420,019. The most important financial transaction of the fiscal year just ended was the purchase in January of $1,962,706 of the $2,000,000 capital stock of the Rogers Locomotive Works at Paterson, N. J. This cost is to be met from income account and is at present carried in the investment account on the general balance sheet. The report shows that the company proposes to devote a separate shop at the Brooks Works exclusively to the manufacture of the electric shovel, and particular attention is being made to the possibilities of the development of the electric locomotive, trucks for electric service, motor cars and other power vehicles.

It is now some years since the French Parliament ordered an investigation preliminary to a proposed acquisition by the state of two of the six great railroad systems of the country, the Western and the Orleans. The present little state system, consisting chiefly of lines which threatened to become bankrupt, between these two systems, is not a very good field for testing state management; and the acquisition of the Western and the Orleans would be looked upon as a preliminary to a union of all the railroads under the government. Those who advocate this policy, when they reach positions of responsibility, apparently are frightened by the dangers which it would involve, and this accounts, in large part at least, for the numerous postponements. The present Minister of Public Works, Gauthier, has recently promised to report on the result of his negotiations with the companies next October.

The Loree-Patenall Semaphore.

The Loree-Patenall semaphore, which is spoken of in another column of this paper, and which is of interest at the present time by reason of the active discussion of the upward inclination which is now going on, was designed two years ago (patented July 21, 1903), by Messrs. L. F. Loree, then President of the Baltimore & Ohio, and F. P. J. Patenall, Signal Engineer of that company. The spectacle casting, as shown in the accompanying engraving, is so designed as to cause the signal to return to the stop position whenever it is released or disconnected or broken, without the aid of a counterweight. Accumulations of snow or ice on the blade or casting will,



The Loree-Patenall Semaphore.

of course, increase the tendency of the arm to turn to the horizontal position, a stop being provided to prevent it from falling below that position. While the signal is designed to be inclined upward from the horizontal the inventors call attention to the practicability of turning it downward also, thus making possible the use of five indications.

The Condition of British Shipping.*

We are now well into the second half of the shipbuilding year, and the prospects of the industry are not so bright as they were six months ago. The amount of new work actually on hand on the stocks is not much above that of last year, while the number of orders booked during the last four or five months have been few. This means that as the vessels now on the stocks leave the berths the builders will have nothing like as many to put in their place. Nor is much contracting, even at the best of times, usually done in August, so that unless there is a revived demand in September and October there will be a considerable shortfall of shipbuilding work with which to face the winter. If often happens that when merchant-ship building is slack some of the yards on the Admiralty list are able to give plenty of employment on warship building; but at present, excluding the Government dockyards, there are only 150,000 tons of warships in various stages of construction at private yards, and as regards the Clyde there is only one warship actually on the stocks. The total output of the shipyards this year will be very large, perhaps larger than last year; but prospects of the near future are not bright, however busy many of the yards and relative industrial establishments may be just now.

The pause in the demand for new shipping, which was so active

*Extract from a paper in *The Statist*, London.

at the beginning of the year, has occurred in spite of the fact that costs at present are not at a high level. They have been lower; and perhaps even now they would be lower than they actually are had it not been for the combination among the English and Scotch steelmakers to keep up the prices of ship and boiler plates. It may be admitted that these prices have not been advanced extravagantly—there has always been the fear of American and German competition to prevent that—but there is no doubt they are higher than they would have been in a condition of free and open competition. Still, prices are not so high as to check building, and the absence of demand for new cargo vessels must be attributed to the depressed and discouraging condition of shipping. We have little faith in the conditions being improved by the efforts which shipowners are makinng to reduce the pressure of international competition. It is claimed that the International Association of Shipowners engaged in the North Sea and Baltic Trades has brought something like order into these trades. This may be, but the Association is not, and can never be, comprehensive, nor can its regulations be made compulsory.

While we sympathize entirely with British shipowners in the adversity of their industry, and would rejoice if they could find a way of improving it, we think they are on the wrong lines. By such combinations they are really playing into the hands of their foreign competitors; just as they do when they sell their second-hand ships at low prices to foreigners, and hasten to build new ones with a larger expenditure of capital, on which they cannot earn a remunerative return because they are undercut in the freight market by their own discarded ships. What would be much more to their advantage would be an international agreement for a universal load line, and for a uniform scale of seaworthiness, so that they may not be handicapped by overladen and imperfectly equipped vessels (with the consequent economies) sailing under foreign flags.

It seems to us that what British shipowners should now do is to organize, through the Government and by diplomatic methods, an International Maritime Conference for the definite settlement of the vexed questions of loading and seaworthiness. The fact that previous conferences of the kind have been more or less abortive should not deter us from further effort, if we go prepared to show that if a universal basis be not established we shall discriminate in our ports against all vessels which do not comply with the regulations which have been found to be necessary and acceptable in the case of British vessels. As the largest shipowner in the world, we are entitled to take up this position, and if we insist on uniformity we can secure it. Overloading may or may not be so common on foreign ships as is commonly supposed. But it certainly exists, and as long as it exists it is a menace to human life, as well as an injury to British shipping and to all shipping conducted on prudent lines. A good deal is to be said against the desire of British shipowners for the Government to be represented at the international conferences for the consideration and adjustment of shipowners' liability in respect of collisions—at least in so far as these conferences have hitherto gone, although the time is approaching when the Governmental arm may be intervened—but we know of nothing that can be said against the Government taking part, in a resolute spirit, in an international conference for the regulation of loading and seaworthiness.

With regard to the condition of shipping, attention may be recalled to some remarks made the other day by Mr. M. M. Rodocanachi, as Chairman, at the annual meeting of the London Marine Steamship Company, Limited: "Abundance of tonnage, and the consequent reduction in freights, is not the only evil by which shipowners are at present beset. They are also adversely affected by customs of the port, terms of charter, and general working arrangements, so that even when the much-longed-for improvement may arrive there will be a lot of leeway to pick up. The depression has been so severe and prolonged, with the unfortunate consequences so far-reaching, that it will take some time to get the shipping trade back on the lines of some years ago." But, he added, "The one gratifying feature is that the cost of construction has ceased declining, and has come to a standstill. This decline in itself has given cause for serious anxiety in the past, as, besides bad freights, steamship owners had also to reckon with a continued falling off in the value of comparatively new steamers." We are not sure that the cessation of decline in the cost of construction is such a gratifying feature as is indicated, although it may be to some extent reassuring to present owners. But what as to the prospective improvement? There is none, according to Messrs. H. E. Moss & Co., for these well-known authorities, in their last freight report, say: "We are sorry that we cannot report any improvement in the shipping trade, nor can we see anything to justify the belief of an improvement in the future. There is too much seeking tonnage everywhere, and the large number of steamers building seems to us likely to prevent any considerable improvement in freights." On the whole, then, it would seem that, however much the decline in the orders for new ships may be lamented by shipbuilders, and however much we may regret it on account of the various industries and workers concerned, it is in the interest of the over-burdened shipping trade. This is not the less true if it be the case that large cargo steamers now cost about £5 12s. 6d. per ton of dead-weight capacity to build, whilst a good many of the steamers now being built or recently launched were contracted at £5 10s., and even down to £5 5s., per ton, dead-weight capacity.

Train Accidents in the United States in August.[1]

dn, 1st, Grand Rapids & Indiana, Kendallville, Ind., a passenger train was derailed at a derailing switch approaching the crossing of the Lake Shore & Michigan Southern, and the engine and first three cars were ditched. The engineman was injured seriously and 13 passengers slightly.

dr, 3d, Baltimore & Ohio, Foustwell, Pa., a passenger train was derailed by a broken rail and the baggage car and smoking car fell down a bank. The conductor and eight passengers were injured.

rc, 4th, 2 a.m., Delaware & Hudson, Sidney, N. Y., a passenger train ran into the rear of a preceding freight and the engineman was killed. The freight had been unexpectedly detained and it is said the flagman did not go back far enough.

dn, 4th, Central of New Jersey, Bayonne, N. J., an eastbound passenger train running at moderate speed was derailed at an unfinished switch which was left in an unsafe position, and the engine fell off the side of the trestle-bridge, on which the accident occurred, and was partly submerged. The engineman was killed. This accident was reported in the *Railroad Gazette* of August 18.

bc, 6th, Maryland, Delaware & Virginia, Centreville, Md., an empty engine, accidentally or maliciously started, ran uncontrolled several miles and finally collided with passenger train No. 3, wrecking both engines. The engineman and fireman were injured, the former fatally.

xc, 6th, New York Central & Hudson River, Savannah, N. Y., an eastbound freight train collided with a string of empty freight cars, and the engine and several cars were wrecked. The engineman was killed.

xc, 8th, Atchison, Topeka & Santa Fe, Emporia, Kan., a switching engine collided with tne caboose of a stock train standing near the station, and 10 persons, mostly drovers in the caboose, were injured.

unf, 8th, Augusta Southern, Warthen, Ga., passenger train No. 27 was derailed by a landslide and the engine was overturned. Four passengers and three trainmen were injured.

dn, 10th, West Virginia Central & Pittsburg, Elkins, W. Va., a freight train descending a steep grade became uncontrollable and was derailed, and 20 cars were wrecked. The engineman and one brakeman were killed and two other trainmen were injured.

unx, 10th, Chicago, Rock Island & Pacific, Limon Junction, Colo., a freight train was derailed and two men, said to have been on the cars without right, were killed.

11th, Southern Railway, Lynchburg, Va., the tender of the engine of passenger train No. 29 was derailed near the bridge over the James river, and, with the first four cars, fell against the trusses of the bridge.

unx, 12th, International & Great Northern, Navasota, Tex., a freight train was derailed and the engine and three cars were ditched. The fireman and two other trainmen were injured, the fireman probably fatally.

bc, 13th, 1 a.m., New York, Chicago & St. Louis, Vermillion, Ohio, butting collision between an eastbound passenger train and a westbound freight, the freight having run several hundred feet beyond the switch at which the trains should have met. Both engines and several cars were wrecked and in the first passenger car of the passenger train 11 passengers were killed; 25 passengers and trainmen were injured, some of them fatally. The passenger engineman was killed. The conductor of the freight attempted to stop the train as soon as he saw that it was not being stopped by the engineman at the right point, but he was unable to act in time to prevent the collision.

bc, 13th, Wabash road, Fremont, Ohio, butting collision of freight trains, wrecking both engines and 12 cars. Two brakemen were killed. It is said that the westbound train had run eight miles beyond the appointed meeting station.

unx, 13th, Atchison, Topeka & Santa Fe, Lewis, Kan., west-

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments: defects of roadway.
eq	Derailments: defects of equipment.
dn	Derailments: negligence in operating.
unf	Derailments: unforeseen obstruction.
unx	Derailments: unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

bound passenger train No. 9 was derailed, and the fireman and one brakeman were killed. The engineman was fatally injured.

xc, 14th, Chesapeake & Ohio, Garrison, Ky., passenger train No. 2 ran over a misplaced switch and collided with an engine and some cars standing on a side track. The engineman and fireman of the passenger train were injured, probably fatally. Two passengers were also injured.

xc, 15th, Rushville, Ind., an eastbound passenger train of the Cincinnati, Hamilton & Dayton ran into a southbound freight of the Pennsylvania Lines, at the crossing of the two roads, wrecking the freight engine and knocking it over into the passenger station, demolishing the baggage room and men's waiting-room. Seven passengers and one trainman were injured.

dr, 15th, Houston, East & West Texas, Urbana, Tex., passenger train No. 1 was derailed and the engine was overturned, ditching the mail car and express car; engineman and fireman injured.

dr, 15th, Houston & Texas Central, Sherman, Tex., the rear car of a passenger train was derailed at a point where the track had been distorted by solar heat, and four passengers were injured.

rc, 16th, Atchison, Topeka & Santa Fe, Corona, Cal., a freight train ran into the caboose of a work train; six employees were killed and 15 injured, many of them fatally.

unf, 16th, night, Baltimore & Ohio Southwestern, Cincinnati, Ohio, a passenger train ran into a street car, crossing the track, and demolished it, killing three of its 13 passengers and injuring the other 10. The conductor and motorman escaped. The locomotive and mail car of the passenger train were derailed and ran into a garden, wrecking three small buildings.

unx, 16th, Pennsylvania Lines, Frazeyburg, Ohio, a freight train was derailed and 11 cars fell down a bank; one brakeman was killed.

unx, 16th, Pennsylvania road, Hydetown, Pa., a passenger train was derailed and one of the two engines and seven cars were ditched; two passengers injured.

xc, 17th, 9 p.m., Beaumont, Tex., a freight train of the Southern Pacific ran into a freight of the Gulf & Interstate at the crossing of the two roads; two employees injured.

†dn, 17th, Atlantic Coast Line (Norfolk District), Bruce, Va., an excursion train ran into an open draw and the engine and two cars fell into the west branch of Elizabeth river. Fifteen passengers were drowned and about 25 injured. The engineman jumped off, struck a log raft and was seriously injured, being at this writing still unable to explain his error. It appears that there is no derailing switch at the draw and that according to rule the train should have been stopped before crossing the draw. This stop was not made, though there is a stop sign half a mile back and another one 300 ft. back. The reports say that the engineman was making his first trip over this line. This accident was reported in the *Railroad Gazette* of September 1, General News Section, page 67. Two coroners' juries investigated this disaster; both find the railroad company negligent in entrusting the train to an engineman not fully acquainted with the road.

rc, 18th, Delaware & Hudson, Fort Edward, N. Y., rear collision of passenger trains; 20 passengers injured.

rc, 19th, Chicago & North-Western, Waukegan, Ill., a freight train standing in the yard was run into at the rear by a following freight, wrecking one engine and 12 cars. One brakeman of the standing train and the engineman and fireman of the other train were killed.

dn, 19th, Chicago, Rock Island & Pacific, South McAlester, Ind. T., a passenger train was derailed by a misplaced switch and two passengers and two mail clerks were injured.

unx, 19th, St. Louis & San Francisco, Cedrom, Ala., eastbound passenger train No. 204 was derailed and several passengers were injured.

xc, 20th, Louisville & Nashville, Gethsemane, Ky., collision between northbound and southbound freight trains, one of which was on the side track but not fully clear of the main line, badly damaging four engines and wrecking one car. One engineman was killed and two other trainmen were injured.

unx, 20th, Southern Railway, Demopolis, Ala., a westbound passenger train was derailed and several cars fell down a bank, the baggage car being overturned. Thirty passengers were injured.

xc, 21st, 10 p.m., Southern Railway, near Salisbury, N. C., a runaway locomotive, unattended, collided with a freight train, damaging both engines. The engineman was killed and the fireman injured. The accounts indicate that the runaway engine had been started maliciously.

dn, 21st, 1 a.m., Lake Shore & Michigan Southern, Vulcan, Ohio, a freight train was derailed and ditched at a derailing switch; the engineman was killed and the fireman and one brakeman were injured.

unf, 21st, St. Louis, Iron Mountain & Southern, Nettleton, Ark., a work train was derailed by running over a cow, and several cars were wrecked. One man was killed and two were injured.

rc, 22d, Pennsylvania road, Howellsville, Pa., rear collision of freight trains; two trainmen injured.

dn, 22d, Middlesboro, Ky., a freight train of the Southern Railway consisting of 38 cars of coal became uncontrollable on a descending grade and, after running uncontrolled several miles, was derailed, the train first having broken into two parts. One of the parts, after jumping the track, ran into and demolished six cottages, killing a child in one of them. The engineman stuck to the engine until it was wrecked, and was fatally injured.

bc, 23d, 1 a.m., Union Pacific, Rossville, Kan., butting collision of freight trains. Three trainmen were killed and two injured.

unf, 23d, Charleston & Western Carolina, Barksdale, S. C., a freight train was derailed and seven cars were wrecked. The fireman was killed and the engineman was injured. It is believed that the derailment was due to a malicious obstruction.

eq, 25th, Pennsylvania road, Bainbridge, Pa., a westbound freight train was derailed, wrecking many cars, some of which fell upon the adjoining track. An eastbound freight train ran into the wreck and its engine was overturned and thrown into a canal, injuring four trainmen. It is said that the first derailment was due to the sudden stoppage of the train in consequence of the rupture of an air hose.

rc, 26th, Toledo, St. Louis & Western, Van Buren, Ind., a freight train ran into the rear of a preceding freight, wrecking the engine, caboose and two cars; three trainmen were injured.

xc, 26th, 8 p.m., New York, New Haven & Hartford, Bridgeport, Conn., a freight train ran into another at a cross-over on the viaduct, wrecking two engines and 25 cars. One fireman was fatally injured.

*unf, 26th, 11 p.m., Seaboard Air Line, Calhoun Falls, Ga., a freight train was derailed at a switch which had been maliciously loosened, and nine cars were wrecked and burnt up. One employee was killed and three were injured.

xc, 28th, 1 a.m., Pittsburg, Cincinnati, Chicago & St. Louis, Logansport, Ind., an excursion passenger train collided with a freight train in the yard, and the engine was overturned and the first two cars wrecked. The engineman and fireman were killed and several passengers were injured.

unx, 28th, Central Vermont, Williamsville, Vt., an engine running backward was derailed and tumbled down a bank. The engineman was fatally injured.

unx, 29th, 1 a.m., Chesapeake & Ohio, Long Run, Ky., the caboose of freight train No. 99, running at moderate speed, was derailed and fell down a bank. The flagman and the fireman, riding in the caboose, were injured.

29th, Lake Erie & Western, Kingsland, Ind., a freight train was derailed at the derailing switch approaching the crossing of the Chicago & Erie and the engine and one car were ditched. The derailment was due to the opening of the derailing switch immediately in front of the train, the signalman having decided to do this to prevent the freight from running into a passenger train on the other road which was approaching the crossing at uncontrollable speed.

unx, 30th, Southern Railway, Augusta, Ga., a passenger car in a passenger train, moving through Washington street at low speed, was derailed at a switch and overturned. A quarantine inspector was killed and a flagman on the ground was fatally injured.

xc, 31st, 1 a.m., Charleston & Western Carolina, Laurens, S. C., freight train No. 14 broke in two and the rear portion afterward ran into the forward one, wrecking several cars. One man was killed.

Foreign Railroad Notes.

The management of the Prussian State Railroads has for some years made provision for special care and treatment of cases of consumption among its employees, who have hospitals provided in favorable locations. These have been found very effective, and now the Minister of Public Works has given instructions which will extend the care given to employees to consumptive members of their families.

The coal shipments from the mines in Germany for the first half of this year were 3,869,095 ten-ton carloads, which is nearly 4 per cent. less than last year. A strike in the Ruhr district, which shipped 70 per cent. of the whole last year, reduced its shipments more than 10 per cent., and this was not made good by the increased shipments from Siberian and Saar mines. Imports have increased, and the indications are that the coal consuming industries have been on the whole just about as active as last year.

A man digging a ditch alongside a railroad in Germany was hit and partly disabled by a bottle which some careless person threw out of a car window. He brought suit for damages against the railroad. The court which first tried the case decided for the railroad; on appeal, the decision was for the injured man; appeal to the Imperial court resulted in the reversal of this decision. Notices in the car forbade throwing things out of the window, and the point contested was whether the railroad had done all that it properly could to prevent such acts.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 13. FRIDAY, SEPTEMBER 29, 1905.

The principal recommendation of the New York State Railroad Commissioners in their report on the Fifty-third street derailment on the Manhattan Elevated is that all trains shall stop before passing the switch leading to the curve; both those that are to run through the curve and those that are to continue on the straight line. For those that are to take the curve the delay of a stop may not be very serious, as the speed must be reduced to 8 miles an hour anyway; and the grade descends southward so that the heaviest trains can be started easily. But why stop the Ninth avenue trains? What is it that has carried trains past this junction on the straight line safely, hundreds of them daily, for the past quarter of a century? Wherein does the Fifty-third street situation differ from that at innumerable facing-point switches all over the country, past which many trains are running every day at high speed? If enginemen cannot be depended on to look for each signal in due season on approaching it, and to heed its indication, how can we justify more than 15 miles an hour anywhere? It goes without saying, almost, that on a road of heavy traffic the signals should be large enough; be well placed for the engineman to see them, and, if disks, have a good background, like the "banjo" automatic block signals. The signals at Fifty-third street are switch lamps. The "disk" is the side of the lamp, somewhat enlarged, with no artificial background. If anyone should assert that a full-size semaphore, at proper height and distance, would have arrested this heedless motorman's attention, and have prevented the disaster, what answer can be made to him? The commissioners recommend the installation of semaphores. It also goes without saying that the interlocking should be complete. But with suitable signals and, of course, the best brake power, kept in the best condition, so that the engineman knows how and to what extent he can respond to a signal indication, we must depend on the man, or else give up trying to carry passengers at speed. If the rule to regularly stop is the true preventive of this kind of disaster, why should not the same remedy be applied at Mentor, or at every sharp curve approaching a high bridge? In short, the New York Railroad Commissioners have raised a question, which they have not answered, as to the adequacy of the discipline of locomotive runners in general, and of Manhattan Railway motormen in particular. There is a severe temptation to railroad officers and investigating commissioners to order radical changes immediately after a fatal accident. If the accident is non-fatal there is less of this sort of tendency, although the need of better methods be quite as obvious. In this case we are inclined to say the remedy is bad. It is costly, for the many daily stops cost the company something like 20 cents each for a few hundred trains, and the loss of time to millions of passengers can be computed any way you like. Good discipline everywhere and good signals are better preventives of accidents than local rules imposed by investigators in a hysterical atmosphere.

The figures on the Chicago track elevation work given elsewhere convey some idea of the stupendous task set the railroads by the city. It has been in progress now since 1892, the first piece of work being done by the Illinois Central in anticipation of the World's Fair in 1893. The expenditure to date by the roads amounts to $29,000,000, in round numbers, according to the estimated approximate cost of the city's track elevation expert. His figures are too high without doubt, possibly as much as 15 or 20 per cent., though of this we cannot be sure. The city has passed and the roads have accepted in the period mentioned 26 ordinances calling for approximately $49,000,000 worth of work. It is estimated that the total cost of the work when ordinances now contemplated have been passed and complied with will be nearer $75,000,000, and that all of the work will have been completed before 1915. The yearly expenditure for all roads so far has averaged under two and a quarter millions. The burden of cost is thus distributed over a period of years that makes it much less onerous. It should be known that the entire cost of the work is borne by the roads, the city contributing no part. The total expense sustained by the latter up to the present time it is claimed will not exceed $35,000. Accepting this figure as correct, the Chicago achievement is remarkable, especially when viewed in the light of conditions in some of the eastern states—New York and Massachusetts, for ex-

ample—where half the cost may, by state law, be borne by the municipality.

What the yearly saving to the roads will be from the elevation of the track is speculative. The elimination of the grade crossings does away with many watchmen and gates, but this will be more than offset by the cost of maintenance of subway bridges, interest on investment, etc. The largest items of saving are in damages due to crossing accidents and loss of life, and of avoidance of numerous and costly delays to traffic. The general ordinance providing for comprehensive elevation of the tracks, known as the O'Neill ordinance, was passed Feb. 23, 1893. It has been made a part of the city's municipal code and has been used ever since as a means to compel the roads to accept the special ordinances that have been passed. There were in 1892 about 1,500 grade crossings in the city which were daily crossed 1,000,000 times by persons on foot or in vehicles, this figure including passengers in trains. Statistics collected at the time were made the basis of an estimate showing the yearly loss to the citizens due to these crossings to aggregate $5,000,000. This took no account of the losses to the railroads. The yearly loss of life was 300 persons, and a much greater number were maimed and injured, while considerable property was destroyed.

Many new methods and original schemes have been applied in executing this work in order to accomplish it expeditiously and at the same time keep traffic moving with minimum delay. To attempt an enumeration of these would mean simply to give a detailed history of all of the work, as every job has its special and peculiar problems to be solved. In several cases additional difficulties were, or will be, entailed by the necessity for elevating entire yards. Also, many of the rights-of-way are only 66 ft. wide, making it very difficult to do the elevation work and keep traffic moving simultaneously. In general features the work is all quite similar. The retaining walls and bridge abutments are for the most part of concrete masonry, though there are a few exceptions where rubble masonry or dimension stone are used. The Chicago & North-Western builds nearly all of its walls and abutments of large dimension stone. The filling material has been almost entirely sand, the average cost of which has been about 26 cents a yard. The work has resulted in the production of a variety of designs of ballasted floor bridges. At the outset these were exceptional, but there were so many objections to the shallow-floor designs as to lead to their abolition and the substitution of ballasted designs. This presented new problems in water-proofing and steel preservation which have not yet been satisfactorily solved.

Track elevation work has been done in several other large cities, while a great deal more is under way or contemplated, but the Chicago situation is unique both as to conditions and magnitude. No other place in the world has such a complicated track and terminal system, or so many streets with heavy traffic crossed by lines of railroad. In the manner of solving the general problem and the multitude of individual problems will therefore be found examples for guidance under any conditions which are likely to arise in any American city for some time to come.

"THE LAW IS GOOD, IF A MAN USE IT LAWFULLY."

[I. Timothy, i:8.]

"In fixing the rate on dressed meat we do not have very much to say. The packer generally makes the rate. He comes to you and always makes you feel that he is your friend. Then he asks you how much you charge for certain shipments of dressed meats. The published tariff may be 25 cents a hundred, but he will not pay you that. You say to him, "I'll carry your meat for 18 cents.' He says, 'Oh, no, you won't. I won't pay that.' Then you say, 'Well, what will you pay for it?' He then replies, 'I can get it hauled for 16 cents.' So you haul it for 16 cents a hundred. He generally tells you that if you want the business you must haul the meat for the price he names." *Testimony of A. R. Stickney, President of the Chicago Great Western, before the Federal court.*

The Majordomo of the President of the United States communicated by long-distance telephone to a trunk-line president the following information and request: The President, with certain public officers and friends, desires to leave Washington on a date named for a trip through several states and stopping at specified cities. For this purpose he wants a special train and suggests for his own use a certain private car which he has already used and which suits him. He would also like to have a certain porter, name given, who had served him before and whom he liked. A list of special supplies for the dining car, in addition to the ordinary commissary, was also submitted. The railroad president assured the President's representative that a plan would be immediately prepared in full detail and forwarded by mail.

This was done without delay. The special private car asked for was at the time in far distant service and therefore unavailable, but it happened that quite an exact duplicate could be put at the President's disposal. Neither was the particular porter to be had. Circumstances had led to a transfer of his racial volatilities to another sphere of service and entertainment. With these exceptions a schedule was made in full detail, giving arriving and leaving times and complying with all of the President's suggestions.

The last sentence in the communication informed the Majordomo that a nominal charge of $50 a day would be made for this special train, fully officered and provisioned. It was really a "nominal" charge, being less than cost. Nevertheless it produced an immediate reply and protest—by telephone: There was no authorized appropriation of public funds for such an expenditure, and the President could not possibly afford to pay it from his private purse. Unless the service could be furnished gratuitously it would not be acceptable.

Railroad presidents are not hard bargainers with powerful rulers, and in this case the reply was cordial and reassuring—no charge would be made for the service. But the itinerary covered many hundreds of miles of travel on other roads, and the officers of these other roads, not dealing directly with the Presidential party, found an easily understandable pleasure in sending to the trunk-line president their several bills for hauling the Presidential train over their lines. The bills were paid, but some of the letters accompanying them were unanswered. One officer quoted from the Interstate Commerce Act of 1887, Section 1, as follows: "All charges made for any service rendered or to be rendered in the transportation of passengers or property . . . shall be reasonable and just." This was in explanation of his charge of 15 regular fares for the hauling of each car. Another apologized for sending a bill, but expressed a fear of the penalty (conviction of misdemeanor, $5,000 fine and two years in the penitentiary) for violating Section 2 of the Interstate Commerce Act, which reads as follows:

"That if any common carrier subject to the provisions of this act shall, directly or indirectly, by any special rate, rebate, drawback, or other device, charge, demand, collect or receive from any person or persons a greater or less compensation for any service rendered, or to be rendered, in the transportation of passengers or property, subject to the provisions of this act, than it charges, demands, collects, or receives from any other person or persons for doing for him or them a like and contemporaneous service in the transportation of a like kind of traffic under substantially similar circumstances and conditions, such common carrier shall be deemed guilty of unjust discrimination, which is hereby prohibited and declared to be unlawful."

It is not suggested that the President, in demanding free transportation, is as guilty as the packers who force a rebate, for custom has much to do with nice questions of morality. It is, too, supposable that the President in taking his oath of office was more impressed by his undertaking to enforce the law than to obey it.

When the trunk-line president paid these bills, his railroad conscience was quieted by this much: He had not successfully induced other railroad presidents to commit a statutory crime and it seemed improbable that the President would instruct the Attorney-General to prosecute him for his crime. Nevertheless he had been "Godlike in giving, but the devil to pay," for in the course of the tour, for which he was paying, the President addressed a convention of the Brotherhood of Locomotive Firemen, and ostentatiously accepted membership in that organization, one of whose main purposes is to monopolize and restrict the business of locomotive firing to its own members. This seemed to be quite as clearly a statutory crime as any one that has been brought before the courts under the Sherman Anti-trust law of 1890. Section 2 reads as follows:

"Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a misdemeanor, and, on conviction thereof, shall be punished by fine not exceeding five thousand dollars, or by imprisonment not exceeding one year, or by both said punishments, in the discretion of the court."

It is not suggested that the President has made himself liable to a fine of $5,000 and imprisonment for one year by accepting membership in an organization whose undertaking is to violate the law and possibly incur such penalty. He likes firemen, and in this we join. He approves, as we also do, of the basic principle that they should organize, and of many of their purposes. Perhaps, too, with genial catholicity, he may paraphrase an utterance of the statesman, Tim Campbell: "Phwat's a little matter like statutory crime between frinds?"

The President's speeches have benefited his countrymen, have done good in the world, by substituting higher ideals of morality,

and observance of the spirit of the law, for the strict limitations of the law. He has, verbally, expanded and made practical application of Mr. Cleveland's theory of a public trust; but for the purpose of making these speeches he has compelled common carriers to carry him free, to be guilty of "unjust discrimination, which is hereby prohibited and declared to be unlawful." He has successfully prosecuted the Northern Securities Company for attempting "to monopolize any part of the trade or commerce among the several States" (a fulfilment of the law, but probably an economic error) while at the same time holding honorary membership in an organization violating the same law for a bad purpose.

Discrimination, charging one more or less than another for like service, is odious; un-American, if you please, for it does not give all an equal chance. Railroad officers do not like to discriminate, but there are more than a thousand railroad operating companies, and in that number one or more can easily be found weak enough, or so sorely pressed, as to make direct or indirect rebates, and, as rates are minutely interdependent, this is liable to tear the structure in pieces. Officers of roads losing business as a consequence of other's rebates have then for instant decision an old moral question: "Shall I obey the law and violate the trust given to me by my stockholders; or shall I fulfill the trust and break the law?" The unshackled moralist says: "Be good; resign if you cannot keep your trust and be law-abiding." But the Bible says: "The law is good, if a man use it lawfully," and the good railroad president derives a converse from this: He fulfills his trust, lawfully if possible, unlawfully if forced to that alternative by another's lawlessness.

We need, and all worthy railroad officers will welcome for their own protection, a strict enforcement of the law against discrimination and the evil results of monopoly. Example, as well as precept, should come from the highest authority in the land.

FORMS OF SIGNALS.

It would seem to be now full time for a summing up of the kinds of information given by signals with a view to standardizing forms for specific purposes. Interlocking, automatic block and telegraphic block signals are in rapidly increasing use, but the same kind of signal which conveys this sign language to the man in charge of a moving train is also used for many other purposes, as we shall see. It does not simplify the work of a mechanic to restrict him to the use of one tool—it complicates it. Somewhat similarly the memory of the engineman is already worked pretty hard in remembering the many meanings of the positions of the semaphore by day and two or three colors at night, and the burden will grow as signal applications increase.

The letter ballot taken by the Railway Signal Association in favor of using the semaphore signal in a way that is new is notable for two reasons; that the vote was 24 to 13 in favor of a radical change; and also the smallness of the vote, which apparently shows that more than 100 practical men are in such open mind, or state of doubt, that they preferred not to vote. Both of these derivatives are distinctly commendable, and suggest that, in view of the fact that railroad signals are now intended to tell so many different kinds of things, some logical variation in their form will soon be quite necessary, or the engineman's memory will be overtaxed.

Enginemen are apt to know much less than is commonly assumed. The specific qualities for which they have every-day use are attention and memory. They memorize the cuts, fills, grades and structures along the line so that they know the road and know where to look for certain signals, of which they have memorized the meaning. With the increasing use of signals of different kinds of meaning the memory is liable to be over-burdened unless it is helped by distinctive forms. This is already partially recognized, and it is worth noting that it is done to a greater extent in England than in the United States, and also that it is rarer there than here for an engineman to over-run his signal. We preach much of discipline. Let us see if in one respect it cannot be bettered by lightening the load on the engineman's memory. This is purely academic, intended to be suggestive of a line of study rather than indicative of a fixed plan.

Signal indications may be enumerated as follows:

First.—Switch signals. This is the primary form of signaling to the engineman that the track ahead is passable either on the main line at high speed or for a turnout at low speed. When the switch is interlocked and we give by concerted movement both a home and a distant warning of the position of the switch, it is not uncommon practice to have two blades on the home signal post; the upper blade to show that the main line is open or closed and the lower blade to show whether or not the switch is set for a turnout. From the positions of these blades the engineman may know whether or not he can maintain speed for the main line, or must slacken for a turnout. There is occasionally a further complication: A diverging line with a No. 20 frog which can be safely passed at high speed, and a near-by turnout. Here three blades are used; the upper for the main line; the next lower for the diverging line; and the third, a short blade, for the low-speed turnout, so that the engineman may know the route indicated and the speed permissible.

Second.—Drawbridge home and distant signals, interlocked and controlled by the position of the bridge.

Third.—Block signals which indicate that the track for a certain distance ahead is or is not occupied by a train.

Fourth.—Unusual route signals. Scheduled trains have in many terminals or important stations a track and platform from which they regularly start, and a path through the yard which they regularly follow, although, generally, this practice is rather English than American. Similarly, in arriving at such stations they usually follow the same route through the yard and arrive at the same platform. Wrecks, track repairs, trains run in sections in busy times, or like unusual causes often make it necessary for scheduled trains to arrive and depart by unaccustomed routes. In terminals where there are six or more tracks, the cross-over signal blades are sometimes specially marked, so that the incoming engineman may know where he is going, and perhaps further slacken speed. At the Waterloo (London) station of the London & Southwestern this special marking is a ring, perhaps 15 in. in diameter, affixed to the blade. The starting signals at this station are also specially marked with an X, and the height of this symbol is perhaps twice the width of the blade.

Fifth.—Train-order signals, notices to the engineman to stop for orders, are located at a station or a tower. The order having been received, the same signal is used for a starting indication.

It appears, therefore, that when a railroad is fully signaled there are as many as five different subjects concerning which information is conveyed to the engineman. Multiply by two for two-position signals and again increase for home and distant signals, and we strain the simple language of the semaphore too much. When under such conditions the engineman makes an occasional error in interpretinng the language shall we charge it all to lack of discipline. The engineman has his limitations.

Broadly, there are two kinds of information given by signals, and for a consideration of the subject they may be grouped as follows:

First.—Signals indicating the physical condition of the track considered as a structure (switch, drawbridge and interlocking signals).

Second.—Signals directing the train movement or restricting it by reason of occupancy of the track (block, starting, unusual movement and train order signals).

Assuming that the increasing quantity and number of kinds of information given by signals to enginemen makes the language of the semaphore inadequate for quick and absolutely certain reading by quite ordinary human beings under all circumstances, it naturally follows that a form of signaling to indicate the condition of the track and an entirely different form to indicate the occupancy of the track might be a simplification. Indeed, we do not need to make that assumption in order to come to this conclusion. Although it is probably true that there is up to now no railroad in this country fully protected by signals, completely blocked and with all switches interlocked, nevertheless there are plenty of roads where the varied meanings of the same sort of indicator tend to make the memory of the engineman uncertain.

A considerable majority, but by no means all railroad men, have the opinion that a semaphore—a position signal—is a more pronounced and effective indicator than a disk showing color only. Of course at night, with the universal use of single lights, preferences for the semaphore have no significance. On the other hand, there is plenty of support for the opinion that, as compared with the position of the semaphore, the color in the disk can be distinguished nearly or quite as far away—or at least far enough.

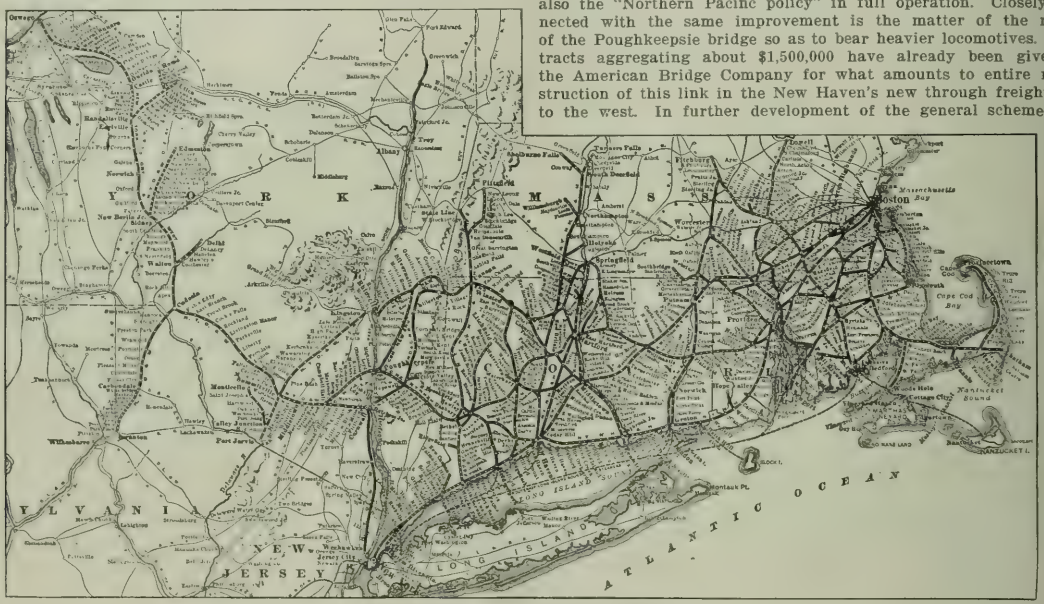
The reason for this rehearsal of facts which every signal man knows is to invite not only their attention but also the attention of managers to the situation—the probability that they are buying

and installing material which it may soon be wise to scrap. The over-running of signals is not all due to defective discipline, for, if one kind of signals told only of track conditions and an entirely different kind told of occupancy, the engineman would not need to do so much thinking. His memory would be helped, and this is what we want to help, for it is his main guide.

It is not intended to propose the use of semaphore and disk signals to do the two kinds of signaling work. The intention is rather to point out that a broad view should be taken of the whole subject, and that, in this comparatively early stage of the art, a logical orderly working plan will make operation safer and prevent the waste of a lot of material. It is a problem to be worked out.

New York, New Haven & Hartford.

Since President Mellen succeeded President John M. Hall as head of the New York, New Haven & Hartford, two years ago, his policy in the development of the property has been one of exceptional import and interest. When he first took office he faced a series of exceedingly grave problems. The rolling stock of the company was in low condition; labor troubles had not been settled; bridges were insufficient to bear heavy locomotives and allow of increased train loads; there were questions in legislation to be



New York, New Haven & Hartford.

asked and answered; certain relations with the trunk lines involving freight rates were in a delicate, not to say dangerous case; and, most momentous of all, was the matter of adopting an electric policy and carrying it through to results. In his first annual report a year ago President Mellen, though in terms somewhat vague and general, showed the direction of policies some of which, as they were in transition, had to be partly masked. In his second report, with those policies more developed, he speaks more freely both of past accomplishments and future plans.

Taking up first the things done, there must be mentioned in the primary place the accomplishments in the development of the company's electric policy. The earnings of the great electric "holding" company, the Consolidated Railway Company, for the first time appear. They are $4,567,978 gross, $1,682,356 net, and $431,333 after charges available for dividends. Subtracting the fixed charge of about $350,000 carried by the debentures by which the trolley system in the city of New Haven was bought, there appears to be a clear profit of about $81,338—in other words, the great electric system of the corporation with some 560 miles of trackage and representing $30,000,000 of invested capital in various forms, is already over $80,000 to the good. But this is by no means all. In the fixed charges of the electric system some $80,000 of former loss on the Worcester & Connecticut Eastern line is digested. This and other losses allowed for on constituent trolley lines would probably carry the total net result to $200,000 or more which represents the real net gain for the year to the parent steam corporation of the bold Mellen policy. Truly a most remarkable showing and very significant as to the general wisdom of acquisition of rival electric railroads by steam companies. The returns also, we presume, do not include a large part of the earnings of the Hartford, Springfield, Berkshire and smaller trolley systems which were acquired but a few months ago. They would show probably that the present electric system of the New Haven is about the same in financial magnitudes as the New Haven steam system when President Clark took charge of it some twenty years ago. Among the assets of the Consolidated Company there are not mentioned, for obvious reasons, in the report the amazingly liberal and expansive charter granted by the last Connecticut legislature to the holding company. And the same suggestion applies to the general railroad law "repealer" which for the future practically prevents any competing line, steam or electric, from crossing the state bounds.

Next in importance are the indices of the progress of the new President in applying to the New Haven system his old Northern Pacific policy of increasing the train load. Last year there was forecasted in the report the substantial renewal of 107 bridges to standardize the line for heavy traffic. During the year a large part of this work has been done, including several of the large bridges. In fact, by the middle of next year, the reconstruction of the Saybrook-Lyme bridge over the Connecticut river will find the whole of the main stem ready for heavier trains and with the old controversy over the New Haven cut—adjusted since the report was written—settled, a very few months will probably find also the "Northern Pacific policy" in full operation. Closely connected with the same improvement is the matter of the repair of the Poughkeepsie bridge so as to bear heavier locomotives. Contracts aggregating about $1,500,000 have already been given to the American Bridge Company for what amounts to entire reconstruction of this link in the New Haven's new through freight line to the west. In further development of the general scheme may be noted the increase in the number of locomotives during the year from 1,055 to 1,186; and of passenger cars from 2,050 to 2,090. The decrease in the number of freight cars from 17,128 to 16,862 means presumptively the discarding of outworn rolling stock which larger cars are presently to replace. The expenditure during the year of $3,564,522 for new equipment is here a suggestive item. So is the laying of 135 miles of new rails. With this rush of improvements, it will not be long before there will be some interesting figures to show the fruits of the increased train load and the decreased ratio of operating expense to business done.

The third subject of importance is the purchase of the New York, Ontario & Western. The net cost of it to the company has been $13,108,397, interest on which will be for the present just about "washed" by the dividends from the acquired property. What the future holds in the way of increased revenue from this line is an interesting speculation, but with all the guesses favoring the investment, to say nothing of its protective features. As in the new official map printed herewith the Ontario & Western appears as an integral part of the system, the reports current not long ago of a transfer to the New York Central may be definitely rejected.

The more formal figures contain some features of interest. The always striking substantial equation of passenger and freight earnings continues with $24,146,454 for the former and $25,341,855 for the latter. Passenger earnings increased over last year $721,281; freight earnings, $928,314; rent and telegraph receipts

$49,442, and total receipts $1,699,038, which, with an increase of operating expense of $673,811, leaves an increased income from operation of $1,025,226. Including gross income from the boat lines, the total gross earnings of the system were $54,530,696, and, if the income for a full year of the electric holding company as now enlarged is added, the full gross income of the steam corporation must now be considerably above $60,000,000, placing it high in gross earning power among the great railroad systems of the country. Its extensive improvements and purchases, of course, spell a large increase of debt, suggested particularly by the item "increase of bills payable $19,600,000" in the summary of financial operations. But the surplus after charges and 8 per cent. dividends was $308,052. The set policy of the company in buying the securities of leased and controlled lines proceeds, the large sum of $5,337,678 having been used for that purpose during the year, and eight subsidiary lines have, in consequence, been practically merged. The large profits of the Sound boat lines appear in a surplus over all charges of $606,831, of which the company has paid itself only $300,000 in dividends, reserving the balance for surplus account. Hints that must be read large between the lines refer to the diversion of freight traffic from the Harlem terminal to the Poughkeepsie Bridge route, over which much westbound interline freight is now regularly routed. "Other diversions" to come may be interpreted as Mr. Mellen's plan of shifting to the inland routes much of the through freight that now goes by the New York division. This will avoid new tracks on the Shore Line.

The general plan of financing in the future the big projects of the company—involving also the taking up of debts already incurred—is a somewhat new one in the company's history. President Clark's old method of convertible debentures reappears, but with several changes. The debentures—$30,000,000—are shortened in time to five years, reduced from 4 to 3½ per cent., and, at maturity, are convertible at 150 for 100 in stock instead of on the old 100 for 100 basis. This gives the stockholders a "melon," the size and succulence of which depends ultimately on what New Haven shares are selling for at the end of the five years, though, in the meantime, the melon can be harvested by the sale of rights. It renews the old policy of giving extra dividends to the shareholders in the form of new stock, which was decidedly modified when President Hall issued new stock at 175 without the debenture intermediary device.

At several points this adoption of the "melon" policy is to be seriously criticised. It is not very many years ago that the corporation, after following the plan, felt constrained to reduce dividends from 10 to 8 per cent. Improvements call for large and even increasing expenditures for which the great railroad corporations need all the cash they can get. Then, too, there is uncertainty as to the duration of the present period of railroad prosperity and the industrial condition on which it rests. In the case of the New Haven, the argument that valuable distributions to shareholders invite hostile legislation may not apply to Connecticut or Rhode Island but does to Massachusetts. All these reasonings urge that—saying nothing of public interests—the present dividend rate should be conservated for stockholders rather than new dividends made for them by added capitalization. On the other hand may be set Mr. Mellen's pronounced opinion that his system can earn the increased dividend fund required; that his improvements will probably much increase net earning power; and finally—an argument of value in these times—that the plan avoids the bankers, prevents concentration of the stock in fewer hands, and leaves unimpaired that unique strength which the New Haven company has, of control distributed through thousands of old and relatively small stock holdings. Still would it not have been just as effective if the present "melon" had not been quite so big? In immediate and practical aspects the company gets $30,000,000 for use during five years at 3½ per cent. and the question of earning $1,600,000 additional net to pay 8 per cent. on $20,000,000 new stock after conversion, is deferred for half a decade, which may be prolific in unforeseen events.

For the New York, New Haven & Hartford proper, the principal statistics of the last two years' operation follow:

	1905.	1904.
Mileage worked	2,088	2,021
Freight earnings	$25,341,855	$24,413,541
Passenger earnings	24,146,454	23,425,193
Gross earnings	49,981,948	48,282,909
Maintenance of way and structures	5,168,709	5,467,201
Maintenance of equipment	5,087,965	4,703,873
Conducting transportation	24,287,018	23,911,347
Total expenses	35,853,023	35,159,211
Net earnings	14,148,924	13,123,698
Gross income	51,205,399	49,189,345
Net income	6,708,052	6,084,756
Dividends	6,400,000	6,400,000
Surplus after dividends	308,052	88,308
Passengers carried	63,323,475	63,130,459
Tons of freight carried	18,321,327	17,560,485
Passengers carried 1 mile	1,175,639,000	1,135,702,000
Tons of freight carried 1 mile	1,742,915,000	1,661,382,000
Rate per passenger-mile, in cents	1.702	1.725
Rate per ton-mile, in cents	1.408	1.423
Average freight train load, tons	222.85	208.58

Atchison, Topeka & Santa Fe.

The last year was a bad one for the Santa Fe on account of the nearly continuous floods which increased the one item, "general repairs of roadway," by over $1,000,000. Maintenance of way expenses as a whole increased over $2,000,000, from $9,170,234 in 1904 to $11,385,418 in 1905, and from $1,106 to $1,371 per mile, an increase of $265 on each of the 8,305 miles of line. The year was remarkable for excessive rainfall not confined to any one locality, but almost universal and nearly continuous. During the fourteen months ended with the last fiscal year there was hardly a week during which some part of the line could not be operated by reason of floods of greater or less magnitude. On at least three occasions the main lines in Arizona and New Mexico were totally disabled for from four to eight days, besides innumerable smaller breaks. For weeks it was necessary to advise passengers and shippers to make use of other routes. A total length of 9,551 ft. of bridges, 31½ miles of track and 1,000,000 cu. yds. of embankment were carried away, and the stone station building at Trinidad, Colo., demolished. It is impossible to estimate the amount of business lost and its effect on gross earnings. The cost of repairing the damages caused by the floods will amount to $2,000,000, the greater part of which has been included in the operating expenses of the year. Heavy expense was also incurred in caring for delayed passengers, detouring trains over other lines, overtime paid employees of delayed trains and wrecks due to washouts, so that nearly all the decrease in net earnings as compared with the preceding year may be ascribed to the floods. So far as is possible, steps have been taken to prevent further disaster of this kind. Entire changes of line have been made at several points and protection work built where a change of line was impracticable. Floods of the same magnitude would still work great destruction, but as their severity was unprecedented, a recurrence seems improbable.

These unusual and severe expenses had marked effect on net earnings, which dropped over $3,000,000 from $25,949,168 in 1904 to $22,858,453 in 1905.

Gross earnings ($68,375,837) in spite of the interruptions and loss of traffic, showed a small increase over the record figure of 1904 ($68,171,200). Nevertheless, the smallness of the increase is somewhat disappointing, in view of the record of the road since its reorganization in 1895. In the eight fiscal years up to last year the average yearly increase in gross earnings has been $4,693,746, and in 1903 and 1904, when there were large losses by floods, the gross earnings still steadily increased $4,500,000 each year. After making liberal allowances for the more general and longer continued ravages of the floods during the past year than in the two years preceding, an increase in gross amounting to less than one-twentieth of the previous eight years' average is less favorable than would naturally be expected, particularly at a time when most railroad companies are reporting large increases. One explanation of the small increase lies in the fact that the grain crops of the year were smaller than usual, the company's share of the grain traffic being less by 685,901 tons, or 30 per cent., than last year. The company also carried 100,000 tons less live stock than in 1904. On the other hand, manufactures and merchandise freight increased by about 170,000 tons—always an assurance of solidity and a traffic which bears a high price.

In every item of maintenance of way and structures, with one very trifling exception, the effects of flood damage are clearly shown. General repairs of roadway increased from $3,343,428 to $4,542,037; ballasting, from $175,348 to $317,453; renewal of rails, from $591,259 to $632,159, and renewal of ties, from $1,250,977 to $1,619,186.

Maintenance of equipment expenses were $10,914,864 for the year, an increase of $908,729 over 1904. The costs per locomotive and per passenger car, though previously liberal, showed large increases. In 1905 this expense was $4,165 per locomotive, against $3,772 in 1904, an increase of nearly $400 in maintenance expenses on each of the 1,454 locomotives. Maintenance per passenger car cost $1,152 in 1905, against $874 in 1904, an increase of $278 per car. The maintenance cost per freight car in 1905 was $94 per car, which is practically the same as the 1904 figure. With all the interruption to traffic and additional operating expenses consequent upon such severe floods, the showing made in conducting transportation is highly creditable. This item increased only $66,900, from $21,295,960 in 1904 to $21,362,860 in 1905.

There were 4,730,090,247 tons carried one mile against 4,682,269,811 in 1904, an increase of 47,820,436 ton-miles for the year. The average distance each ton was carried increased from 355 miles to 367 miles. Had the average earnings per ton-mile, which decreased 18/100 of a mill, remained as high as in 1904, there would have been an increase of $851,416, instead of a decrease of $353,671, in freight earnings. The rate received was 1.002 cents against 1.020 cents in 1904. The earnings per passenger-mile also decreased from 2.180 cents to 2.158 cents; but an increase of 666,943 in the number of passengers and 35,380,000 in the number of passengers carried one mile compensated for this and made an increase of

$611,607 in passenger earnings. The freight traffic was almost evenly divided between eastbound and westbound shipments, there being an excess of 351,549 tons eastbound. Westbound earnings, however, exceeded eastbound by $3,743,188, the higher grade traffic evidently coming from the east. The average train load was 282 revenue tons, an increase of 12 tons, or 4.46 per cent. Products of mines furnished 32½ per cent. of the total tonnage against 30 per cent. in 1904. Of the total of 4,191,123 tons under this head, bituminous coal was 1,908,070 tons, and stone and sand, 1,039,553 tons, the latter an increase of 285,554 tons over 1904. Products of agriculture furnished the next largest percentage, 25½ per cent., of the total tonnage. The total tonnage of grain was 1,486,781 tons against 2,172,682 tons, a decrease from 16½ per cent. of the total tonnage in 1904 to 11½ per cent. in 1905. Manufactures were 14.63 per cent. of the total, against 13.21 per cent. in 1904, and merchandise (l.c.l. tonnage), 6.86 per cent. against 6.50 per cent. in 1904, small but valuable increases in high-class tonnage.

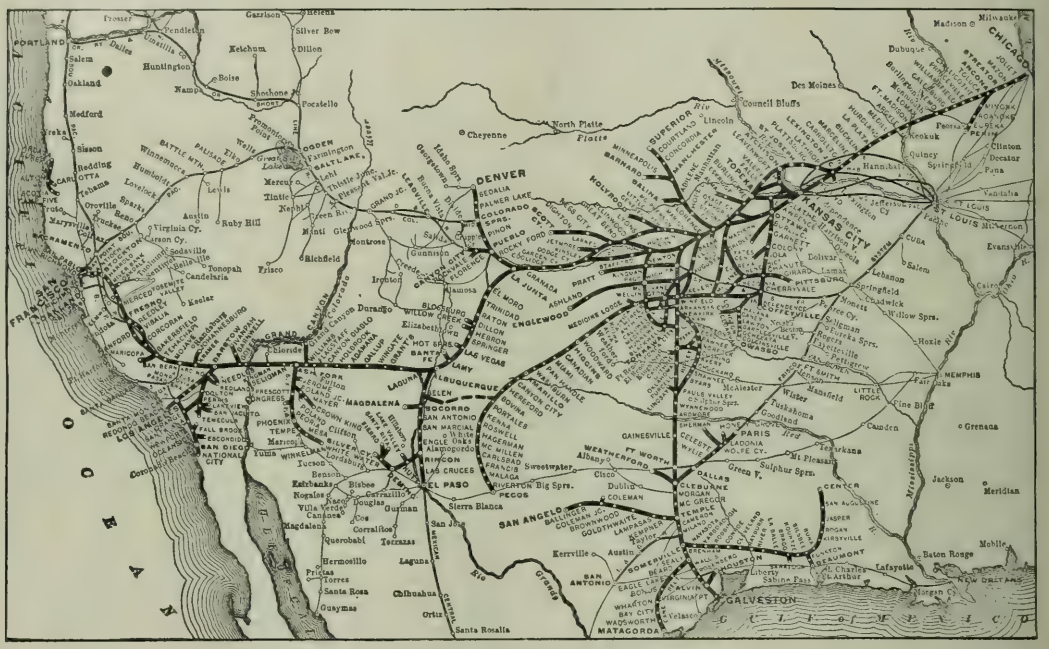
During the year there was expended for additions and improvements a total of $8,737,509, against $11,609,521 in 1904. Of these amounts, $4,253,630 was, in 1905, charged to earnings, and $3,378,970 in 1904. The remaining amounts, $4,483,879 in 1905 and $8,230,551 in 1904, were charged to capital account. In this large charge against earnings in so disastrous a year, the showing made by the system is good.

One important policy inaugurated during the year was the increasing of second track by about 100 per cent., made necessary by the density of traffic on portions of the main line. Appropriations were made for building 161 miles, most of it in Illinois, Missouri and Kansas. All of this is to be finished by the end of the calendar year, when a total of 323 miles of second track will be in operation. The report states that in spite of adverse conditions, both track and equipment are in better condition than ever before.

Since 1897, there has been charged to operating expenses for maintenance of equipment $61,735,742. At the beginning, in 1897, this expenditure was $534 per mile, and it has risen to $1,314 per mile in the year just closed. During the year there was added to the credit of rolling stock replacement fund, $1,601,363, of which $1,491,408 was charged to operating expenses and $109,954 was collected in cash for equipment sold and destroyed. In addition to the 8,318 miles of line covered by the report, the company controls, through ownership of securities, 986 miles of line of auxiliary railroad companies. During the year, $681,306 was received as the net proceeds of sales of lands embraced in the Santa Fe-Pacific Land Grant. This sum was, however, written off the book value of railroads, franchises and other property, so that the transaction does not appear in the income account. In addition to the $2,500,000 serial debenture bonds redeemable February 1, 1905, there have been purchased and cancelled $1,301,000 of the series of bonds falling due February 1, 1906.

During the year the privilege was given to holders of preferred and common stock to subscribe for 4 per cent. convertible bonds to the extent of 15 per cent. of their holdings. These bonds, in amount $32,420,000, bear interest from April 1, 1905. Including this amount, most of which will not be issued until September 30, the funded debt on July 1 amounted to $265,986,500, and the actual interest charges for the year ending June 30, 1906, will amount to $10,589,958.

The uniformly conservative policy of the management of the Santa Fe since the reorganization has been pursued during the past year. Unfortunately the severe natural handicaps to economical operation have resulted in a large decrease in net earnings, but with the line strengthened and improved, and barring a repetition of such unusual conditions, there should be a fine showing made in the year now under way. The grain crops, which are of no small importance to the road, are large, and business conditions generally are favorable. As the only road which has a line from Chicago to the Pacific Coast the Santa Fe has long been an important gage of industrial conditions on two-thirds of the continent, and for this reason the outlook for the ensuing year is bright.



Atchison, Topeka & Santa Fe.

For this reason the outlook for the ensuing year is bright.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	8,305	8,180
Freight earnings	$47,408,982	$47,762,653
Passenger earnings	16,045,380	15,433,774
Gross earnings	68,375,837	68,171,200
Maint. way and structures	11,385,418	9,170,234
Maint. of equipment	10,914,864	10,006,135
Conducting transportation	21,362,860	21,295,960
Total expenses	45,577,384	42,222,033
Net earnings	22,858,453	25,949,168
Gross income	69,189,740	68,171,200
Net income	11,742,346	15,359,771

TRADE CATALOGUES.

Nernst Lamps.—The Nernst Lamp Company, Pittsburg, Pa., sends its "Central Station Bulletin" for September, as well as a small pamphlet describing and illustrating in detail the Nernst 220-440, 3-wire A. C. system of lighting for small cities, etc.

Ring Type Generators and Motors.—The Northern Electrical Manufacturing Company, of Madison, Wis., sends Bulletin No. 51 covering their Northern ring type machines for power and lighting service. There are very complete illustrations of the ring type generators and motors, as well as of the detailed parts, with several descriptive tables.

Electric Railway Apparatus.—The Westinghouse Electric & Manufacturing Company has issued a special publication under the title of "Westinghouse Railway Apparatus" for distribution at the convention at Philadelphia of the American Street Railway Association. The pamphlet illustrates and describes the kinds of alter-

nating and direct current railroad motors made by the company, as well as generators for railroad work and systems of control for electric railroads. It also describes with illustrations the Westinghouse system of catenary line construction for street railroad work. There is included information covering detail and repair parts of motors and other railroad apparatus.

Pipe Joints.—The Crane Co., Chicago, has issued two advance circulars; one dealing with its No. 181 E "Cranelap" extra heavy flanged pipe joints, with swivel flanges, and the other with its No. 295E "Craneweld" flanged pipe joints, with wrought steel flanges welded on; both suitable for working pressures up to 250 lbs. Sectional views, dimension drawings, tables and price lists of both styles of joints are given. The No. 181E joints can be furnished with flanges made from cast-iron, ferrosteel, malleable iron, cast steel or weldless steel.

Curve Lining Gage.—F. A. Smith, Chicago, sends a two-leaf folder of his curve-lining gage. The device is illustrated and its design and method of use described.

CONTRIBUTIONS

"The Division Engineer in Railroad Work."

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the *Railroad Gazette*, September 8, is an article by Mr. Willard Beahan, on the Division Engineer in Railway Work, which is of a kind altogether too rare in the columns of our journals.

There are two or three points upon which he touches which the writer wishes to emphasize. The first is his putting the handling of men ahead of every other qualification. I have in my mind a most excellent civil engineer, when engaged in the smaller duties, but when he became chief engineer it was no unusual thing to see him working over the drafting table with assistants and stenographer idle. When one venturesome assistant asked him one day for something to do, the toiling engineer exploded to the effect that he had only two hands, and they were both busy. How can such a man as this ever rise above the using of his two hands?

The late Collis P. Huntington, when organizing his eastern system of railroads, met a capable Division Superintendent who was in charge of a division of what was then known as the Ohio & Mississippi Railroad. Mr. Huntington appointed him later Superintendent of his line from Louisville to Memphis. On visiting the Louisville office one day he asked for his superintendent, who was not in his office. His chief clerk said "He is down in the yard." Mr. Huntington went down into the switching yards and there found his superintendent throwing a switch. He was doing the work well. Mr. Huntington complimented him on it, but reminded him that if he spent too much of his time at that switch he might be compelled to send the switchman up to the superintendent's office. Some men can never learn that they are paid for doing a higher class of work than throwing a switch or making a drawing.

Towards the end of his paper Mr. Beahan speaks of the fact that we as engineers are coming to be useful just because we can put a dollar where it can earn more than where another man can put that dollar. If we can thoroughly disabuse our minds of the idea that the title, engineer, gives us any special claim on any job whatsoever we will have advanced ourselves materially. Comparatively few engineers are good at handling a gang of men, and when one of them takes charge of railroad work he will usually do well to leave the handling of this gang to the section foreman, or extra gang foreman.

The writer of this has by force of circumstances been compelled to handle gangs, running from 20 to 60, of nearly every nationality which serves on railroad work. It includes Chinese, Japanese, negroes, Mexicans, Austrians, Italians, and the mixed "navvy." He has never met with any two of these classes who could be managed by exactly the same method. He will say right here that with the first three mentioned above he never considered himself a howling success. He was able to master the handling of the Mexican; got along very well with the Italian; and has made a record with the "navvies"; but this accomplishment was acquired by watching the way his most successful foremen handled their crews. After the ability to handle his subordinates the greatest necessity, it seems to the writer, is for the engineer to get along peacefully with his neighbors. He is apt to be a better educated man than the trainmaster, or even the master mechanic, with whom he must come in contact on his division. In most localities there is a sort of chip on the shoulder for the educated man in railroad circles. It is a good plan to be blind when looking at the point where this chip may be. A railroad division is very much like an army division. All the officers must work together. Lack of harmony amongst the officers lost many a battle. Lack of harmony in a division writes its record in various mishaps all over the division.

Mr. Beahan is strong against letter writing. There certainly is both a use and abuse of letter writing, but I am a strong believer in written reports. A thing every subordinate should be required to do is to make frequent and regular written reports to his superior. The fact that he has to account for spikes, oil, and other loseable property, makes him look more carefully after such things. If, besides this, the records are written up in the division headquarters, and it is passed down the line with the cost of doing the various work on various sections, it helps keep up enthusiasm. Without this many even among good men are inclined to be a little easy and let things drift.

It certainly is essential if letters of instruction be written, that the superior officer should get around frequently enough to know by personal contact with his assistant that they have received those letters; that they have understood those letters; and that they have put into effect the orders contained in them. It was my fortune to be located upon one road where the roadmasters uniformly laid the letters which came to them to one side, knowing well by past experience that no effort would ever be made to know whether those orders were ever carried out or not; and each section foreman ran his section according to his own ideas.

The writer had an experience, serving for 12 years, coming up from axman and rear chainman to be division engineer on construction, entirely under one man. This man was not a letter writer, and it was before the days when typewriters were in common use. When the writer entered the service of another railroad, he was thrown under a letter writer. While his office was in the same room with the resident engineer, during the four months they were together he never received a verbal order from his superior. If he asked any advice on any subject he would within an hour or two have a letter laid on his table giving instructions on that point. Perhaps it was his lack of worldly wisdom, due to the narrow surroundings of his earlier life, but he carried out the instructions contained in one letter so literally that it was necessary to rebuild a bridge. It is perhaps needless to say that some of the doings of this residency brought letter writing into disrepute on that road.

I wish to fully indorse Mr. Beahan's opinion on letter writing, and at the same time to say I would require from roadmasters, bridge foremen, and section foremen, weekly reports covering the most important things, and have a complete monthly report. These things should go on record. The subordinate has comparatively little use for a record provided he has a superior in whom he feels confidence and who gets around to talk with him occasionally.

C. M. V.

The Railroad Systematizer.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Two editorial notes which appeared in the *Railroad Gazette* March 3 touched upon a subject which in my opinion demands more attention than you and your readers are giving to it, and with your permission I will indulge in a little amplification of what you said. I refer to the economizing of blanks on the Pennsylvania and the intelligent use of publicity on the Long Island road. On the Pennsylvania, as a result of conferences between the operating, the traffic and the accounting departments, 100 blank forms were done away with, which in the aggregate means, of course, a large saving in work. On the Long Island road the President, after failing, by the ordinary means—interviews with citizens and with daily-paper reporters—to convince the public of the fairness of an advance in passenger fares which had been made, adopted the novel course of setting forth his defence in the shape of letters—advertisements—in the newspapers. His letters were not exactly in the shape of "display ads," but they were printed in large type and put in such shape that they were sure to attract the eye of every reader.

Now, these incidents furnish strong support for two of what seem to me most essential principles in railroad management: First, that no new form of record or report whatsoever should be put into use on a railroad until it has been examined and approved by an expert systematizer reporting direct to the President; and second, that it is to the interest of every large railroad to take its employees, and incidentally the public, into its confidence, by the publication of a weekly or monthly journal, to be circulated gratuitously among employees, and devoted to the discussion of all matters pertaining to the operation of the road.

The professional systematizer has become indispensable in our industrial and commercial institutions, and although he avails himself largely of engineering knowledge, his greatest efficiency lies in the designing, and the education of employees in the use of, simple systems of records which give to officers, at the earliest possible moment, and with a minimum of labor on the part of employees, exact knowledge of the condition of every vital detail of the business, and the net results obtained.

The railroad systematizer should by experience and constant

association be familiar with the duties of every employee, and thus be competent to judge, whenever it is proposed to inaugurate a new report or record, whether the information desired is not already accessible in the records of some department, whether it cannot be obtained more economically in some other manner, and if, when obtained, it will serve a purpose commensurate with the cost of compiling it, measured in actual increase of wages paid, cost of stationery, the discontent engendered among employees by burdening them with labor which they know to be unproductive, and the accidents and losses caused by diverting their attention from more important duties.

A Railway Systematizer would of necessity report to the President only, as his work would in many cases antagonize departmental incompetents and faddists, bent upon aggrandizing their own departments at the expense of labor appearing on the payrolls of others, and in many cases burdening their own employees with useless work in order to demonstrate some personal hobby.

In the matter of co-ordination of departmental records, most railroads are now practically without a head, as the President obviously cannot give personal attention to the details necessary for the purpose. The result is that an aggressive head of department carries his point in every case. One department will submit to the impositions of others, rather than provoke friction by referring them to the President, which might be construed as a violation of professional etiquette.

This question of professional etiquette is indeed responsible for much useless work on railroads, and it even affects retired officials as well. Many a useless or long outlived report is made for years and religiously filed away without examination, because its withdrawal would be a tacit admission of its uselessness, and a reflection on the officer who originated it. The writer in recommending the withdrawal of such reports has been met with the reply, "Of course we do not use the data, but the men who furnish it have plenty of time to spare, and they think that we check it, so that it serves the same purpose." Both these ideas are fallacious. If errors in such reports are passed over unnoticed the maker does not need to be told that the report serves no purpose. If he is conscientious he may continue to make it carefully, but he is much more likely to save labor by "faking" it.

That any additional labor whatsoever can be imposed upon an employee, without its value eventually appearing in the salary, or in the accident, or loss and damage account, is a mistake. While there may be an occasional apparent exception, in the long run the rule holds good that "you cannot get something for nothing."

The burden of useless and duplicated records and reports is largely borne by the transportation department. Notwithstanding the unification of recording methods accomplished by associations of railroad officers, on many roads agents still record every transaction in a book, transcribe it to a daily or weekly report, rearrange it in a monthly report, and finally dissect it in detail from a statistical standpoint, when every one of these operations but the first could better and more cheaply be carried out in an audit office by men trained to do that one thing only. Conductors spend hours when nominally off duty, in making out complex reports, or endanger the safety of their trains in order to make them "on the company's time." Both agents and conductors often telegraph an analysis of the day's work, viewed from a multiplicity of standpoints, to various officials who, after the novelty of the new report wears off, do not give it a casual glance. Agents, operators and despatchers handle stacks of messages mostly not only uncoded, but written in conversational style, which if charged for at one-tenth commercial rates, would more than offset any value to be derived from them.

Occasionally an auditor rises superior to the mere consideration of an economical showing for his own department, and by a centralization of work in his office with a consequent increase of his own payroll, effects a saving for the road, much of which cannot be measured in dollars and cents. But even if he is sustained in this policy, there still remains the necessity for many similar reforms which lie outside his control. Only an officer whose authority extends to all departments, and whose sole business is to keep in personal touch with the making and handling of the records, can judge of their efficiency in practice and promptly attend to the weeding out of unfit and the substitution of simpler records, which the constant change in operating methods makes necessary everywhere.

The purpose of an official periodical published by a railroad should be mainly educational. Employees should be encouraged to study the reasons underlying every rule, and when the reasons are not plain to them, be allowed to make inquiries or to criticise the practical working of the rules. This may be done anonymously if they so desire, in fact preferably so. Such communications should be published, together with an explanation prepared by a competent officer.

The educational benefits to be derived from the publication of frank discussions between officers and men would by no means all accrue to the latter. Officers would soon hesitate to issue orders which were not defensible from a standpoint of fairness and sound common sense, were they deprived of the mantle of official infallibility with which they so often seek to clothe themselves. No officer who gives his men to understand that he is competent to do all the thinking, and that their duty is only to obey orders blindly, can command their respect or co-operation. No railroad can afford to countenance any policy in dealing with its employees which will not bear the test of publicity and of frank discussion. As was evidenced in the case of the Long Island Railroad, previously referred to, the public is quickly satisfied with a plausible explanation, when proffered, of what previously was viewed as a mere edict by circular, and seemed to be an autocratic abuse of power. The point to be noted, however, is that for weeks the same explanation was proffered verbally to citizens' committees and newspaper reporters, but that the garbled versions of it which appeared in the press only served to inflame public indignation. As soon, however, as it appeared in the public press backed by the signature of the president of the road, the agitation immediately subsided. This must have been due to the publicity given to reasons which were presumably incontrovertible. As railroad men are not less amenable to reason than the public generally, such a policy as between a railroad and its employees, in dealing, at their inception, with the causes that sometimes lead to disastrous strikes, could not but be beneficial. It is usually the case after such a strike that each side learns that the statements of the policy of the other, delivered verbally and perhaps imperfectly expressed in the beginning, have been greatly distorted by the successive prejudiced interpretations placed upon them by the persons transmitting them. This would be obviated by the publication in an official journal, of both sides of the question, which would put each clearly on record before every man interested, bring officers and men closer together, do away with the one-sidedness which now characterizes both the official conferences and those of the lodge room, render innocuous the oratory of the agitator, and restrain abuses of power on the part of subordinate officials. An appropriate motto for such a publication would be, "A square deal for every man, and for the company as well."

Aside from the discussion of so-called grievances, an esprit de corps could be built up by a series of "friendly talks" in print. These could impress on each employee that every dereliction of duty on his part, even if he evade the responsibility, would serve to discredit not only himself but his fellows with their immediate superior; his division with the management, the latter with the stockholders, and the road with the public. As an instance of such a "friendly talk" the writer has in mind an address recently published in the *Railroad Gazette*, which was delivered by the General Claim Agent of a western line at a meeting of its agents. Such an article, addressed by an officer to the employees of his own line, goes home to each man with a thousand times the force which it would have if read in a journal devoted to the interests of the railroads of the country as whole.

In the days before the standardizing of train despatching rules, the western transportation man's most valued book of reference was a Union Pacific time-table, each issue of which contained all the queries which had been made to date regarding seemingly ambiguous or conflicting rules, together with the official ruling governing their interpretation, the latter always expressed in such a form as to render the reasons underlying it apparent. As a clearance from the Union Pacific was then sufficient to secure employment anywhere for a conductor, train despatcher, agent or telegraph operator, it is evident that the road was repaid in the efficiency of its men for the increased expense incurred in supplying the entire west with time-tables.

The writer believes that a spirit of personal honor and pride in the road may be, through such a journal, built up among employees in the same manner as is done in many educational institutions. One cannot, however, inculcate honesty without making use of the word and of its opposite—dishonesty; and although the leakage of revenue through the dishonesty of employees is a most vital question to every railroad, it is generally a tabooed subject between officers and men, and the methods employed in checking the latter are surrounded by the greatest mystery. No honest or fair minded man can object to being surrounded by precautions tending to lessen the temptations to which he may be exposed, and these precautions in many cases protect him from being forced into collusion with dishonest fellow employees who might otherwise make his position unpleasant. He has, however, a right to expect that the methods of checking him be fair and aboveboard, and that he be heard in his own defense. The writer has found it advantageous to explain clearly to employees the methods to be used in such checks, together with the bearing which the non-observance of seemingly unimportant rules might have on the result; at the same time impressing upon them that the company does not purpose to await absolute evidence of dishonesty, but will punish by dismissal any employee who, by the violation of such vital rules, gives cause for suspicion.

As an example of an opposite policy, a certain great railroad has for years been noted for its niggardliness in the granting of

allowed railroad men, but many discharges undoubtedly took place due to the carrying of men on the request of officials. With the certainty of being eventually discharged without a hearing, as the result of such a secret check, it is not difficult to follow up the train of logic which would influence a conductor in his dealings with the company. Did the road in question publish such a journal as is herein advocated, so that conductors could anonymously explain their side of the case without imperiling their positions or reflecting on their immediate superiors, the high officials responsible for this pass policy would ere this have discovered that there exists a serious loss of revenue and an injustice to a class of employees as an offset to the apparent economy shown by their exceedingly small pass lists.

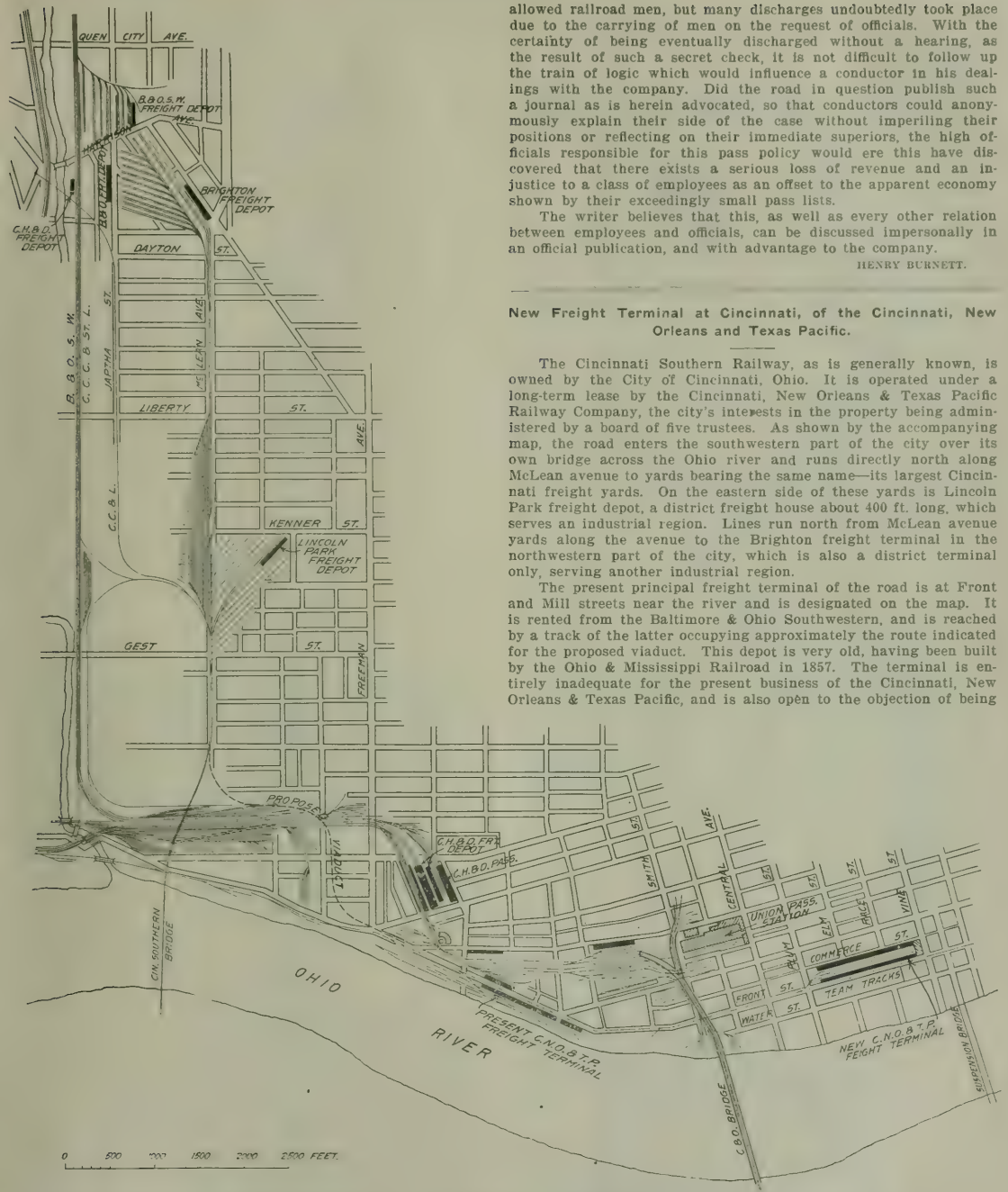
The writer believes that this, as well as every other relation between employees and officials, can be discussed impersonally in an official publication, and with advantage to the company.

HENRY BURNETT.

New Freight Terminal at Cincinnati, of the Cincinnati, New Orleans and Texas Pacific.

The Cincinnati Southern Railway, as is generally known, is owned by the City of Cincinnati, Ohio. It is operated under a long-term lease by the Cincinnati, New Orleans & Texas Pacific Railway Company, the city's interests in the property being administered by a board of five trustees. As shown by the accompanying map, the road enters the southwestern part of the city over its own bridge across the Ohio river and runs directly north along McLean avenue to yards bearing the same name—its largest Cincinnati freight yards. On the eastern side of these yards is Lincoln Park freight depot, a district freight house about 400 ft. long, which serves an industrial region. Lines run north from McLean avenue yards along the avenue to the Brighton freight terminal in the northwestern part of the city, which is also a district terminal only, serving another industrial region.

The present principal freight terminal of the road is at Front and Mill streets near the river and is designated on the map. It is rented from the Baltimore & Ohio Southwestern, and is reached by a track of the latter occupying approximately the route indicated for the proposed viaduct. This depot is very old, having been built by the Ohio & Mississippi Railroad in 1857. The terminal is entirely inadequate for the present business of the Cincinnati, New Orleans & Texas Pacific, and is also open to the objection of being

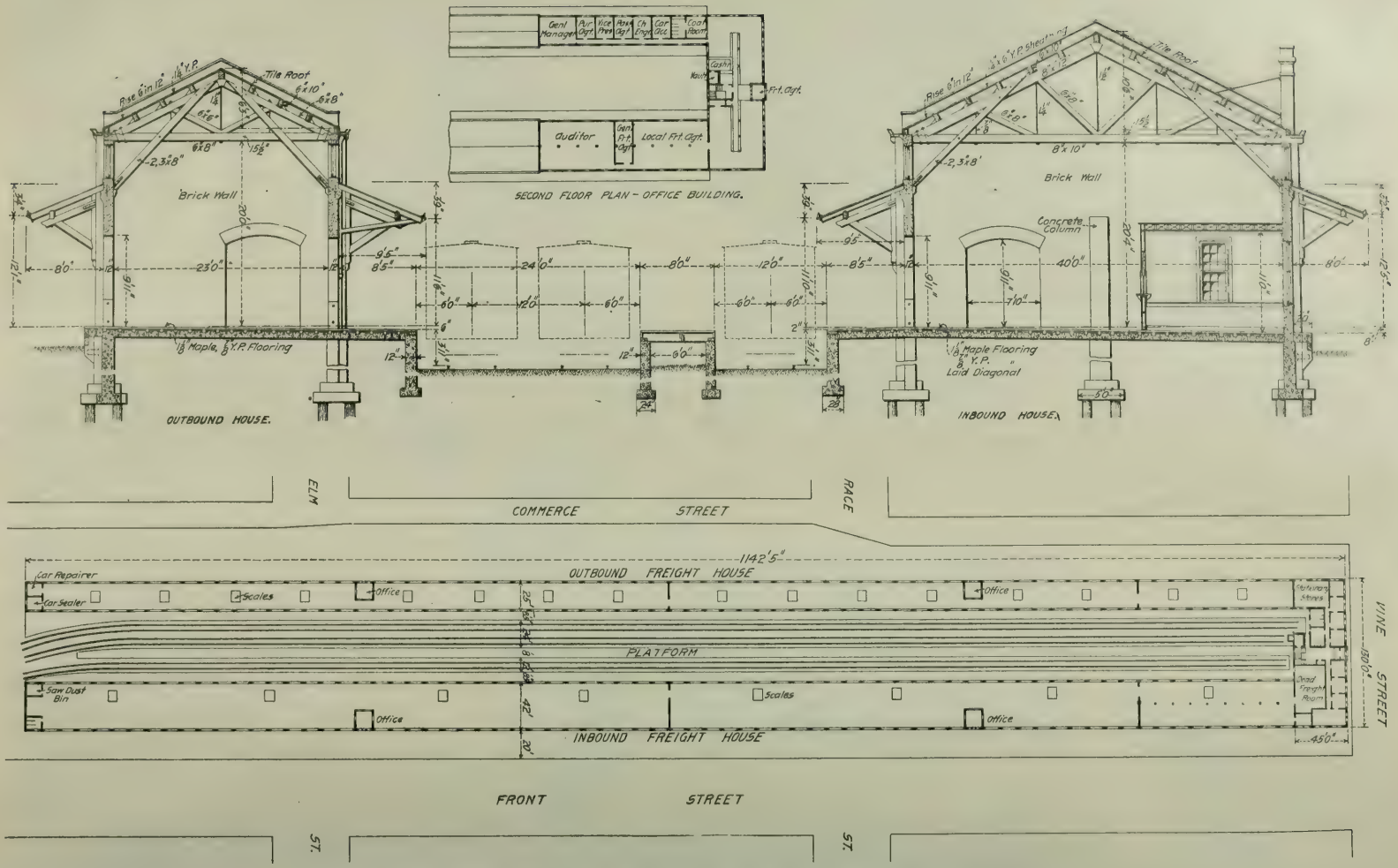


Cincinnati Terminals of the Cincinnati, New Orleans & Texas Pacific.

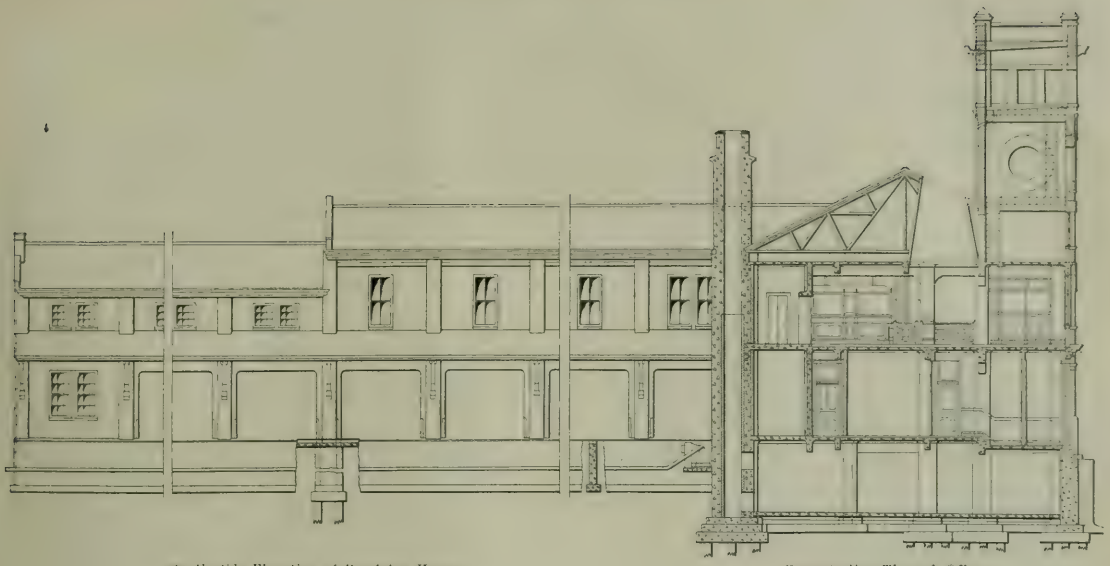
passes to employees of its own and other lines, all passes given by transportation officers being checked against their payrolls, and an explanation demanded where the necessity for issuance of transportation is not obvious. As a result it was for years tacitly understood by every transportation man below the rank of General Manager that each conductor would be allowed to carry free over his run "two railroad men," and in addition to this as many more were "fixed" verbally with the conductor by despatchers, trainmasters, and superintendents, as they saw fit. When this road covered its trains with "spotters," as it does periodically, it is possible that the auditor made allowances for the two tacitly

inconveniently situated relative to the business district of the city. The trustees of the Cincinnati Southern accordingly took steps some time ago to provide a new freight terminal more favorably located with reference to the wholesale section of the city, and of a capacity and arrangement that would provide not only for present requirements but that would be ample for the needs of the road for some time to come.

In order to obtain a suitable site having the desired proximity to the wholesale section, improved property had to be acquired at great expense, the outlay for this purpose alone being in excess of $1,300,000. The new terminal fronts on Vine street and extends



New Freight House at Cincinnati for the Cincinnati, New Orleans & Texas Pacific.

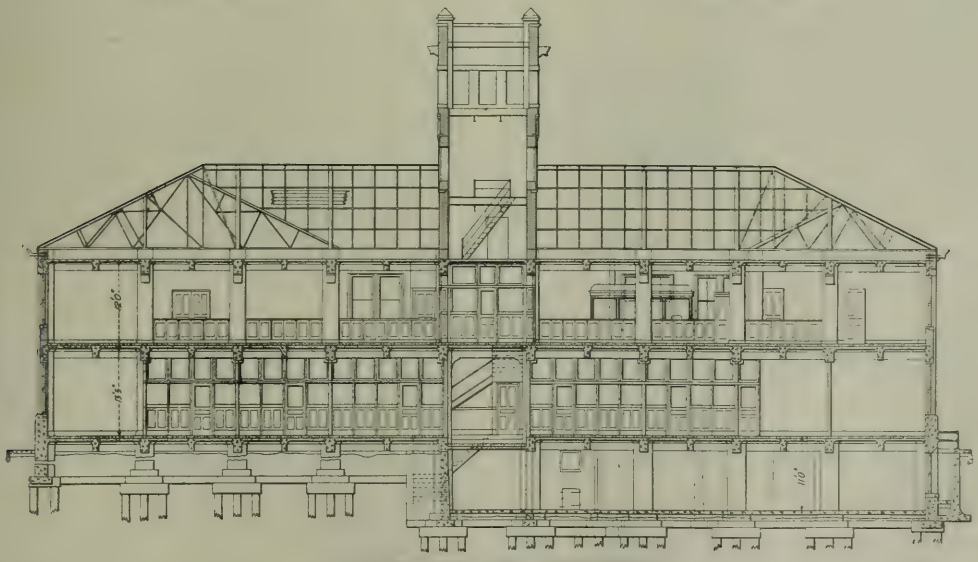


South Side Elevation of Receiving House.

Cross-Section Through Office.

Vine Street Elevation.

Plum Street Elevation.



Longitudinal Section Through Office Building.

Vine Street Freight House and Office Building C., N. O. & T. P. Ry, Cincinnati.

westwardly through three city blocks to Plum street. The buildings will occupy the space between Commerce and Front streets, and across the latter, on a tract almost as large, will be team tracks. The entire property was occupied by warehouses from four to eight stories high, some of which had been standing for upwards of 50 years. The presence of abandoned wells, old privy vaults, deep cellars, etc., revealed in the wrecking of the old buildings and the excavating for the foundations of the new, presented difficulties in building the foundations.

The buildings consist of a two-story and basement office part, 130 ft. front on Vine street and 50 ft. deep, between Front and Commerce streets, and inbound and outbound freight houses extending westwardly from same, the inbound building facing Front street and the outbound Commerce street, the whole forming a U-shaped structure. The freight houses are each 1,100 ft. long. The outbound house is 25 ft. wide and the inbound 42 ft. wide, both having a 8½-ft. platform on the track side. Between the two freight houses are three tracks, two serving the outbound house and one the inbound. Between the inbound and outbound tracks is a platform 8 ft. wide and extending practically the entire length of the freight houses. Each freight building has a second story 135 ft. long adjoining the office building, to be used as record rooms for the general offices of the railroad company. The office building is to be of reinforced concrete construction practically throughout, with steel roof trusses and tile roof. It will be faced with pressed brick and have stone trimmings. The freight houses will also be of reinforced concrete, but with wooden roof trusses. They will be without the brick veneering, and the walls and piers separating the doors will show a tooled or floated concrete surface.

The foundations which were put in differ considerably in detail from those shown by the general plans herewith, these plans having been made early in the year before there was any certainty about the exact location of the terminal and therefore of the soil and other conditions to be encountered. The quality of the soil and the condition of the large warehouses, which had stood for years on the site finally chosen, made it evident that piling was unnecessary. Instead, broad footings of reinforced concrete were put in for the columns and pedestals, the dimensions in each case being such as to give a load of 3,000 lbs. per sq. ft. on the sandy clay soil.

Details for the reinforced concrete construction to be employed in the buildings are not yet fully decided upon, therefore drawings of typical designs of columns, girders and floors cannot be shown at this time. The loads for which designs are being prepared are: 125 lbs. per sq. ft. for the first and second floors of the office building; 300 lbs. for the stationery store room and the record rooms over the freight houses; 100 lbs. for all attic floors. It is not anticipated that any unusual design or construction will be used in any part of the buildings. A 1-2-4 mixture of concrete will be used throughout. All footings, beams and floors will be reinforced with Kahn bars, and columns with plain rods ¾ in. to 1 in. in diameter. There are expansion joints where the freight houses join the office building, and every 90 ft. along the freight house walls. The 4-in. x 4-in. floor timbers of the office building will be bedded in cinder concrete. At the rear of the office building will be a plain concrete chimney 56 ft. high and 2 ft. 6 in. square inside. The walls are 21 in. thick up to the roof of the building, reducing above that to 17 in. and then to 13 in. The tower, which is 65½ ft. high above the street, is of brick and steel, with stone trimmings.

As already mentioned, the freight houses have concrete walls with wooden roof trusses and tile roof. A cross-section of both houses and the platform between is shown. The platforms on the track sides of the two houses are covered by roofs bracketed to the building walls. The street sides of the buildings also have each a projecting roof 8 ft. wide. The roof truss knee braces, which are formed of two 5-in. x 8-in. timbers, rest on corbels on the walls of the house. They are each anchored to the wall by a ½-in. by 3-in. strap bolted to the brace. This strap is given a quarter turn and anchored into the concrete by a short vertical rod passing through a hole in its end.

The space under the houses between walls, including the platforms, is filled with earth rammed in layers. On this will be laid a double floor of yellow pine and maple respectively, resting on sills bedded in a 6-in. layer of concrete. The floor of the outbound house has a slope of 6 in. to the edge of the platform at the track side, while the inbound floor slopes 8 in. toward the street side. Both sides of both buildings will have rolling steel doors 11½ ft. wide by 10 ft. high, with piers 3½ ft. wide between all doors. Commerce street, on the north side of the outbound house, will be considerably wider than formerly. This space and all other roads and driveways around the terminal will be paved with granite, or other material to be determined later.

Each track between houses has room for 27 cars, or 81 cars for the three. The capacity of the outbound house will be double that of the present terminal, while the inbound will have six times as much room. All of the switching to and from the present house is done for the C., N. O. & T. P. by the B. & O. S. W. For the new terminal the approach will be over the tracks of two foreign roads temporarily: the B. & O. S. W. and the Pennsylvania, which will do the switching jointly. But proceedings have been begun to acquire land for a viaduct approach about 3,000 ft. long from the north end of the Ohio river bridge. Its route will be approximately as indicated on the map, coming to the surface at its juncture with Front street. From this point the company expects to put in its own surface track to the new terminal.

At the present time the foundations of the buildings have been completed and work has begun on the superstructures. It is expected to have the terminal ready for occupancy by the spring of 1906. Mr. G. B. Nicholson, Chief Engineer of the Cincinnati, New Orleans & Texas Pacific, is Chief Engineer and Superintendent of the terminal work for the Trustees of the Cincinnati Southern. He is being assisted by H. E. Warrington, Principal Assistant Engineer, and Adam Ritter, Assistant Engineer of the C., N. O. & T. P. The Collier Bridge Company, Indianapolis, Ind., has the contract for the construction complete. The buildings will cost about $250,000. We are indebted to Mr. Nicholson for the data of this article.

Commerce Street Elevation, Vine Street Freight House and Office Building, C., N. O. & T. P., Cincinnati.

Fines for Soliciting Rebates.

At Chicago, Sept. 21, four officers of the Schwarzschild & Sulzberger Company were fined an aggregate of $25,000 by Judge Humphrey in the United States District Court, following a plea of guilty to indictments charging conspiracy to accept railroad rebates. The defendants were: Samuel Weil, of New York, Vice-President of the company; B. S. Cusey, Traffic Manager; V. D. Skipworth, and C. E. Todd, Assistant Traffic Manager. Mr. Weil was fined $10,000 and the other three $5,000 each.

With the entering of the plea the statement was made that unless at least one of the cases was immediately settled the life of Mr. Weil would be jeopardized, his nerves being shattered. The plea was entered, it is said, after an understanding with United States Attorney General Moody that the jail provision of the law, under which the indictment was returned, should be waived and only a fine imposed. The four men were accused of unlawfully combining and agreeing to solicit rebates for the Schwarzschild & Sulzberger Company from the Michigan Central, the Chicago, Rock Island & Pacific, the Grand Trunk Western, the Lehigh Valley, the Boston & Maine, and the Mobile & Ohio railroads. Charges were also made that the defendants had conspired with each other in presenting supposed claims for damages which were in reality claims for rebates.

The plea now entered does not in any way affect the charge of interference with government witnesses made in a previous indictment returned against Mr. Cusey and other Schwarzschild & Sulzberger men. Max Sulzberger at once gave his check for the

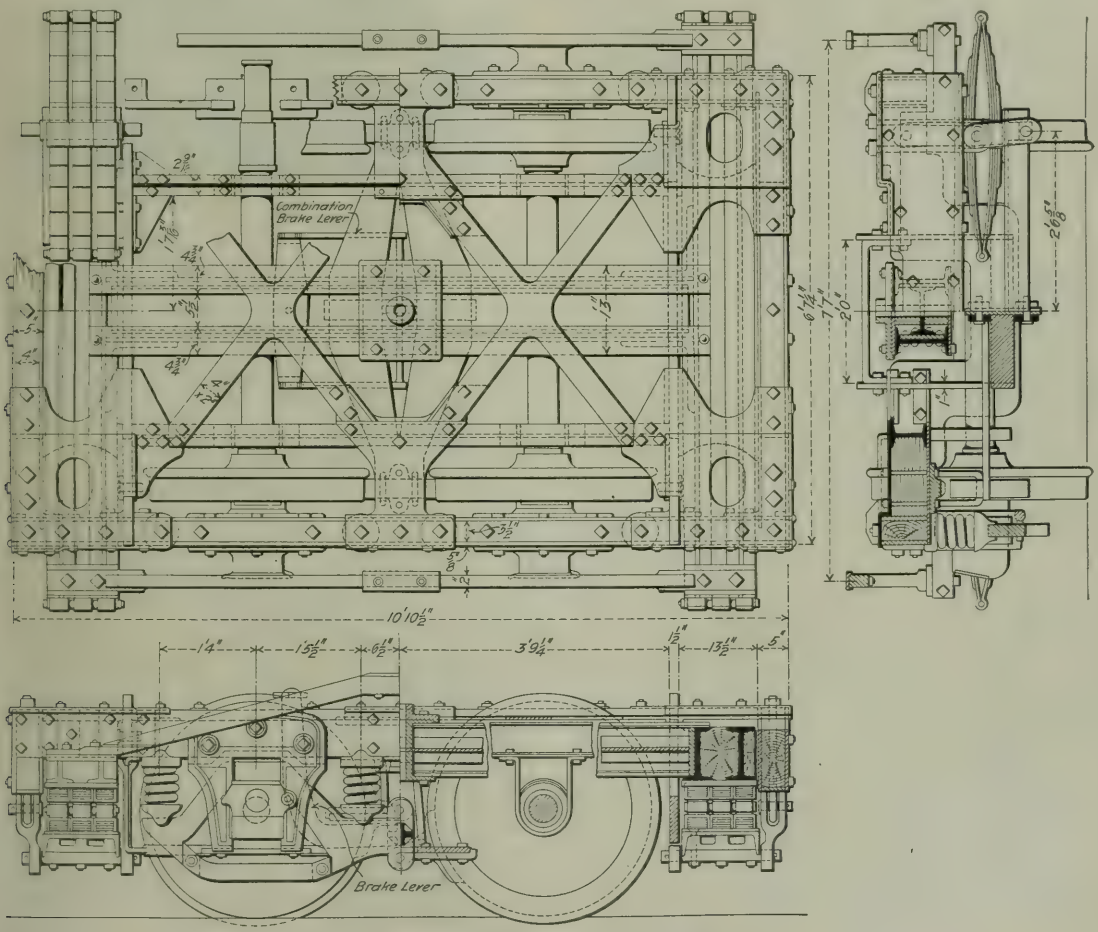
total amount of the fines. It is said that it cost $16,000 to collect evidence against the four defendants and bring about their indictment.

A New Four-Wheel Passenger Truck.

Mr. T. N. Hyden, Chicago, has designed a four-wheel passenger truck in which he has endeavored to embody the good qualities of the six-wheel truck, at the same time effecting a reduction of weight, and of construction and maintenance cost. The drawings show that the chief points of difference from the usual four-wheel truck are: the short wheel-base, the placing of the bolsters and spring planks at the ends of the frame, and the extension of the equalizers at each end to provide for an additional spring. These features required a novel frame construction, in which it was endeavored to combine strength and rigidity.

The wheel pieces of the frame are plated with ⅝-in. plates which are stiffened vertically by plates riveted to the inner sides of the webs. These plates are joined across at the ends, forming, in fact, a rectangular frame. Inside of the frame is an 8 in. I-beam placed horizontally for lateral stiffness, its flanges being riveted through the stiffening plates and webs of the 9 in. beams. The bridge beams rest on top of the bottom flanges of the 9 in. bolster beams and are secured thereto by bent plates. Two bolts pass from the end of the stiffening frame through the bolster. Also, the top flange of each bridge beam is extended over the top flange of the bolster beam and riveted to it. The bolsters are two 9 in. I-beams with a seasoned oak filling beam between. They are reduced in depth at the ends to extend under the wheel pieces and carry the side-bearing beams. These latter will be made of cast-steel not quite to the form shown in the drawings.

The spring plank, which is a 13 in. 40 lb. channel, flanges down, is swung from the end pieces and transoms. A cast-iron filling block is interposed between the spring plank and hanger



The Hyden Four-Wheel Passenger Truck.

and the end pieces with ½-in. In addition there are members corresponding to the safety beams of the ordinary four-wheel truck, and others which combine the characteristics of the middle transom of the six-wheel truck with those of the four-wheel truck transom. These latter members are placed 13½ in. inside the end pieces. They are heavy forged or cast-steel pieces which are U-shaped at the middle to pass around the center-bearing bridge. The safety beams, which are 6-in., 17¼-lb. I-beams, are rigidly connected at their ends to the transoms and at the middle to the wheel pieces. At each corner of the frame is a heavy plate of either malleable iron or cast-steel, securely bolted to the wheel and end pieces and the transom and safety beam. Additional lateral stiffness is secured to the frame by two X braces between the safety beams.

The center-bearing bridge is formed of two 9 in. 35 lb. I-beams

axle. The burden springs are three-bundle elliptics, with seats of either malleable iron or steel. The extension of the equalizers beyond the journal boxes to provide for additional equalizer springs has been mentioned. The equalizer is braced across below each pedestal somewhat similar to the bracing of a locomotive frame pedestal.

The brake rigging embodies a special lever device, which may be seen on the plan and side elevation, the latter showing it in broken lines. It provides for inside-hung brakes and is essentially one lever for the two beams, the fulcrums being so placed as to equalize the pressure on the two beams.

Mr. Hyden estimates that the saving in weight of his design over a six-wheel truck would be about 8,000 lbs. per car, and the saving in cost of making would be several hundred dollars. He has patented the design.

Union Highway Crossing Bell.

The Union Switch & Signal Company has lately brought out a new design of highway crossing signal—an iron post and sign with a relay box—that will take the place of the former designs, which were largely of wooden construction. The new design is shown in the accompanying illustration, Fig. 1. The advantages of this design, with its more durable parts, are obvious. The wires connecting the tracks, batteries and instruments, being run entirely inside the post, are protected both from weather and from malicious interference.

The bell fixed on the top of the post is of the well-known Rousseau type, its working parts being protected by its own gong and a semi-circular metal hood above it. This bell requires only eight cells of caustic potash battery to operate it, and the battery is kept in the cast-iron box at the foot of the bell post. The sign is a cast-iron ring 3 ft. in diameter, with raised letters cast on each face. It is made of two similar sections bolted together. It has an advantage over the usual wooden sign, in that it does not require the services of an expert to repaint it, the raised letters making the job comparatively simple. Signs (rings) can be made from any design, with lettering to suit the requirements of different state laws, without changing any of the other parts.

Fig. 1—Union Crossing Signal.

The relay box will hold two interlocking relays, or four simple relays, as conditions require, and is absolutely water and dust proof, being fitted with a gasket of rubber tubing and a special hasp for forcing the door tight against the gasket, similar to the design employed in the Union Company's well-known electric semaphore signal.

The interlocking relay used on single track lines is shown in Fig. 2. This design embodies all the features of the standard enclosed relays, manufactured for a number of years by the Union Company, the cores, magnets, and armatures being identical with those of the "Universal" type of relay. It can be equipped with platinum or carbon contacts, as desired, and is provided with high grade insulation throughout, thus insuring immunity against any ordinary lightning discharge. All relays of this design are tested with an alternating current of 5,000 volts before leaving the factory.

The locking arrangement between the two armatures of the relay is an adaptation of the original Scott design, used for many years by the Union Company. On double track, the locking arrangement is omitted entirely, and each side of the relay operates independently of the other, the whole instrument being practically two relays mounted on a common base.

The connections for a single track crossing are shown by Fig. 3. The track is bonded for from 1,500 ft. to 3,000 ft. on each side of the crossing from A to B and C to B. As a train enters from either end the interlocking relay makes back contact on one or the other of the fingers attached to the armatures of coils D or E which completes the local bell circuit of battery F. To stop the bell as soon as a train has cleared the crossing that part of the relay controlled from the section beyond the crossing is prevented from acting by the locking pawl H which, when D is dropped, keeps H from dropping far enough to close the local circuit.

Fig. 4 shows the normal condition of an interlocking relay when the coils are energized, with the armatures "picked up" and the controlling track sections unoccupied. D and J are the armature bars, carrying contact arms E and G. H and I are the interlocking arms, carried by D and J and insulated therefrom, notched to engage the locking pawl F; M and N are contact points. Fig. 5 shows the condition of the relay after a train has entered the track section A B. The coils of magnet K are de-energized and D has made back contact with post M. Arm H in falling throws locking pawl F to the position shown and thereby prevents contact being made between G and N, when the train passes beyond B and de-energizes magnet L. The armature J cannot fall far enough to make the contact as the notch in I catches on the pawl F. This condition will continue until the train clears section A B, when armature D will be lifted and open the contact between M and E, thereby breaking the local circuit passing through M and E, and the bell will stop ringing. The armature J remains down and locked. As the train continues on and clears section B C, armature J will rise and the relay will be in its original and normal condition.

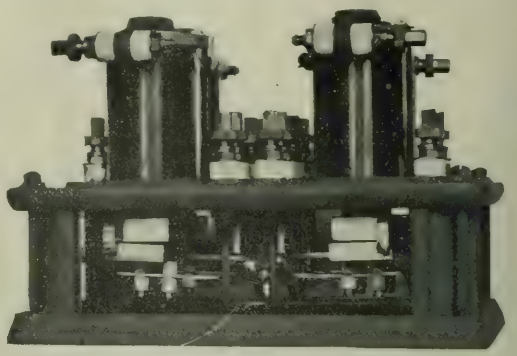
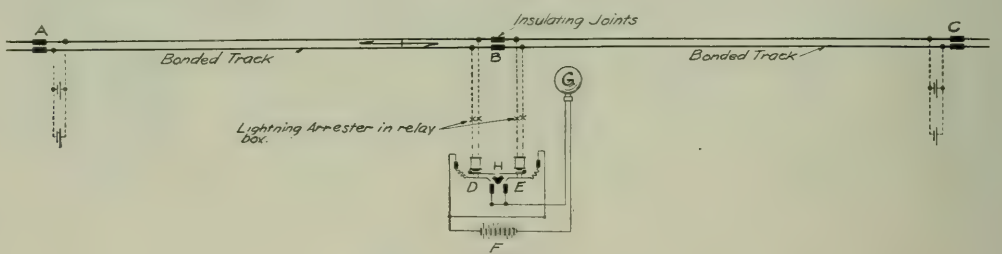


Fig. 2—Union Interlocking Relay.



Single Track Crossing Bell.

On double track an interlocking relay with the locking pawl removed is used to control the local bell circuit. Two ordinary relays would answer, but it is often desirable to maintain the interlocking type as a standard for bell work, and besides it is more economical of space.

The Prussian Railroads have ordered eight hospital cars, as we may call them, to be stationed at different places in the country for the transportation of people too ill to sit up and requiring the attendance of doctors and nurses. Each car has a sick room with bed for the patient and reclining chairs for attendants, opening into another compartment also provided with a bed, and a servant's compartment. All the appliances likely to be needed in a sick-room are provided and conveniently at hand. One of these cars can be ordered at any station, on the purchase of 12 first class tickets for the route over which it is to go. The first of the eight has recently arrived at Charlottenburg, a suburb of Berlin, where it will be stationed.

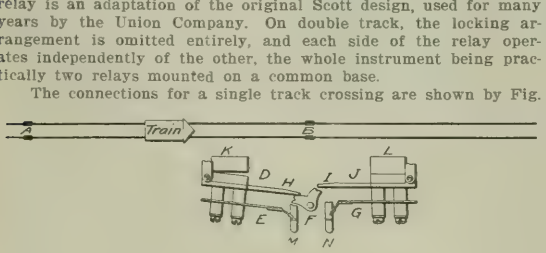


Fig. 4.

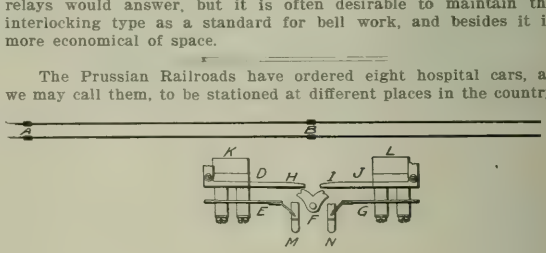
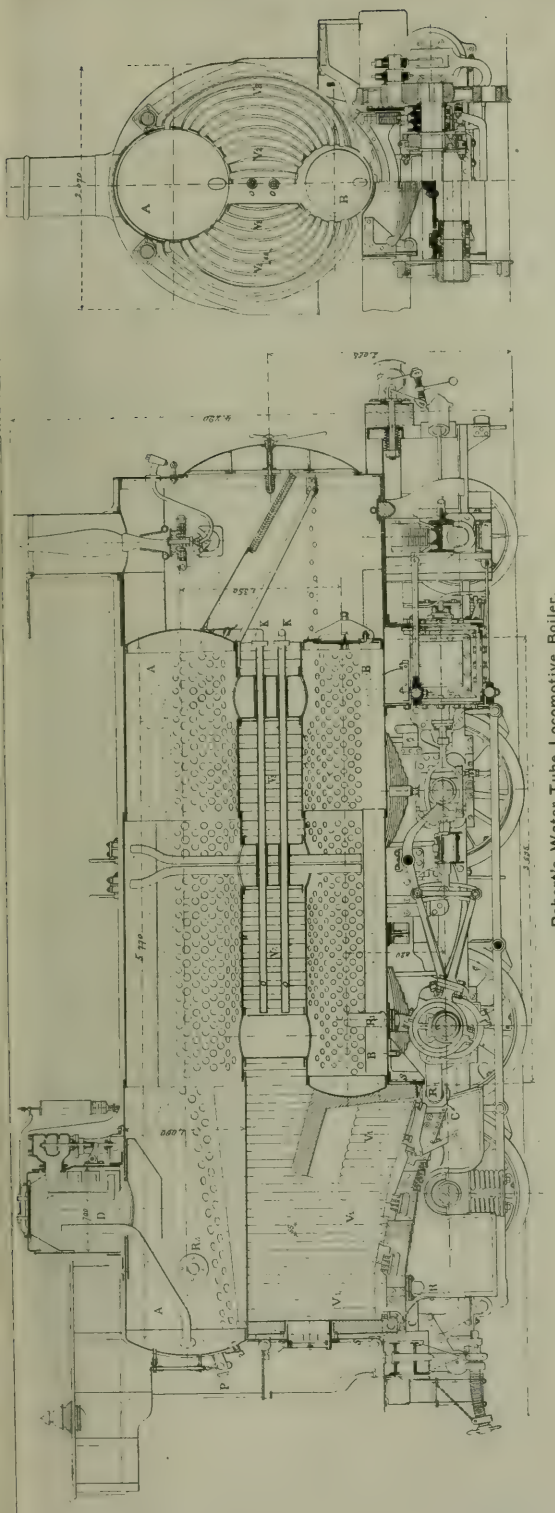


Fig. 5.



Robert's Water-Tube Locomotive Boiler.

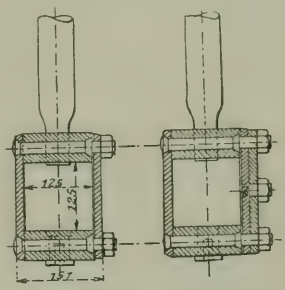
Robert Water-Tube Locomotive Boiler.

The water-tube boiler that has achieved such economical results in marine and stationary practice offers an attractive field for experiment on the locomotive. According to *La Genie Civil* a boiler of this type has been built and for more than a year in successful working on the Algerian lines of the Paris, Lyons & Mediterranean Ry. by M. Robert, the chief engineer. The boiler is of the Yarrow type though still preserving, in external appearance and method of location on the machine, the ordinary form of boiler.

The boiler is composed of three main parts; the firebox, the body and the smoke-box. The body is formed or is built upon two cylindrical reservoirs A and B in the drawings attached to each other by three drums for direct connections as well as by the tubes that serve the purpose of water evaporation and circulation. These, V^2 V^2, are of steel. The upper reservoir holds both water and steam; while the lower one, which ends at the front end of the firebox, is filled with water only.

The firebox extends down to the grates that carry a hollow frame. The crown of the firebox is the upper reservoir A; the front and back walls are of fire brick, and the side walls are formed by the tubes V_1 with expanded joints and connect the upper reservoir with the hollow ring. The latter is further connected with the two reservoirs by large return pipes R_1 R_2.

The gases of combustion pass between the nests of water tubes that extend from the firebox to the smokebox. In order to avoid an admission of air, steel covering plates have been applied to the sides of the firebox and body of the boiler.



Cross Sections of Mud-Ring.

As in the case of the boilers of torpedo boats, the circulation of the water is maintained in such a way that there is an ascending current passing through the tubes immediately surrounding the firebox, and in the principal nests nearest thereto, while the descending current passes through those that are more remote as well as through the return water tubes R_1 R_2 which are not in contact with the flames. While the circulation is quite rapid, the adherent deposits have a tendency to form in the tubes that are the hottest, though they are easily removed when scale is thus formed, as will be shown later. The principal dimensions are as follows:

Grate length	72 in.
" width	41.34 in.
" area	2.67 sq. ft.
Tubes, 2.6 in. diameter (number)	556
" 1.8 in. diameter (number)	60
" 2.6 in. diameter (average length)	67 in.
" 1.8 in. diameter (average length)	47.8 in.
Heating surface (firebox)	165.67 sq. ft.
" " (nests of tubes, reservoirs and drums)	1,108.07 "
" " (total)	1,273.74 "
Length of nest of tubes	143.7 in.
Steam pressure per sq. in.	160 lbs.
Total capacity	300 cu. ft.
Volume of water at upper level	248.8 cu. ft.
Volume of water at lower level	206.45 "
Difference available for evaporation	41.35 "
Weight of boiler empty without attachments	29,700 lbs.
Weight of boiler filled	42,570 "
Height, center of gravity of boiler above the rail	7 ft. 5¾ in.

The Robert boiler has one advantage over the ordinary locomotive boiler in ease and speed in freeing the scale without taking out or disturbing any part of the structure as must be done in the case of the standard style. When the boiler is to be washed out, it is first emptied and then filled with cold water so as to make it possible to enter the cylindrical reservoirs, which are provided with manholes. There need be no fear of overstraining or distorting any of the parts by this sudden cooling as would be the case with boilers fitted with the ordinary fire tubes.

The reservoirs can always be cleaned without using any special apparatus, as they are always accessible. The tubes are cleaned as follows: The workman takes a piece of flexible shafting into the upper reservoir. This carries cutting teeth at one end and is driven from the shop. The teeth cut away the scale in a few moments and it falls into the lower reservoir or the hollow frame of the firebox, from either of which it is readily removed. All parts of the boiler can be cleaned in the manner thus indicated and kept in such a state of cleanliness that the best condition of evaporative efficiency be maintained.

It is also necessary to free the tubes from the soot that may have accumulated upon them. This can be done by the crew.

even while the engine is on the road, for there are two pipes *o o* connected to the steam pipe *k*, and perforated with small holes inclined in the proper direction. By opening a cock and allowing the steam to blow out at these holes, the surfaces of the tubes are scoured and cleansed of the soot which is blown out at the stack.

The advantages that are claimed in comparison with the ordinary type are: Less weight for the same amount of heating surface, and the entire avoidance of flat surfaces that must be stayed by bolts or braces; ease of cleaning, as no tube joint is exposed to the action of the flames, the liability to leakage from this cause is avoided; the construction and especially the work of repairs being less troublesome than in the case of the ordinary boiler, the time occupied in the making of repairs is shorter, and this lessens the period that the engine is out of service.

The criticism to be made is that, owing to the limited area of the water surface in the upper reservoir the liberation of the steam is likely to be accompanied by a violent ebullition with a consequent intrainment of water.

The engine shown has been in freight service for 16 months. The line has a length of about 74 miles, with an undulating profile in which there are some long 2 per cent. grades. The train loads handled are about 25 per cent. more than those taken by engines with fire-tube boilers, having the same heating surface and practically the same grate area, in the same service. The saving in fuel amounts to about 10 per cent., which is due to the better condition of the evaporating surfaces and the improved circulation of the water.

The maintenance of the boiler, up to the present, has been practically nothing, while, in the case of the ordinary locomotives during the same period, it has been necessary to replace a large number of staybolts and tubes as well as tube sheets on account of the bad quality of the water, which contains about 2.8 grains per gallon of solid matter and in some localities the waters are so hard that this proportion rises to 9.2 grains per gallon.

The salts in solution, with the exception of a small quantity of carbonate of lime, are the sulphates of lime and magnesia, which produce very hard and adherent deposits.

The writer of the article in *Le Genie Civil*, M. F. Barbier, is of the opinion that the experience thus far obtained with the Robert boiler seems to indicate that it marks a notable advance in construction.

The Prussian State Railroad management having been criticised because of the very large number of cases where it had notified prosecuting attorneys that employees might be prosecuted criminally, while in only a fraction of such cases were the men actually tried and found guilty, the management explains, that in all cases where an accident has caused loss of life or endangered it, the local railroad authorities notify the local prosecuting attorney, who actually prosecutes only after an investigation is made—something as a motorman is arrested here, when some one has been killed, before there is any evidence that it was any fault of his. In 1903 the Prussian railroad authorities notified 1,147 cases of accident to the prosecuting officers; but in only 155 cases did they, after investigation, ask for prosecution, and in these cases only 93 employees were reported as the guilty persons. Prosecutions were made in 151 cases; in 14 the charge was withdrawn, in 28 the defendant was found not guilty, and in 76 found guilty. The other 33 cases ha not yet come to trial. This the management adduces as evidenc that it acted with judgment, and was not unduly severe.

Time Freight on the Southern Railway.*

The revised instructions governing time freight on the Soutl ern went into effect March 1, 1905. Although nominally there only one class of time freight, including all kinds of perishabl freight, all merchandise, carloads or l. c. l., machinery and liv stock, and a number of other articles, as a matter of fact perisl able goods really constitute a special class within the general clas Special forms shown below are provided for the record of perisl able freight and also of merchandise freight in case the latter b comes delayed in transit. Except for these two items the genera system corresponds quite closely to those already shown. The form used are the time freight waybill envelope, the telegraph train r port for passing trains, the consist report, the cut-out report, an the two special forms mentioned. Four previous forms in use pric to the revision were abandoned. It is taken for granted that time freight car is moving uninterruptedly in the train in whic it started until form 84, the cut-out report, is received, showin that the car has been cut out. Time freight, except perishable, de tined to branch line points is followed to divisional terminal o branch line junction points only, after which it is left to the chie train despatcher, train master and superintendent to see that suc cars are forwarded to their destination on the first proper trai For example, a car of time freight billed from Pinners Point to Co cord, N. C., is followed by the system only as far as Spencer.

As is generally the case, it is provided that time freight mus

6000 4-9-1904—D **Form 184.**

SOUTHERN RAILWAY COMPANY.

A B

Station_____ Date_____ 190____

J. N. SEALE, S. of T., Washington, D. C.

The following cars of Merchandise Freight (PACKAGE CARS) were C D

ready for Train No._____ _____ 190____, which left F

at_____ M., but were forwarded on other trains as below:

G	H	J	K Forwarded.			M
Initial.	Number.	Destination.	Train.	Time.	Date.	Cause of Delay.

This report to be telegraphed to the Superintendent of Transportation immediately cars are forwarded.

Report of Merchandise Freight Delayed.

1-11-05. 5M. B03594 Form 84

SOUTHERN RAILWAY COMPANY.

CUT-OUT REPORT.

.....Date.....190

Mr. J. N. SEALE, Supt. Transportation,
Washington, D. C.

Following Cars, PACKAGE, TIME or PERISHABLE Freight were Cut Out of TIME FREIGHT Trains:

DESCRIPTION					CUT OUT		CUT OUT OF			FORWARDED		
A	B	C	D	F	G	H	J	K	M	N	O	P
Initial	Number	Contents	From	Destination	Where	Why	Train	Time	Date	Train	Time	Date

..... Superintendent.

INSTRUCTIONS.

1. This Cut-Out Report must be transmitted BY WIRE to the Superintendent of Transportation as soon as cars which have been cut out are forwarded.
2. If cars cut out are delayed over 24 hours before being forwarded, report showing why cut out should be sent promptly, and a separate report showing forwarding should be sent as soon as cars are forwarded.
3. If cars cut out are transferred for any cause, this report should show car into which transfer is made, and give forwarding.

Cut-Out Report.

be moved only on certain through trains designated to handle it except time freight originating at non-waybilling points for thi class of freight, and that this freight must be bunched, as far as pos sible, at district terminals to expedite the movement. In other words it is the constant aim to assemble at district terminals all the tim freight possible in order that carded trains may have as near th full tonnage rating of time freight as possible. When there is no full tonnage of time freight, it is provided that carded trains may b filled out with ordinary freight, care being taken to select the highes class loads and the longest haul in order to enable the time freigh train to be handled throughout its full run with the least possibl amount of switching and setting out of cars. It is emphasized tha each division must inevitably protect the through freight sched ule, running a sufficient number of sections to move all the tim freight and as much of the long haul business delivered by th connecting division as can economically be done. A sufficient num ber of short haul loads and empties may be kept at district termi nals when necessary to fill out through trains to their prope tonnage rating.

The Southern has, of course, a very important fruit traffic and this requires some special provision in the time freight system already alluded to in the mention which has been made of the extr classification given perishable freight. It is also provided tha bananas and other perishable shipments of eight or more cars may

*For previous time freight articles see Sept. 8, Great Northern; Sept. 1 Chicago & North-Western, (Sept. 22, Chicago Freight Terminals); Aug. 25 Atchison, Topeka & Santa Fe, and Boston & Maine; Aug. 18, St. Louis & San Francisco.

when necessary, be run as extras under the time freight classification. When regular messengers accompany bananas and other fruit the names of these messengers are shown on slip bills as well as on the regular waybills covering the shipments, and the messengers are also furnished with term passes or with a banana messenger's ticket as the case may require, to provide for their free transportation on the train carrying the shipment. These messengers have entire control of the ventilation of the cars in their charge and are entitled to call on employees of the company for any help that they may require. When the messengers leave cars which are to go forward without a messenger, the position of the ventilators as they have left them must not be changed except on written instruction from the messenger in charge or on special instruction from the proper officer of the company. The ventilation of all cars not accompanied by messengers must be regulated and operated through to destination in accordance with instructions endorsed on the waybills. In the absence of these endorsements or other instructions the cars will be carried through to destination with the ventilation the same as when received by the Southern Railway from connecting lines. It is specifically provided, however, that all ventilators and side doors in this case must be closed when the temperature falls to 32 deg. Fahr., and that they must be opened as before when it rises above 32 deg. Fruit, vegetables and berries

3-22-05- 60M-S Form 16

SOUTHERN RAILWAY COMPANY.

.....Division.

190

SUPERINTENDENT OF TRANSPORTATION,
WASHINGTON, D. C.:

Below please find correct list of all cars loaded with Vegetables, Fruit, Melons, Meat, Poultry, Eggs, Beer, etc., Received from

*A *B *C

TRAIN No. / or / Connecting R.R. (Time)..... M. 190

*D *E *F

forwarded by Train No. ..... Section No. ..... or Delivered R. R.

*G *H *I

leaving here at..... o'clock. M. (date)..... 190

*J Initial	*K Number	*M Contents	*N Final Destination	*O Received at	*Q Explanation of any delay
1					
2					
3					
4					
19					
20					
21					
22					

Agent or Yardmaster.

INSTRUCTIONS.

This report to be made up by *Yard Foreman* or *Agent*, and telegraphed to Superintendent of Transportation as soon as train leaves his station.
Cipher letter "O" Received at, to show connection received from or local starting point on line of Southern Railway.
Make full explanation of any delay.
If cars are transferred, show Car Number and Initial into which transferred.
Operators will transmit only written portion of this report, and use Cipher Letters for that purpose indicated thus*.

Record of Movement of Perishable Freight.

loaded in common or ventilated box cars must be transferred to refrigerator cars when the temperature falls to 10 deg. above zero, and when so transferred, or if loaded in a ventilated refrigerator car with the ventilation closed, the car must be iced sufficiently to prevent heating. When the temperature falls to zero the division officers are instructed to place all cars containing fruits, vegetables and berries in roundhouses or other places of security and do everything possible to protect them.

When these cars are left at junction points for delivery to connecting lines, branches or other divisions, or when they are similarly received, the agents and yard masters at these points are required to take a full record of the position of the ventilator plugs and trap doors, stating what ventilators, if any, are opened or closed or if any are closed and cleated; also, whether or not the train pipes under the refrigerator cars are plugged up and the character of the plug. Finally, the name of the messenger in charge, if there is one, must be recorded. All instructions given by messengers in regard to the ventilation of their cars must be in writing and signed. A continuous accurate record is also kept of the weather conditions and temperature at all junction points.

The diversion of loaded cars in transit is handled through the office of the freight claim agent and the superintendent of transportation is advised promptly of the change in destination or routing. In case of an accident necessitating the transfer of perishable freight a report is made by wire to the superintendent of transportation, the superintendent and train master of the district and the freight claim agent at Washington, stating the nature and extent of damage to the cars and contents together with a report of the action taken regarding handling and forwarding. When bananas are transferred they are apt to be more or less injured by being bruised which causes them to reach their destination in bad condition, in many cases being decayed and occasioning heavy claims for damage. It is therefore insisted upon that whenever it is possible to do so the cars must be repaired without transfer, and that this class of freight must never be handled in transit when it can possibly be avoided.

For the data used in preparing this article we are indebted to Mr. J. N. Seale, Superintendent of Transportation.

Alternating Current Electric Locomotives.

The determination of the New York, New Haven & Hartford to use the alternating current in its locomotives for the New York terminal is important. As they come in over the New York Central line these locomotives will necessarily use the direct current, but, without question, their own line will have an over-head trolley system for the single-phase alternating-current series motors.

The contract taken by the Westinghouse Electric & Mfg. Company comprises 15 locomotives for high-speed passenger service, each of which will weigh approximately 78 tons and will be capable of maintaining a schedule speed of 26 miles an hour in local service with a 200-ton train making stops every 2.2 miles and reaching a maximum speed of about 45 miles an hour between stations. In express service a speed of from 60 to 70 miles an hour can be main-

SOUTHERN RAILWAY COMPANY. Form 32.

TELEGRAPHIC TRAIN REPORT.

_____ 190__

To Mr J. N. SEALE,
Supt of Transportation,
Washington, D. C.

A TRAIN	(B) STATION	(C) ARR.	(D) LEFT	(E) LOADS	(F) EMPTIES	(G) CARRIED FORWARD

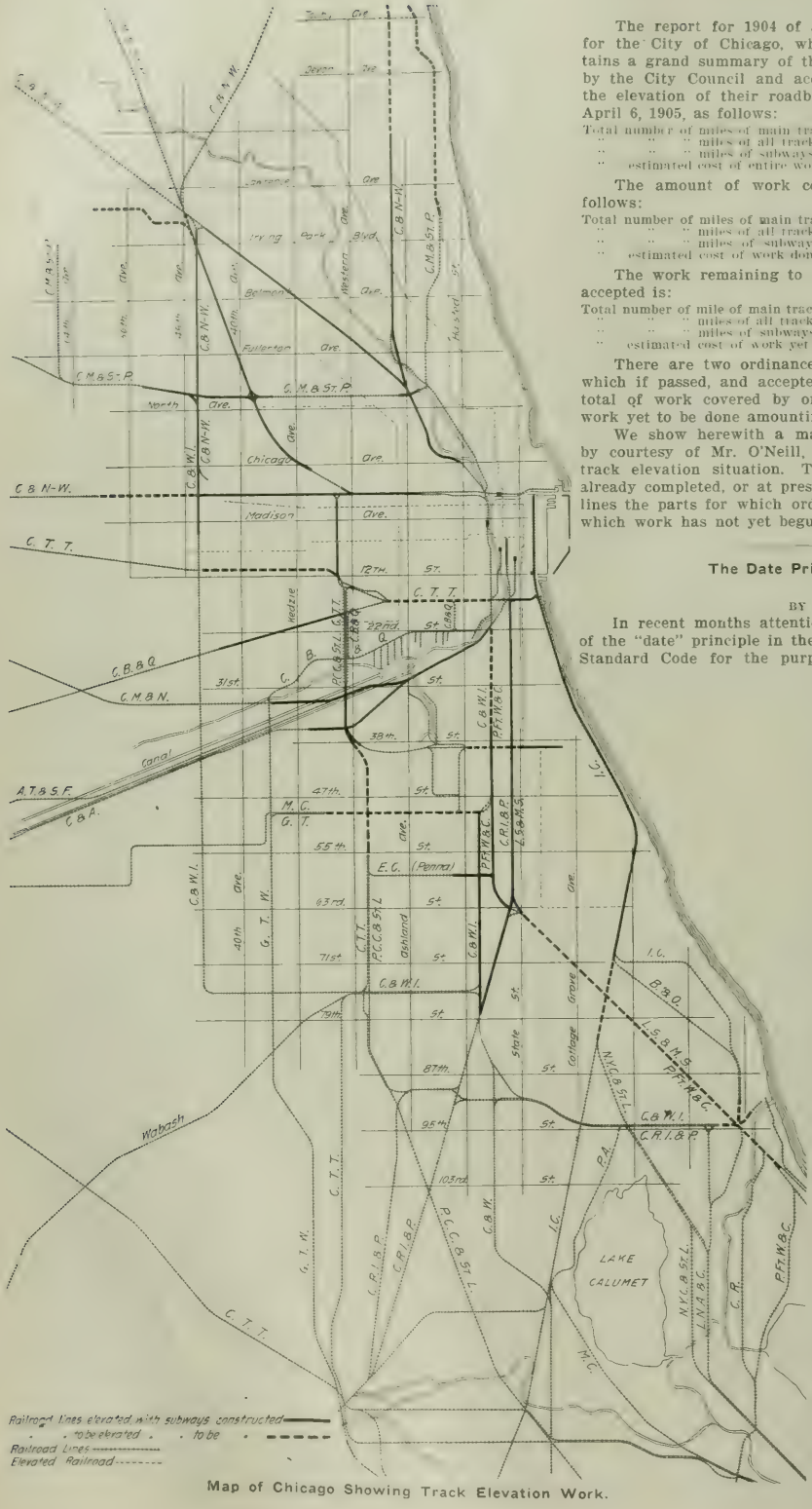
_____ *Supt.*

Telegraphic Train Report.

tained with a train weighing 250 tons. To handle heavier trains two or more locomotives will be coupled together and controlled from the forward cab. The multiple-control system which forms part of the equipment makes it possible for a single engineer or driver to operate several locomotives coupled together just as easily and as accurately as he can handle one, in a manner similar to that with which we are familiar on electrically operated elevated roads where trains made up of many motor driven cars are controlled entirely from the forward car.

One of the important characteristics of Westinghouse single-phase alternating-current series motors is that they will operate successfully when supplied with direct current and may therefore be employed on either the alternating or the direct-current system. It has, accordingly, been possible for the railroad company to adopt this economical system for the operation of its lines and at the same time accommodate its equipment to the direct-current system now being installed by the New York Central. The New York, New Haven & Hartford uses the Central tracks between Woodlawn and the Grand Central Station. For a time the service will be confined to this section. It is therefore with an eye to future rather than to present requirements that the alternating-current system has been adopted. The decision indicates a belief on the part of the railroad engineers that this method offers the real solution of the problem of heavy transportation.

Each locomotive will be equipped with four Westinghouse single-phase railroad motors of the straight series gearless type and with the unit switch system of multiple control. The motors will be permanently connected two in series. On direct current the pairs of motors will be operated in series parallel and on alternating-current by voltage control. The motors will be spring supported and connected by flexible drive in such a way that all dead weight will be taken off the axles. On direct current each motor will be capable of developing a rated output of 400 h.p.



Map of Chicago Showing Track Elevation Work.

Chicago Track Elevation.

The report for 1904 of John O'Neill, Track Elevation Expert for the City of Chicago, which has just been made public, contains a grand summary of the ordinances which have been passed by the City Council and accepted by the railroad companies for the elevation of their roadbed and tracks from May 23, 1892, to April 6, 1905, as follows:

Total number of miles of main track to be elevated	153.22
" " " miles of all tracks to be elevated	746.32
" " " miles of subways to be constructed	57[illegible]
" estimated cost of entire work when completed	$48,910,25[illegible]

The amount of work completed up to Dec. 31, 1904, is as follows:

Total number of miles of main track elevated	82.84
" " " miles of all tracks elevated	425.19
" " " miles of subways constructed	36[illegible]
" estimated cost of work done	$28,725,25[illegible]

The work remaining to be done under ordinances passed and accepted is:

Total number of mile of main track yet to be elevated	70.38
" " " miles of all tracks yet to be elevated	321.13
" " " miles of subways yet to be constructed	21[illegible]
" estimated cost of work yet to be completed	$20,185,66[illegible]

There are two ordinances at present before the City Council which if passed, and accepted by the roads, will bring the grand total of work covered by ordinances to date to $51,860,250, and work yet to be done amounting to $23,135,000.

We show herewith a map of the City of Chicago, furnished by courtesy of Mr. O'Neill, which presents in graphic form the track elevation situation. The heavy solid lines show the work already completed, or at present under way, and the heavy broken lines the parts for which ordinances have been accepted but upon which work has not yet begun.

The Date Principle and Rule 4 B.

BY H. A. DALBY.

In recent months attention has been called to the application of the "date" principle in the operation of Rule 4, Form B, of the Standard Code for the purpose of determining beyond question whether or not a particular schedule is in effect after a change of time-table and what trains may or may not assume that schedule. To any one who has made a study along this line the necessity for some such determining factor is so apparent that no argument is required for its support. The fact that almost every road, whether using the Standard Code or not, employs the principle of Rule 4B seems sufficient evidence that it is considered the most advantageous for the government of trains at such a time. The principle is that the authority of a schedule that is in effect when there is a change of time-table shall be transferred to a corresponding schedule of the new time-table, the train or trains that were using the old being instructed to proceed to their destination on the new. The principle is good but in the present rule *only* the principle is established. In many cases the schedule on the new time-table can be made to supersede the corresponding one on the old without confusion, but in others serious questions have arisen and not a few instances have been pointed out in which it is entirely possible for two trains to assume the same schedule while following the instructions in the rule. To overcome this defect the "date" principle has been adopted as the official understanding on a few roads.

The weakness of the present rule can best be explained by referring to a change of time-table which took place on a western road something more than a year ago. The schedules given are

bbreviated but are essentially correct. The train is No. 1, daily, n both time-tables.

	Old.	New.
Leave A	12.01 a. m.	10.30 p. m.
" B	2.15 "	12.30 a. m.
" C	7.00 "	5.00 a. m.
" D	2.15 p. m.	12.30 p. m.
Arrive E	3.30 p. m.	1.30 p. m.

The time-table took effect at 2 a.m. April 10. No. 1 left A n time the 10th and was ready to leave B at 2.15 a.m. The ques- ion arose whether it should consider itself one hour and 45 min- tes late and proceed or should wait 22 hours and 15 minutes and roceed on time. Many would reply without hesitation that it hould proceed, being one hour and 45 minutes late, and, indeed, his would seem to be authorized by the rule. But suppose the rain which left A at 12.01 the morning of the 9th was 11 hours nd 45 minutes late at D and was overtaken by the new time-table t that station. What would it do? There is only one thing it ould do; wait until 12.30 p.m. and proceed on time. But the train t B has already assumed that schedule. Which one is right? Both have done precisely as the rule directed.

It hardly seems worth while to put the question, "Is No. 1 ue to leave A at 10.30 p.m. the 10th?" for the reply may be antici- ated, "Certainly. Why not?" Well, there is nothing in Rule 4 (B) hat forbids it, neither is there anything that will answer any f the above questions. It has been customary to say that the uperintendent should arrange for such circumstances and say vhich schedules are in effect and which are not. This is equiva- ent to saying that it is his business to interfere to keep trains rom getting together. If a blizzard should take the wires for a lay or two about that time his instructions might be a little late rriving.

The "date" principle, when applied, establishes two important overning facts. First: The train in assuming the schedule of he corresponding number on the new time-table must assume the chedule *of the same date* as the one it has been using. Second: Not more than one schedule of the same number can be in effect t the initial point on one day. With this understanding, the train t D, having been the train of the 9th, continues to use the schedule f the 9th and was due to leave D at 12.30 p.m. the 10th. The train t B had been using the schedule of the 10th and should have con- inued to use the schedule of the same date on the new time- able which would make it due to leave B at 12.30 a.m. the 11th. At the initial point, A, a train has already left at 12.01 a.m. the 0th, therefore another train cannot be due to leave A until the 1th at 10.30 p.m. For a daily schedule, according to this inter- retation, No. 1 is due to leave A once every day and only once, o matter how many time-tables may be in effect.

An aid to the understanding of this plan may be found in the ollowing suggestions: In considering the status of a train which appens to be on the road at the time of change, determine first vhether its schedule has a corresponding number on the new time- able. If it has, keep in mind the date the train was due to leave its nitial point. These facts being settled, cut loose from the old time- able entirely, and, to use a popular expression, "forget it." The ew time-table has completely superseded the old. There is only ne time-table in existence, the new one. The two facts being de- ermined, the train knows its place on the new time-table. To all ntents and purposes the time-table has been in effect for years. This applies not only to the schedule used by the train in question, ut the validity of all other schedules are determined in the same way.

For schedules extending between the same initial and terminal tations and that are otherwise similar this principle seems to be an infallible guide to all trains concerned at such a time. It would *not* solve all the grievous questions, however, if the two words 'and date" were inserted in the present rule so as to make it read, "A train of the preceding time-table shall retain its train rders and take the schedule of the train of the same number and date on the new time-table." There are possible combinations by the score which would produce questions just as unanswerable as those that have puzzled us for years. The initial point or the terminal, or both, may be changed by the new time-table. It would not be an unheard of occurrence if the directions for odd and even numbers were reversed. These possibilities seem to make it im- practicable to try to construct a rule by which every train, no mat- ter under what conditions, may assume the schedule of the cor- responding number on the new time-table, therefore the application of the principle is restricted in the rule proposed by the writer of this article to schedules extending between the same stations on both time-tables. When the schedules are not thus similar the old one dies with the old time-table and the one on the new time- table does not become effective until its leaving time after the time-table has taken effect. In the greater number of cases the schedules come within the required conditions so that the prin- ciple of the rule may be used. In the few instances where the schedules are dissimilar, while it may occasionally happen that a train on the road may find itself without a schedule to complete its run, there will be the *safe* condition that all concerned will understand alike.

In presenting a proposed substitute for Rule 4 (B) it will be necessary to explain the displacement of the word "train" and the substitution of "schedule" therefor. In many of the Standard Code rules the word "train" is used when a *schedule* is meant. Rule 4 (B) refers to a schedule, not a train. It affects a column on the time-table and there may be no *train* in the case. The train may not yet have left the initial station. There may be no in- tention of running a train at all. But the *schedule* is there and it is the life or death of the schedule that Rule 4 (B) is intended to determine. Our proposed rule is as follows:

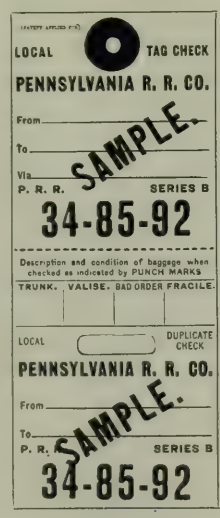
> 4 (B). Each time-table, from the moment it takes ef- fect, supersedes the preceding time-table. When a sched- ule of the preceding time-table corresponds in number, direction and initial and terminal stations to a schedule of the new time-table, its existence and authority, with every condition pertaining thereto, will be transferred to the schedule of the same number and date on the new time-table. A schedule of the new time-table which does not correspond in number, direction and initial and termi- nal stations to a schedule on the preceding time-table shall not be in effect on any district until its leaving time at its initial station on that district after the time-table takes effect.
>
> Schedules on each district date from their initial sta- tions on such district.
>
> Not more than one schedule of the same number and date shall be in effect on one district.

It is intended that the words, "its existence and authority, with every condition pertaining thereto," shall be taken in the most literal sense. If a train has been running on the old schedule it is authorized to continue on the new. If the old schedule has been partially fulfilled, that much of the new one has also been fulfilled. If a train is running late on the old it continues to run late on the new. If the old has been annulled the new one is also annulled. Whatever is said of the old must also be said of the new.

The writer wishes to explain that the "date" principle was brought to his notice after the manuscript for his book, "Train Rules and Train Despatching," had been completed, else his treat- ment of this subject would have been different. The principle im- mediately commended itself to him as a solid foundation upon which to build an infallible Rule 4 (B). He applied himself to the task with the above result, and he offers it for the approval or disap- proval of those who may feel the necessity of a change.

Pennsylvania Railroad Baggage Checks.

The Pennsylvania Railroad has adopted a new design of card or tag baggage check, a sample of which is shown herewith. This check is, we understand, the design of Messrs. G. W. Conrad and W. J. Fitler, of Pittsburg, and a patent has been applied for. The illustration shows a local check two-thirds size. The check for use in sending baggage to other roads is made a little longer, to allow room for writing in the route, and is printed in blue instead of black. On all checks the numbers are printed in red. The novel features of the check are the hyphens in the numbers, and the use of punch marks to indicate the kind and condition of the bag- gage. It is believed that with the hyphens, numbers will be much more easily and rapidly read, and that in reading, there will there- fore be fewer errors. If a piece of baggage is in bad order, it is believed that the punch mark, indicating to the passenger that the defective condition has been noted, will be a sufficient safeguard against unreasonable claims and will make it unnecessary to secure written releases from passengers. The inventors, in their circular, claim that this check will obviate the necessity of entering a description of the bag- gage on the waybills carried by the train baggage master. This would seem to be only partially true, as it is often very convenient to know not only whether it is a trunk or a valise that is being looked for, but also what kind of a trunk or valise; that is to say, it would seem desirable to have, as many roads do have, six or more (abbreviated) terms for describing baggage instead of only two. It is claimed also that the check will

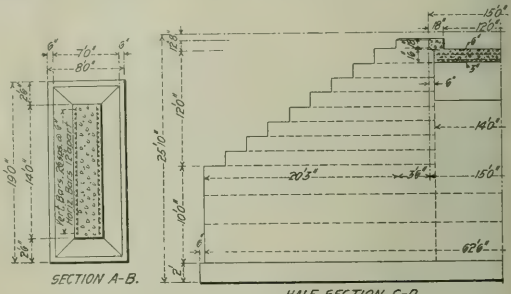


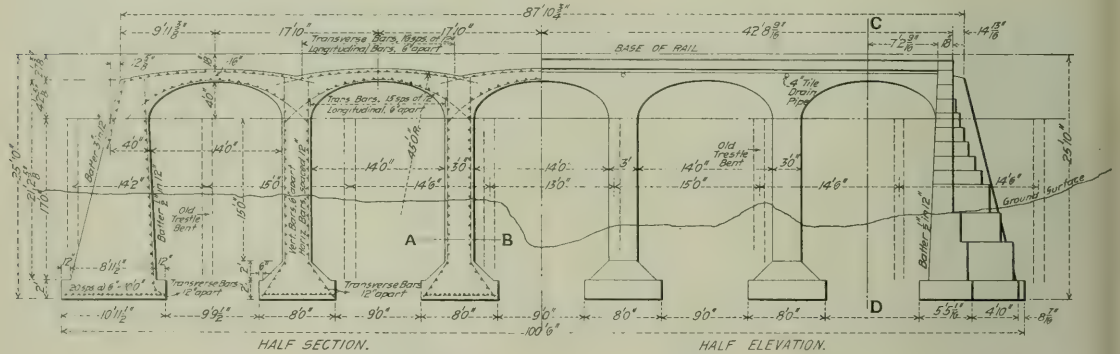
prevent [illegible] will hinder sneak thieves from changing strap checks from worthless valises to valuable trunks.

Reinforced Concrete Trestle for the Illinois Central.

The Illinois Central has been building reinforced concrete trestles for several years, but the design used up to the present time has made use of old rails for the reinforcing metal. A new design has lately been prepared which accords more nearly with theoretical principles, and two single-track trestles are being built at the present time from these plans, both being on the St. Louis-Carbondale line. The trestle illustrated herewith is of typical design, and is located near New Athens, Ill., and has five panels. It is an elliptical arch design, each arch being a full half ellipse. The span is 14 ft. in the clear and the piers are 3 ft. wide, the distance from center to center of arch crown being therefore 17 ft. The piers and abutments rest on a natural gravel foundation, the former being spread at their bases to a width of 8 ft. and a length of 19 ft. The resulting load is about 1½ tons per sq. ft. Where the soil conditions require, a pile foundation is used.

Reinforcing is by means of ¾-in. Johnson corrugated steel bars throughout, the arrangement and spacing of which are clearly shown by the drawings. The cross-section shows the arch to be 16 in. thick at the crown and a parapet on each side of the trestle 18 in. high and 18 in. wide at the top. The width between parapets is 12 ft. and over all is 15 ft. The extrados of the arch is at subgrade level at the crown. The drop each way is slight but sufficient to drain thoroughly, and 4-in. tile drain pipes are placed on each side of the trestle at the low points, which are, of course, directly on the pier center lines. The entire structure, both inside and out, will be finished with a mortar composed of one part of cement and two of sand, which is the standard finish of the road for cement structures.





Reinforced Concrete Trestle—Illinois Central.

The concrete trestle replaces an old wooden structure and the work is being done without interfering with traffic. The broken lines show the position of the bents of the present trestle, which has been raised so as to allow the stringers to clear the concrete about a foot. One bent of the wooden trestle conflicts with a concrete pier and will have to be removed. This design will be the standard on the road for the replacement of long wooden trestles, as it furnishes an economical permanent construction. The two trestles being built now are over streams which only have water in them after heavy or protracted rains. A 1:2:5 mixture is used mostly and the cost is about $6 a yard, or about $7,500 for the New Athens trestle. It is expected that the two trestles now building will be completed about November 1. The design was worked up by H. H. Hadsall, Assistant Engineer of Bridges, under the supervision of R. E. Gaut, Engineer of Bridges, to whom we are indebted for the data. The Widell-Finley Company, Chicago, has the contract.

Hydrostatic Tests of Locomotive Boilers.*

Since it is impossible to separate hyrodstatic tests and inspection, the two should be considered together. The object of the test is to ascertain if the boiler is capable of sustaining some given pressure, and also to test the joints as well as the quality of workmanship.

The only means we have of ascertaining with any degree of certainty the safety of a boiler is by the application of pressure, which should be under conditions as similar as practicable to those of actual work.

No matter how carefully a boiler may be designed and constructed, there will still be a doubt as to its actual strength, since the material may have sustained injuries in the process of construction which may have escaped detection.

Many cases of dangerous defects which the strictest scrutiny of the complete boiler would fail to detect have been brought to light by the hydrostatic test combined with careful inspection.

This is especially true where there has been a cutting out of the holes in order to insert rivets, a reckless use of the drift, or improper bracing that is so covered that it cannot be seen.

The locomotive boiler does not admit of anything like proper examination. The expense of removing the tubes alone would forbid a periodical examination of the shell of boiler, and the water spaces around firebox are almost entirely out of sight, consequently a thorough examination is out of the question. In all cases there is only one means of testing the strength of the boiler, and that is—the application of pressure.

We would not consider it practicable to allow a boiler to go through any of our shops for general repairs without having a hydrostatic test, this test to be applied before the boiler is covered so that any defects that may be found through said test may be properly taken care of.

When we consider that a locomotive boiler is constructed with a factor of safety of between 4 and 5, it would be impossible to injure the boiler in any way testing it at a pressure of 25 or even 50 per cent. above its rated working pressure.

The laws of the State of Massachusetts on inspection and testing locomotive boilers give the following, adopted June 1, 1901, by the Board of Railroad Commissioners under the provisions of Chapter III, Section 218, Revised Laws:

1. All boilers for locomotives before going into service must be subjected to a hydraulic pressure of not less than 25 lbs. per sq. in. in excess of the maximum amount to be carried when in service, and in no case less than 150 lbs. per sq. in.
2. The water must be heated to near the boiling point.
3. This test must be repeated at least once a year.
4. The Superintendent of Motive Power, Master Mechanic or some other proper agent of the company will attend in person. He will remain outside while an assistant will examine the firebox from the inside.
5. A record of all tests must be made, giving dates and anything worthy of mention, and a report of the same must be made to the Board on or before the first day of February annually, covering the preceding calendar year.

*Abstract of a paper read before the Central Railway Club, Sept. 8, 1905, by George Wangstaff.

6. Special examinations of the stay-bolts of locomotives in service must be made not less frequently than once in three months.

7. When these examinations are made, all the water must be drawn from the boiler, so that the vibration of the sheet may indicate any unsoundness of the stay-bolt when it is struck with a hammer. When stay-bolts are drilled this test may be omitted.

8. All stay-bolts applied after this date, with the exception of crown sheet bolts and bolts behind frames, must be drilled from the outside one and one-fourth of an inch deep and three-sixteenths of an inch in diameter.

9. No locomotive shall continue in service with a broken stay-bolt in the top row, or with two or more broken bolts contiguous in any part of the firebox.

10. Steam gages must be tested immediately before hydraulic pressure is applied, and must be tested at least once in three months thereafter.

11. These regulations supersede all regulations heretofore made by the Board.

The large percentage of dangerous defects found each year by the inspection of boiler insurance companies goes far to prove the necessity of a periodical test. From the reports issued by one company it appears that, in the year 1904, out of 152,282 defects discovered, 13,390 were dangerous.

That the hydrostatic test is very convenient method of testing the tightness of the work on a new boiler cannot be gainsaid, and as a detector of leakages it has at least no rival, and its application enables faulty caulking to be made good before the boiler has left the works, and before a leak has time to enter on its insidious career of corrosion. It will be evident that, if the test be applied with this object to a new boiler, the pressure should range to some point in excess of the working load if such a test is to be of any practical value.

While these arguments have been made to apply to new work it is evident that, if they are valid for this, they apply equally well to the periodical testing of locomotive boilers in service, and the conclusion may be drawn that there should be such a test once a year in which a pressure at least 25 per cent. above that under which the engine is to be worked should be applied.

Tunnels Under the Hudson.

There was incorporated last week in New York and New Jersey the Interstate Tunnel Railway Company, to build a tunnel under the Hudson River from New York City to Erie and Thirteenth streets, Jersey City. The proposed New York terminus is at Chambers street and Park Row, east of Broadway. The purpose of this tunnel is to connect the lines of the Metropolitan Street (surface) Railway, Manhattan, with the trolley lines in northern New Jersey controlled by the Public Service Corporation, and these two interests will finance the project. Work will be begun, it is said, as soon as the necessary rights have been granted by the public authorities, and these have been applied for.

Of the half dozen projects for tunneling under the North River, those now alive are controlled by three companies. The first was started in 1874, by the Hudson River Tunnel Company, on the line from Henderson street, Jersey City, to Christopher street, New York. Work was begun and was continued spasmodically, being stopped several times by accidents and lack of funds, until 1892, when the works were abandoned and the completed portion, about 4,000 feet of the total 5,200 feet, was allowed to fill with water. In 1899, the property was sold at a receiver's sale, and in 1902, the New York & Jersey Railroad Company was incorporated to take over and complete the work. Two tunnels were to be made, to accommodate light narrow gage electric trains. The tunnels were to connect at grade with surface lines at Thirteenth and Henderson streets, Jersey City, and Christopher and Tenth streets, New York. The north tunnel was driven through in March, 1904, the south tunnel being then about half completed.

In March, 1903, the Hudson & Manhattan Railroad Company was incorporated to build two single-track tunnels from Cortlandt street, New York, to Exchange Place, Jersey City. In January, 1905, the Hudson Companies was incorporated to merge the control of the New York & Jersey and the Hudson and Manhattan companies. Work on the last named tunnel was begun a few weeks ago. In 1899, three other companies were incorporated, but nothing has since been heard of them. The Pennsylvania tunnel at Thirty-fourth street is familiar to the reader.

The Hudson Company proposes to extend its lines (underground) in Manhattan from Christopher street northward to Thirty-third street and Sixth avenue. The "Interstate Tunnel" Company proposes to run cars through and over the surface lines both in Manhattan and on the New Jersey side.

Use of Superheaters on the Locomotives of the Belgian State Railways.

The Belgian State Railways have recently brought out three new types of locomotives. These are all six-connected; one, for heavy passenger service, with inside compound cylinders and piston valves; the second, a four-cylinder compound, and the third a four-cylinder single expansion. Superheaters have been applied to all of these engines, designed for both passenger and freight service. In addition to these a number of de Glehn compounds have been purchased.

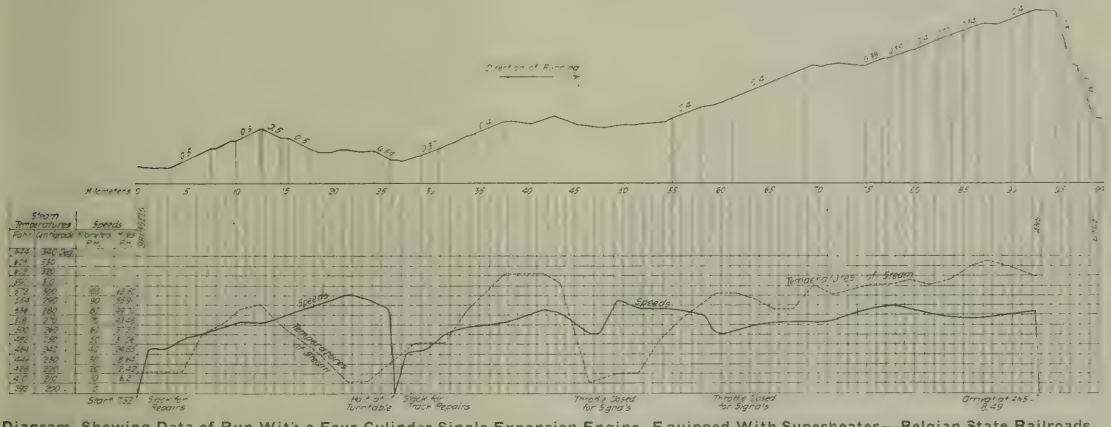


Diagram Showing Data of Run With a Four-Cylinder Single Expansion Engine Equipped With Superheater—Belgian State Railroads.

Up to the present, however, no data is available regarding performances either in the matter of capacity, maintenance or fuel economy, and will not be for some time to come. It is expected that when the final results are worked out between the four-cylinder compound and single expansion engines, they will decide as to the value of superheating with and without compounding.

The accompanying diagram is an interesting method of presenting the data of a run from Brussels to Liege with a four-cylinder single expansion engine of the type named. The train consisted of 13 six-wheeled and one eight-wheeled car having a total weight of 327.5 tons, to which 118.5 tons must be added for the engine itself, making a grand total of 446 metric tons, or a little more than 490 tons of 2,000 lbs. It is evident from the diagram that the amount of superheat fluctuated between wide limits and is apparently dependent neither upon the grade nor the speed, but upon other matters the details of which are not at hand. For that reason it would be well if the chart could be supplemented with diagrams of the steam pressure and the horse-power developed.

The run is one of 58 miles, of which 41 are on adverse grades varying from .35 to .50 per cent., so that it is well adapted to bring out the pulling capacity of a locomotive. The highest speed was attained at kilometer 77 on a rising grade of .35 per cent. Speed is not, however, the best measure of what a locomotive is doing, as a portion of it may be traceable to the effect of a previous descent. A fair exmple of this is shown at kilometer 21, where the speed was 62.5 miles per hour, while the moderator

damper being closed at the same time, the steam temperature was only 21 deg. C., or 110 deg. F.

The practical demonstration of the value of superheating occurred after kilometer 51, where the driver opened the damper in order to ascend the continuous grades between kilometers 54 and 92. The lowest speed on this long rise occurred on a grade of .50 per cent., and as this was 19.3 miles per hour the work done may be considered as excellent.

The engine from which this data was obtained was built at La Meuse, and was fitted with a Schmidt superheater. The principal dimensions of the machine are as follows:

Driving wheels, diameter	78 in.
Cylinders, diameter	17⅛ in.
Piston, stroke	24 in.
Steam pressure	227.8 lbs.
Type of valve gear	Walschaert
Grate area	33.36 sq. ft.
Heating surface, firebox	181.52 "
" " tubes	1,490.54 "
" total	1,672.06 "
" superheater	380.3 "

Efficiency of Large Gas Engines.*

We are frequently asked, "What is the overload capacity of your gas engine?" A clear understanding on the part of the purchaser of the limitations in this direction is very desirable, from the point of view both of the buyer and the seller. A gas engine and producer is thermally very much more efficient than a steam engine and boiler. It is, perhaps, not amiss to say that, with a well designed producer and gas engine plant, a horse-power can be delivered with one-half the cost of fuel that is possible with a well designed steam engine plant. The power of the gas engine, however, is limited by *the total volume of explosive mixture which can be drawn into the cylinders* during the suction stroke, compressed and finally ignited. This condition sets a limit which does not allow of a large temporary increase of the power, such as obtained with the Westinghouse steam turbine by the automatic operation of the secondary admission valve. Such overload capacity is, of course, convenient for the purchaser, but it is unobtainable on a gas engine, unless the engine is largely under-rated, and the purchaser should consider that this is one of the prices that he pays for the enormously increased output obtained with the gas engine per pound of coal. *The overload capacity is, therefore, simply the amount which the builder rates his machine below its ultimate capacity.* It has been our practice to rate our gas engines in such a way that they would have a safe overload capacity of 10 per cent. Our machines are ordinarily good for somewhat more than this, but conservative engineering requires that there be a margin of power in order that overloads may not materially reduce the speed. The above remarks on overload furnish a general guide which may be of service in selecting suitable generator capacity for a gas engine. For ordinary cases the overload capacity of the generator and that of the gas engine should be about equal, although the gas engine will indefinitely carry its overload while the generator will not, in all cases, unless it is bought with that understanding.

The mechanical efficiency of a large gas engine is very much greater with a four-stroke cycle than with a two-stroke cycle, this being one of the arguments against the two-cycle engine. It is no uncommon thing to see two-cycle engines which do not realize as brake horse power more than 60 per cent. of the work actually done by the combustion in the cylinders. The efficiency of a four-cycle engine varies considerably, but it may be said in a general way that a well designed engine will deliver about 85 per cent. of the gas indicated horse power in the form of brake horse power. This 15 per cent. of power lost is not exclusively composed of frictional resistance of journals, crossheads, slides, etc., as is the case in a steam engine. The four-cycle engine has, of course, to draw in its own mixture of air and gas and compress the same, and its functions, therefore, combine those of a pump, a compressor and a motor. It is the pumping and compressing work which causes the mechanical efficiency of the gas engine to be somewhat lower than that of a steam engine. The actual friction of the working parts need be no greater than with a well constructed Corliss engine, viz., 90-95 per cent. In order to keep down the friction and increase the reliability of the machines, it is the practice of the Westinghouse company to design large gas engines with provisions for attaching a continuous return oiling system. The large amount of oil put through the journals increases the safety, requires less attendance and keying up, and washes out dust if the engine is required to operate in an atmosphere which is not clean.

The thermodynamic efficiency of the gas engine varies so much with different kinds of gas that it is hard to say just what the average value would be. It is probably not far from the truth, however, that its thermal efficiency is about 25 per cent., though in favorable cases gas engines have obtained efficiencies well over 30 per cent.

There is an impression rather prevalent that a gas engine is uncertain and hard to start. A properly designed engine, supplied with fairly decent gas, can be started as easily as a steam engine. Large Westinghouse horizontal gas engines are started by means of compressed air, the only operations required being, (1) open the main gas valve; (2) close the igniter circuit; (3) open one compressed air valve, similar in construction to an engine throttle. The compressed air puts the engine in motion, which draws the charge into the cylinders and compresses the same, after which the first explosion takes place. Air is shut off and the engine is in full operation. We find no more difficulty in starting our gas engines than a steam engine of comparative size. I desire to lay stress on this point, as one of the stock arguments against the gas engine is that it is difficult to get into operation.

With certain kinds of gas, inspection of the interior parts of the cylinders is often desirable at regular intervals of, say, a couple of months. This is especially the case with blast furnace gas, and also with producer gas made from certain kinds of fuel.

*Abstract of paper read before the American Street Railway Association; by Mr. Arthur West.

The Making and Repairing of Locomotive Frames.*

The conditions which confront us with the repairing of locomotive frames have changed so in the last ten years that we now have difficult problems to solve in order to keep abreast of the new conditions. A few years ago the wrought iron frames that have done work so well for half a century were universally in evidence. The failure of these was of rare occurrence, and was easily repaired in the blacksmith shop. To-day we have the low carbon cast-steel frame with all its imperfections. And another innovation is the welding of broken frames on the engine with oil for fuel, or with aluminum thermit.

Evidently the steel frame will be the frame for the future, for the reason that it can be produced much cheaper than wrought-iron forged frames. Future developments may bring the steel frame to such a standard that it will resist the strain to which it is subjected as well as the forged wrought-iron frame. From my point of view and the many failures that have come to my notice in the past two years, the steel frame has not yet reached the standard that the wrought-iron frame has. Many of the steel frames break at the intersection of the pedestal to the back bone of the frame where the main driving axle is located. As this failure often takes place with our largest engine frame, it is evident that the severest strain is located at this point, consequently it cannot be expected that an ordinary weld at this point will be stronger than the original solid material. When a broken steel frame is placed in the blacksmith shop, the best method practical to strengthen this portion of the frame should be adopted, regardless of extra expense. The method adopted in the Southern Pacific shops is to forge a new piece of the best quality of iron and cut out the defective portion; weld in a new "T" piece with the fiber flowing in the direction of the strain to which this portion is subjected. By this method we have to make three welds. This may look like a roundabout way of repairing the fracture. The object of this is to get a sound piece of iron at the point where failures continually occur in the steel frame. The method adopted for welding the new piece into the steel frame is first to weld a piece of iron about an inch thick on to the different ends of the frame at the proper angle to receive the V-shaped piece, the new piece firmly fastened in place with straps bolted together. By this method we have for our main welds iron to iron to receive the V-shaped piece.

Recently we have been changing many of our compound locomotives to straight engines. To accomplish this it became necessary to lengthen the front end of the steel frames as shown in Fig. 1. The following method is used at the Sacramento shops to produce the new iron portion. First, the part C, Fig. 1, is produced by lap-welding a T piece, one-half the thickness required, then laying two of these T pieces together as shown at B. They are welded together under a steam hammer after being heated in a reverberatory furnace, producing the shape shown at C, in which the fiber flows in the same direction as the strains. The upper portion of the frame shown at D is made from solid material and with a side projection, which measures about 5 in. The parts C and D are then welded together to produce the forward portion of the wrought-iron frame as shown at E, Fig. 1. This new end is then welded on to the steel portion of the frame as shown in Fig. 2.

When preparing the steel end of the frame for the final weld, a piece of iron is welded on about 1 in. thick as shown at E, Fig. 2. This method leaves the two ends of the frame to be welded of the same material and shaped to receive the pieces G and F. The V piece, F, is welded in the cavity for the pur-

*From a paper read by S. Uren before the Cleveland meeting of the National Railroad Blacksmiths' Association, August, 1905.

ose of insuring a perfect weld in the center of the bar. The iece G is made with an angle of about 110 deg., and when elded into the cavity under the steam hammer is almost equiva- nt to a lap weld. On our system 40 of these iron to steel frames ave been in service a year. Only one has come to the shop broken the weld. I am under the impression that this break was aused by the steel frame breaking on the opposite side as no gn of the weld presented itself in the fracture.

The welding of frames with oil, without removing the same om the engine, has caused me to become somewhat skeptical, s well as many of our members, regarding this method. After ading the report of the committee on this subject, I must con- de they have done well; however, it is remarkable that all of ie welds noted in the reports which have been by this method, ere has been only one failure. Great claims are made by some our California shops for this method of repairing frames. I now of several cases of frames welded by this method that ave not run ten miles before the welds parted. The engine turned to the shops, the frames removed and properly welded the blacksmith shop. Certainly a good welding heat can be roduced by this method in members of frames that are accessible; owever, I am opposed to butt welding or any other method of elding in the blacksmith shop, after the iron is brought to a elding heat, without the proper lamination.

Iron, when brought to a high heat, becomes disintegrated. he molecular structure is impaired and lamination is the only ethod that will produce the original structure. In my opinion ie same conditions exist in welding frames on the engine where mination is impracticable. I coincide with the views of Mr. Mc- aslin. If the metal has to be brought to a welding heat, the roper place is on the anvil. If a first class weld can be made a steel or iron frame by this method, the same method would e applicable to other members of the locomotive. I do not think ere is a member of this convention who would attempt to weld main or side rod of an engine by this method.

Another innovation in the art of blacksmithing is the repair- g of frames on the engine by the Thermit method. This, above l other methods, is the simplest and quickest, and from my point view is the best. Forge, anvil and steam hammer excepted. t the present time the Thermit method is in its experimental ages; it does not require an experienced smith to repair a ame on the engine by this process. The most particular part making the preparations for the weld is the making of the old to fit perfectly around the part of the frame to be welded. his is usually done by a moulder. The moulds should be made halves and bolted together, so that all joints are perfectly tight. y this method of repairing we not only form a perfect union the broken sections but we can also reinforce the weak points with a collar projecting on each side of the fracture any dimensions we may desire.

The first experiment in the Sacramento shops of mending a frame with thermit was tried April 14, 1905, on engine No. 287, the longest engine on the system. The frame was broken at the junction of the pedestal to the back as shown at A, in Fig. 3. The first preparation made to repair the frame was to drill a series of ⅝ in. holes through the broken section as shown. The holes being drilled at right angles to each other, produced a number of small facing projections. The ends of these projections were cut off so as to leave a ⅝ in. opening. A jackscrew was then placed between the pedestal, spreading the crack ⅛ in. A wooden pattern was made. This had the same contour as the portion of the frame to be repaired, and had such projections on it as were required to produce the reinforcement desired. Eleven ounces of thermit were placed in the crucible for every cubic inch of space in the mould. The space in the mould for the reinforced portion as well as for the parts to be welded were included in determining the amount of thermit to be used. Before igniting the thermit the ends of the parts to be welded should be warmed with an oil burner. A collar ¾ in. thick, as shown at B, Fig. 3, was left around the broken section. This welded frame has been in service up to the present time without showing the slightest defect, and eight welds have since been made by this process and not one of these has failed.

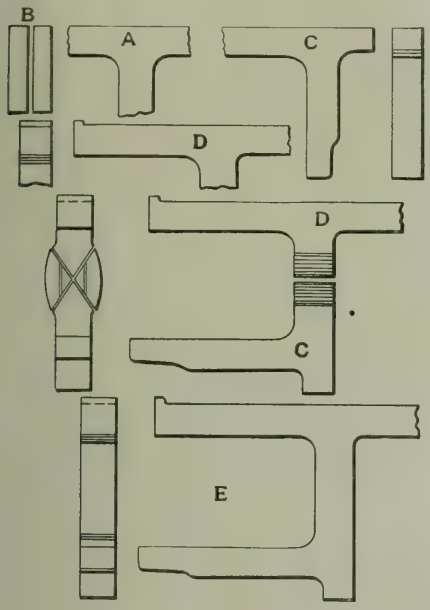


Fig. 1.

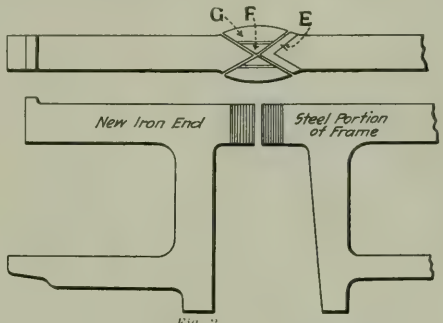


Fig. 2.

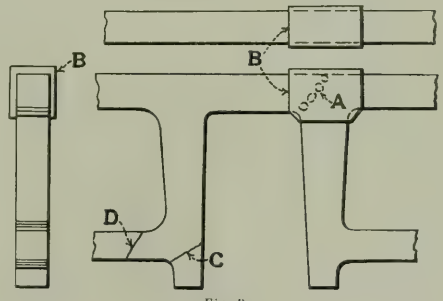


Fig. 3.

Repairing Locomotive Frames.

Early Railroad Construction in New South Wales.*

BY JOSEPH BRADY, M. INST. C. E.

Railroad construction in Australia was commenced late in 1850, by the Sydney Railway Company, of which Mr. Charles Cowper was the first Chairman and Mr. F. W. W. Shields, M. Inst. C.E., the first Engineer. At that time all the goods and passenger-traffic of the interior passed over the highway between Sydney and Paramatta, a distance of about 14 miles, passengers and mails being carried by stage-coaches, and goods by bullock-teams, and it was thought that there were fair prospects of a railroad between the two places paying good dividends on the capital required for its construction. The scale of wages was low, laborers being paid about 2s. 6d. per day of 10 hours, and tradesmen, including mechanics, about 5s. per day. There was therefore good reason for assuming that the line could be completed at a moderate cost.

The preliminary and working surveys were completed in the latter part of 1850, and one small contract for earthwork and bridge-construction was let to a local builder early in 1851, and was carried

*Reprinted from the *Proceedings* of the Institution of Civil Engineers, Vol CLIX.

on at a very slow rate. There were no railroad men in the country at the time and no railroad plant of any description. Mr. Stokes had only a small staff of assistants, composed of a Scotchman as draftsman, one surveyor, and the author, who had recently arrived from England. In February, 1851, Mr. Stokes resigned his position as Engineer to the company, and Mr. H. C. Gains M. Inst. C.E., was appointed in his place. In November of the same year the author commenced work on a special survey for railroad extension towards Goulburn; this survey was finished as far as Mittagong, over rough country, in February, 1852. An alternative loop-line was then marked over the Razorback range, through the town of Camden, and in April the survey was finished and camp was broken up. The length marked out was 58 miles. The contingent office work was completed and the plans and report were submitted to the directors and adopted by them in June. The author was then appointed Acting Engineer in charge of the works of construction in progress. About this time Mr. James Wallace was appointed Chief Engineer to the Sydney Railway Company, arriving in Sydney in July. After inspecting the works he recommended the directors to stop them at once, and to begin afresh at the Sydney end of the line, under new management; this recommendation was acted upon by the board. On July 17 Mr. Cowper retired from the Managing Directorship of the company and succeeded Mr. Charles Kemp as President, Mr. Wallace being appointed to a seat at the Board of Directors, to advise but not to vote. On July 29 the contractor for the works in progress was asked to give up his contract, a fair value being allowed for the work done, and Mr. William Randle was appointed Manager of Works, it being intended to carry out the work on the small sub-contract system, the company to supply the necessary plant. On August 7 an agreement was made between Mr. Randle and the company, under which the former undertook to carry out certain earthworks at the Sydney end, at agreed prices, including all plant and tools. There were as yet no earth-wagons, nor any rails; in fact, the first rails subsequently used were of hardwood, plated with flat bar-iron. On August 10 the first party of excavators under the new management was set to work at Redfern, at day wages. On August 31 the Government decided to bring out 500 trained railroad workmen from England, the available local labor being scarce and inferior. At the same time the Government agreed to advance funds to enable the company to proceed vigorously with the works. At this time the Hobson's Bay Railway Company was formed in Melbourne.

On October 14 Mr. E. Deas Thompson, the Colonial Secretary, made a personal inspection of the works, and on November 15 a loan of £100,000 from the Savings Bank to the company was authorized by the Government. On revision of the plans it was found that barely sufficient land had been purchased for a single line of railroad, and as a double line had been decided on it became necessary to secure additional width throughout the entire length of the line. On November 23 a letter was received by the Directors from the Government offering to provide funds at the rate of £3 for every £2 of capital raised on shares, on condition, however, that the Government should appoint two directors, one of whom was to be President of the Board. On the same date there was an official demand on the part of the contractor for an increase in price from 1s. 6d. to 2s. 2d. per cubic yard for earthwork, on account of increasing labor difficulties. On April 2, 1853, the laborers working as excavators struck work for an increase of wages to 10s. per day. Very little progress was made with the works during April and May. Early in June the Hunter River Railway Company was formed to open up the Hunter River district, Mr. Charles Cowper being one of the directors. The line projected was to connect Newcastle and Maitland. On October 3, Mr. Wallace, the Chief Engineer of the Sydney Railway Company, was appointed Consulting Engineer to the Hunter River Railway Company. On August 25 200 railroad men arrived in Sydney from England, engaged and shipped for the Government. Seventy ordnance tents were supplied for their accommodation, and they were placed temporarily in the charge of the Manager of Works. A second consignment of men arrived on November 11 and a third and final consignment on December 10. Many of the newly-arrived laborers were Welshmen, and objected to working under other than Welsh foremen, and as many of them could not speak English there was a good deal of trouble in setting them to work. On August 26 the Government notified the company of the appointment of Mr. Merewether as President of the Railway Board, and at the first meeting held under this new arrangement, on August 29, Mr. Cowper resigned his position as a director.

Mr. Wallace, on taking charge as Chief Engineer, strongly urged the Sydney Railway Board to adopt the standard English gage of 4 ft. 8½ in. instead of the 5-ft. 3-in. gage decided on prior to his arrival. Mr. Wallace's reason for advocating the alteration was that for the standard gage there would be no difficulty in obtaining an ample supply of rolling stock at short notice, whereas for the 5-ft. 3-in. gage there was a very limited supply there being only a small number of manufacturers of rolling stock of this gage. At that time (July, 1852) there had not been a yard of permanent-way laid in any of the Australian Colonies, nor had any rails been imported. The directors approved of the recommendation, which was adopted by the Government, and the 4-ft. 8½-in. gage thus became the standard for New South Wales railroads. An official communication was at once forwarded to the Government of Victoria giving particulars of the change decided upon, and asking that Government also to adopt the alteration; but, although railroad construction had not been begun in Victoria, the authorities decided to adhere to the 5-ft. 3-in. gage; hence arose the break of gage between New South Wales and Victoria.

On March 22, 1854, the first consignment of permanent rails arrived in Sydney. On May 12 the directors called for independent test tenders for fencing, and on May 29 the lowest rate tendered was 18s. per rod (16½ ft.), being 3s. per rod higher than Mr. Randle's scheduled rate. There was no contract under seal for the Sydney-Paramatta line, the rates of payment for the various works being agreed upon from time to time, as the state of the labor market rendered revision of prices necessary. Mr. Randle was, in fact, the acting contractor for the line. There was no possibility of competition, as the only railroad men in the country were those imported by the Government, supplemented from time to time by a few skilled artisans or laborers, attracted by the gold-diggings and the chance of employment on the only railroad works then in progress.

During the years 1851-1857, many changes took place in the cost of labor and materials, and the following are some particulars relating thereto; the working-time for all classes of labor was fixed at 60 hours per week.

Rates of Wages.

	Per day of 10 hours.
In the United States in 1851:	
Laborers on public works	3s. to 4s. 6d.
Carpenters, bricklayers and masons	6s. 3d. to 9s. 4d.
In England in 1851:	
Excavators	3s. to 3s. 6d.
Masons, bricklayers and carpenters	5s. to 5s. 6d.
Smiths	4s. 6d. to 5s.
Horse, cart and driver	7s.

	Per day	
In Sydney:	Sept., 1852.	Sept., 1854.
Laborers	5s. to 6s.	15s.
Masons and bricklayers	8s. to 8s. 6d.	26s. to 27s.
Carpenters	7s. to 9s.	18s.
Smiths	9s. to 10s.	15s. 6d.
	April, 1855.	August, 1855.
Masons	16s. to 21s.	16s. 8d.
Bricklayers	20s.	18s.
Carpenters	10s. to 11s.	10s.

On August 10, 1854, an estimate of the cost of the Hunter River line was submitted by the Consulting Engineer, Mr. Wallace. The total cost was estimated at £310,000 for a double line 18¼ miles long. The consideration of the estimate was postponed, and, meantime, the Resident Engineer was sent to Newcastle to erect huts for the expected railroad men. On October 5, tenders were received by the Hunter River Railway Company for the construction of the first section of the line between Newcastle and Hexham; the lowest was that of Mr. William Wright, which was accepted. On November 16 the Chief Engineer's estimates for the construction of the line were adopted. A Government Railways Bill was passed on December 2. On February 20, 1855, the two first locomotive-engines were received from the shops of Messrs. Stephenson & Sons, of Newcastle-upon-Tyne, and on March 29 No. 1 engine made its trial trip.

On the Sydney-Paramatta Railway approaching completion, it was agreed that Mr. Randle should undertake the working of the traffic, receiving 55 per cent. of the gross revenue on condition that he maintained the works and rolling-stock in good order, wear and tear being allowed. On August 18, 1855, the railroad was officially opened. The first train consisted of No. 1 engine, three first-class carriages and a van. Several special trains were run during the month of August, but the line was not opened for public traffic, pending completion of the sidings and stations, until September 26. Up to Sept. 1, 1856, the line was worked by four engines, Nos. 1 and 2 from Messrs. Stephenson's, and Nos. 3 and 4 from Messrs. Hawthorn's works, Newcastle-upon-Tyne. The following are particulars of No. 1 engine: Inside cylinders, 16 in. diameter by 24 in. stroke; six wheels; leading and driving wheels, coupled 5 ft. 6 in. diameter; trailing wheels, 3 ft. 9 in. diameter; working boiler-pressure, 110 to 120 lbs. per sq. in.; six-wheel tender; wheels, 3 ft. 9 in. diameter; tank capacity, 2,000 gallons; weight of engine, empty, 20 tons; with fuel and 500 gallons of water, 22.85 tons; weight of tender, empty, 9½ tons; with fuel and water, 20.55 tons; gross weight of engine and tender, 43.40 tons; hauling capacity on the level, 372 tons; on a 1-in-66 gradient, 85 tons; cost, shipped, £2,725; freight and charges, £600; landing and erecting, £350; total cost, £3,675.

The Prussian Minister of Public Works, in issuing orders for a thorough inspection of all passenger cars during the months of July and August, calls especial attention to enforcing cleanliness, outside and in, and especially in the water-closets; and to seeing that where trains are made up that the cars are well ventilated and cooled off, if necessary by wetting down the roofs. Passengers early for their train in Jersey City (or elsewhere) who have been baked in a parlor car until the train started, will approve this latter suggestion.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 14. FRIDAY, OCTOBER 6, 1905.

The control of the Wabash is still uncertain, and present indications are that Mr. Ramsay has a reasonable chance for success, but belief in this is not strengthened upon reading his statement issued this week to the security holders. Presumably such a statement was made for the purpose of influencing their votes at the annual meeting on October 10. Nevertheless, for this purpose it is not understandable, even as a reply to unwarranted charges of ingratitude. It is largely devoted to a history of his personal relations with Mr. Gould, but in this history the security holders have slight interest. It contains, also, a record of syndicate operations, in the course of which either he or Mr. Gould, or both of them, have made or lost money. The publicity given during the past few months to syndicate operations has not been of a sort to inspire an investor with confidence. It would seem, therefore, to be at least undiplomatic to have brought this subject up for discussion before an audience of investors in the stock and debentures of the Wabash, although apparently justly provoked by personal attacks upon himself. It has not often occurred that the control of a great corporation has been wrested from another, or successfully held in a contest, by means of personal attacks through the newspapers. It has usually been done more quietly and by means well known. On the other hand, it has often occurred, as a result of an attempt at getting or defending control, and likewise as a result of negotiations for a championship prize fight, that the one who foresees failure makes open personal verbal attacks, sometimes containing a good deal of truth, to the end of leaving himself in a better position after a foreseen loss. Mr. Ramsey's suggestion, quoted in another column, of the possible loss or gain in traffic by the Wabash as a result of becoming independent, will be read with considerable interest.

"The Law is Good, if a Man Use It Lawfully," was the title of an article published in these columns last week. It has been republished in full and in part by many of the daily papers. It has been the subject of many daily paper editorial articles, of interviews with the President's private secretary, and of despatches from Washington correspondents. Apparently all of this attention has been given simply because the article mentioned a true incident of a sort familiar to every railroad president and general manager in the United States. The evil cannot be corrected by the carrying out of the proposal seriously made by many newspaper editors that Congress make an appropriation for paying the cost of presidential trips. It is common among public officers all along down the line, from the President of the United States to the justice of the peace or the coroner, to compel railroad companies to violate the provision of the Interstate Commerce Act against discrimination. The United States laws prohibit pooling, prohibit joint traffic agreements and prohibit discrimination. It enforces the laws against pooling and agreements; it does not enforce the law against rebates, and its officers and state and municipal officers violate this law and set the example. The public should know that the railroads are interested in precisely the same way, and proportionately to the same extent as they are, in needing the protection of the existing law against rebates. They should know these facts and the unwisdom of taking away from the railroad officers the power of making rates and entrusting it to a commission which has even less power than the railroads to protect themselves against the demands of the packer and other monopolists and public officers. It will be indeed a pity if the lesson derived from the presidential rebate should simply be a correction of one item of evil. This is small, indeed, by comparison, and was taken simply as a shining example. Some of the newspaper defences are amusing. One quotes an experienced passenger agent as saying that the "railroads lose nothing, as it stimulates business along the line" when the President travels. This is undoubtedly true, but it does not justify violation of law. When the King of Great Britain travels he pays full first-class fare for himself and his companions in precisely the same way that any other first-class passenger pays. He does not pay the additional expenses incurred by the railroad company in transporting an exalted person. The railroad company provides a train of special cars, spikes all the facing-point switches, runs a pilot engine in front, and incurs a considerable expense which the first-class fares do not cover. This, however, is not the King's fault and he ought not to be asked to pay. Great crowds assemble at every station and there is the ever present danger from the lunatic. The railroad company, being a common carrier, must take these extraordinary

precautions. It gladly does so, because the addition to its local passenger receipts is enormous. For example, during the recent visit of the King to Edinburgh to review the Scottish troops the North British Railway sent out sixty special trains, loaded, in two hours and a half. The Caledonian, and other railways, also profited largely. The main point which the public should understand is that it is quite as much for the interest of the railroad company to treat all alike as it is for the public interest. Independent traders and manufacturers should not be smothered by monopolies, and government officers should not set the pace and pave the way to such iniquitous proceedings. It is the railroad's interest to build up business along its line and foster every paying industry. In this it needs no government control; it simply needs protection.

FEDERAL REGULATION OF RAILROAD RATES.*

It will be essential in any successful scheme for settling our interstate railroad rate problem to allow railroads freely to confer with each other; and (possibly subject to the veto of some Governmental authority) to freely contract with each other; and it will be highly important to improve the Interstate Commerce Commission—or whatever body performs the present functions of the Commission—by strengthening its personnel and by putting into it men having a thorough knowledge of railroad affairs. These two points deserve the careful attention of all thoughtful lawmakers. It does not seem possible that Congress will ever make it lawful for the Commission's rates to go into effect, on order, and remain in force until abrogated by the courts; and it is also quite plain that the proposition to have an Interstate Commerce Court, or several courts, as recently re-emphasized by Senator Elkins, cannot be made to fit all of the thousand details of the trouble that we desire to cure. The only value of a new court is a betterment of the methods of our existing courts—not any radical change from their methods.

That railroad rate-making officers ought to confer freely, and (in some situations) regularly, is almost self-evident to anybody acquainted with a general freight agent's work. The Sherman anti-trust law forbids combinations between competitors; and regular or formal conferences have in some cases been assumed to be a criminal step toward such combination. Relying on the unreasonableness of this construction, and on the disinclination of district attorneys to do absurd things, the traffic officers go on with their conferences. To be sure, there are not nearly so many of them as in former years, before competing roads had the benefit of community of interest and of the other conditions that now deter them from throat-cutting; but still the technically unlawful work goes on. And the Supreme Court has said that the Sherman law is rightfully applied with technical precision and minuteness, regardless of its absurdity. Conference between competitors, looking to the removal or prevention of those things which irritate soliciting agents and cause rate cutting and rate shading, would be necessary under ideal legislative regulation.

Moreover there is good ground for the hope that rate regulation by conference might now be highly useful in this country. The Joint Traffic Association, killed in 1898 by the Supreme Court's application of the Sherman law, had given promise of usefulness. It aimed to regulate competition without pooling, and in its short life had made real progress in that direction. Its constitution contained a vital provision in the regulation of rates on competing railroads—a rule to require the regular attendance of all competitors at all conferences. Usually the rate-cutter's first downward step in the path of sin consists in staying away from a meeting—avoiding the presence of his competitor. Such an association to-day could probably do more than any other instrumentality to rid the railroads of the domination of the beef trust.

With the railroads associated together now as they were in the Joint Traffic Association—lawfully and above-board—they could really co-operate with a Government commission in efforts to cure discriminations.

But to "co-operate" implies equality; hence we have said that the quality of the Interstate Commerce Commission should be improved; and Mr. Fink's suggestion of a way to do this seems good. There can be no question that two or three strong and high-minded men of railroad experience could improve the work of the Commission. If they were of judicial mind they could do great good, even if they had no higher function than writing dissenting opinions. The Commission has been reversed by the Supreme Court because it misinterpreted the law and because it deemed it safe to meddle with rates that could not be disturbed without causing other disturbances which could not be controlled. With better lawyers in its board it would avoid misinterpretation; but to avoid unwisdom, it will be necessary to secure the benefits of railroad experience. Railroad officers therefore may justly applaud Mr. Fink's suggestion and enthusiastically work for its adoption. To have a part of the Commissioners appointed for life would be only a reasonable step toward giving the Commission the dignity and stability that such a body needs. If we are right in assuming that the courts will never prescribe transportation rates—holding such an act to be non-judicial—then it is safe to say that in passing on the rate-making work of a Commission the courts will always presume the Commission's knowledge to be complete and its judgment sound—as the courts have done in the past, except where the evidence forced the abandonment of the presumption. This being so, it will be vitally necessary, in any rate legislation in the coming Congress to provide in the best possible way for a dignified and intelligent commission. Without these qualities, embodied in strong men of high character and free from political bias, there can be no hope of wise treatment of the interstate rate problem.

To the first of these two essentials (free conference and a wise commission), Mr. Fink adds a note intimating that the railroads, freed from the Sherman law and allowed to form associations, can probably deal effectively with private car lines. But these lines are essentially instruments of transportation, and they should be made subject to law to the same extent as the railroads. In some respects private cars are already subject to Federal law—as, for example, the safety-appliance requirements. A man dropping chunks of ice into a refrigerator car, or a porter making up a berth in a sleeping car, is clearly engaged in a department of transportation and the law should no longer split hairs about it. Mr. Fink says also that the repeal of Section 5, the anti-pooling law, is not necessary. He is a clear thinker and few men in America have a richer store of experience to guide them in forming opinions; but, if not repealed, this section ought to be made clearer. It well may be that the fight which would be developed by any attempt to secure repeal of the Fifth Section would be more costly than any possible benefit to be derived from the repeal. Pools are seldom perfect. It must be that they are born of woman, for they usually have a short life and are full of trouble. There will be no inconsolable regret if traffic pools are never again allowed; still, the anti-pooling section of the law condemns, in spirit, the traffic agreements which Mr. Fink desires to see again legalized.

Mr. Fink's suggestions for legislation are embraced under six heads. These are reprinted in another column. The only one of them on which there can be any reasonable disagreement, in principle, is the recommendation that the Cullom report of 1886 be reissued. Even in this the root idea is sound; the people ought to be educated. The Cullom report is one of our most valuable historical documents. But, like the Elkins report of the present year, it needs to be digested and greatly reduced in bulk, if its facts are to be made available to the thousands of laymen who need them.

On the separation of the work of supervising the safety appliance laws Mr. Fink is right in principle; but there would be strong opposition to the creation of a new bureau, especially at this time when so many Washington offices are under criticism. Everybody can see, however, that the present Commissioners take little interest in couplers and brakes and such things. The work in this department is wholly foreign to the habit of mind which rules in the other department of the Commission's work.

The one important element of the Government's problem which Mr. Fink ignores is that concerning the delays of the law. With the difficulties confronting us in every attempt to devise new methods of rate regulation—the constitutional and fundamental limitations on the powers of courts and of Congress, and the vast extent of our country—many even of the "friends of the people" would be glad to leave the laws as they are, if only the litigations which arise could be promptly settled. If controversies like the Chattanooga rate case, the Social Circle case and others on which the powers and qualifications of the Commission have been debated, could be appealed, retried and thrashed out within a few weeks

*Regulation of Railway Rates on Interstate Freight Traffic. By Henry Fink. New York. 1905. Mr. Fink is the veteran Chairman of the Board of Directors of the Norfolk & Western Railroad. This book, a volume of 236 pages, embodies a review not originally intended for publication, but put in print on the advice of the author's friends. It is divided into three parts. Part I., "Regulation by the Railroads," describes how freight rates are made and gives full notes concerning the different traffic associations which flourished in this country in the last quarter of the nineteenth century. The subject is brought down to date and the Northern Securities decision is noticed. Part II. deals with Federal Legislation and its effects. Part III. deals with the agitation which has been going on for the past two years. The arguments against government rate-making are marshalled effectively. Mr. Fink's recommendations for legislation are printed in another column.

or months, instead of years, a reasonable crystallization of public opinion might be looked for. An "interstate commerce court" would be a court of specialists, presumably wiser and surely quicker in making decisions, but is without precedent of any importance; and in no department of government is experiment so undesirable, and lack of precedent so fatal as it is in the administration of justice.

Encouragement of Non-State Railroads in Russia.

The Russian Government began to build and acquire railroads for itself about 20 years ago. Previously nearly all railroads in the Empire had been built and were worked by corporations, though the government in nearly all cases guaranteed interest and dividends on the capital invested and was paying yearly very large amounts on this account. To-day the government owns about two-thirds of all the Russian railroads, and has of late years added largely to the state mileage; and it seemed its settled policy to make the Russian system substantially a state system. But last July the government made an announcement which seems like a reversal of this policy: "For the sake of attracting private capital for railroad construction in Russia, it is considered possible to grant certain aids and privileges," These are then enumerated as follows: State guarantee for the payment of interest and principal of bonds. The payment of dividends, not exceeding 3 per cent., on capital stock during the period of construction. The limitation of the state's participation in the net earnings of the new roads according to contracts to be made in each case according to circumstances. Putting farther in the future the time at which the state may purchase the road for its own account, making it 25 years from the date of opening. The reimbursement of the companies of any reductions in freight rates made by the government below the regular rates, in the course of the first five years. Reimbursement of the cost of construction required by the authorities and not necessary for the freight traffic. Payment for services rendered to the government, such as carrying mails. Immunity from charges for government police, inspection, etc., of the railroad.

The supposition is that in its then situation, with a great war pending which had already seriously reduced its resources, the government felt unable to construct the lines believed to be indispensably necessary for the development of the country. The great investments in railroads made by the state do not yet make any direct return. On the contrary the interest on the cost of the state railroads and the guarantees on private railroads exhaust the net earnings. This is not so surprising when we remember that not only the Siberian Railroad but some other long lines as yet do not earn their working expenses.

Whether the new policy will attract capital does not seem quite certain. In most cases the returns on the investment are likely to depend, for some time at least, on the government very much as if the state built the roads on its own account, and the companies have scarcely any discretion as to the rates they may charge. It seems certain, however, that the rational construction and management of many thousands of miles of new railroad in European Russia would be of an enormous advantage to the country and could readily be made to yield abundant returns on the investment. But though the country is in many respects similar to this, the population is so very different from ours that an American is liable to make great errors in forecasting the result of any such enterprise.

This announcement, be it remembered, was made last July. The close of the war since has certainly modified the necessities and may have changed the purposes of the Russian government.

Boston & Maine.

The Boston & Maine is the railroad ruler of northern New England. With the exception of 160 of its 2,286 miles of line, all of its mileage lies within the states of Massachusetts, Maine, New Hampshire and Vermont. Its ownership also is highly concentrated in New England, 7,052 out of its 7,631 owners, who represent 202,723 of its 266,592 shares, residing in the three states of Massachusetts, New Hampshire and Maine. North of the Boston & Albany, the Boston & Maine covers New England almost as completely as the New York, New Haven & Hartford does south of that constituted dividing line. Like the New Haven, its territory is the originating point of large amounts of manufactured products.

The Boston & Maine took a step similar to President Mellen's bold acquisition of a trunk line connection by the purchase of the Central New England and the New York, Ontario & Western, when, in 1900, it leased the Fitchburg. This lease was the direct result of the New York Central's acquisition of the Boston & Albany. The Fitchburg added 458 miles to the Boston & Maine's operated mileage and gave it a direct western connection from Boston and a voice in through traffic. As the New York Central controlled the West Shore, its lease of the Boston & Albany would have resulted, if the Fitchburg can be imagined to have remained an independent road, in its turning over all eastbound New England freight to the Boston & Albany, thus depriving the Boston & Maine of all its direct westbound business. With the Fitchburg in its possession, the Boston & Maine could demand and secure its share of eastbound traffic, for it has western connections other than through the Albany gateway. By shipping north over any one of its three lines to Portland, where it connects with the Grand Trunk, or northwest to its connection near the Vermont-Quebec boundary with the Canadian Pacific, the Boston & Maine can always reach the west. By throwing all of the large westbound traffic originating in the territory north and northwest of Boston to these northern Canadian routes, the New York Central would have been deprived of a large amount of westbound business. Thus the routing of freight by the New York Central over the present Fitchburg division of the Boston & Maine is on a reciprocal arrangement by which the West Shore gets westbound traffic from the Boston territory, and the Boston & Maine in return receives eastbound traffic from the West Shore at Rotterdam Junction.

The Boston & Maine, although serving almost as dense a territory as the New York, New Haven & Hartford, is handicapped by the greater severity of the northern New England winter, which requires, during two or three months of every year, large extra expenditures on account of snow and ice and adds greatly to the expense of moving traffic. This, combined with the highly conservative policy of the company in charging betterments directly to expenses, explains the high operating ratio of 73.5 per cent.

The present report is especially interesting, because the fiscal year ended June 30 completes a period of five years' operation since the lease of the Fitchburg. During this time there has been no material change in mileage, so that an accurate judgment may be formed of the growth of the railroad during the five-year period.

In 1901, the first fiscal year after the Fitchburg lease, gross income was $31,375,620, against $22,865,977 in 1900, the year before the lease. In the succeeding years, gross income has yearly increased to $32,430,595 in 1902, $34,266,608 in 1903, $35,471,492 in 1904, and $36,800,834 in the year just closed. This is a five years' growth of $5,425,214, or over 17 per cent. At the same time, the annual fixed charges have increased only $131,100 and the annual dividend payments only $161,646, a total increase of $292,746 in annual fixed charge and dividend requirements. Thus these charges for the year ended June 30, 1905, were less than 3 per cent. greater than for the year ended June 30, 1901, while gross income had increased 17 per cent. during the same length of time.

This very large and disproportionate growth of earnings over fixed charges and dividends has enabled large annual expenditures out of current income for permanent improvements to the property. During the five-year period, there was spent out of earnings: for repairs of locomotives, $1,349,315; of passenger, baggage, mail and express cars, $680,524; of freight cars, $963,716; repairs of roadbed and track, $2,224,478; for rails, ties, ballasting and maintenance of bridges, buildings and structures, $1,859,179. The amounts expended last year for these decisive items of maintenance increased $1,431,403, or 25½ per cent. over the same expenditures in 1901. That such large expenditures could be consistently made during this period at the same time that dividends aggregating $8,766,727 were paid on the company's stock is an example of the peculiar conservatism and prosperity of a New England railroad.

In the year just passed, there were paid for out of the year's current income, 38 locomotives, 130 freight cars and 31 passenger cars of various kinds, their cost, including expenditures on 576 new freight cars in process of construction, but not completed, amounting to $807,782. There was charged to capital account, $452,155, which was expended in the elimination of grade crossings. The total net expenditure to June 30, 1905, for this purpose has been $2,804,274.

With an increase of $1,318,637 in gross earnings, there was a decrease of $29,195 in net earnings, though this would not be guessed by a casual reader of the report, as no comparative figures for net earnings are given. Of the $36,213,246 gross earnings, 39.5 per cent. were passenger earnings and 60.2 per cent. freight earnings, the percentage of passenger earnings being about 10 per cent. smaller than on the New York, New Haven & Hartford, where the two classes are still approximately equal.

Operating expenses cost $25,811,959, plus $807,782 for new equipment, a total of $26,619,740. Maintenance of way took $4,501,378 of this; maintenance of equipment, $3,396,380; conducting transportation, $17,117,307, and general expenses, $796,894. Maintenance of way cost $1,967 per mile; maintenance of locomotives, $1,460 per locomotive. Conducting transportation increased $141,740 over 1904.

With its large local traffic and short through hauls, the Boston & Maine does not have a large train load. This was 212 tons in 1905. However, this is an increase over the figure for 1904, which was 203 tons. In 1903, the train load was 207 tons; in 1902, 201 tons, and in 1901, 202 tons. The profitableness of the freight business comes not from a high train load but from the high grade

ot traffic and the high average rate received, which was 1.152 cents per ton per mile against 1.178 cents in 1904. The list of commodities carried shows throughout a high proportion of high grade tonnage. In point of tonnage, the principal commodities were anthracite coal, 1,461,754 tons; bituminous coal, 3,044,927 tons (against 867,164 tons in 1904); grain, 1,068,871 tons; lumber, 2,418,089 tons; merchandise, 1,249,164 tons, and miscellaneous, 2,095,234 tons, the latter two classifications, high grade and profitable traffic.

The average gross earnings per mile of road were $16,082, against $15,521 in 1904; net earnings, $4,192, against $4,210 per mile of road in 1904. The average rate per passenger mile was 1.755 cents, a small decrease from 1904. The average distance each passenger traveled was 18.17 miles, and the average haul per ton of freight, 90.24 miles. Of the total number of passengers carried—2,874,810—22,880,000 traveled to and from Boston, a clear indication of the great density of the Boston & Maine's passenger traffic.

There is soon to be voted on by the stockholders the issuing of bonds to an amount not exceeding $10,000,000 for refunding purposes; also an increase of $4,203,700 in the common stock and the issuing of $5,331,900 common stock for the purpose of buying 6,000 additional freight cars at a cost of $5,000,000, building new shops at cost $1,000,000, 27 miles of second track to cost $1,100,000, and covering the Boston & Maine's proportion ($1,600,000) of amounts to be expended in grade crossing elimination. This covers the general financial plan of the company for a period of at least five years to come.

From the new issue of bonds, material reductions in fixed charges amounting, on and after Sept. 1, 1906, to not less than $43,000 annually, will result. On that same date, it is proposed to apportion the $5,331,900 common stock among the stockholders to the extent of three-eighths of their holdings. Of this $5,331,900 new stock, $1,128,200 is owned by the company and now held as collateral for payment of certificates of indebtedness of an absorbed line. When released by the payment of these notes, this amount will be combined with the new issue authorized ($4,203,700) for the distribution.

In justification of the proposed expenditure of $5,000,000 for additional freight cars, the increase in the company's freight business during the last five years is cited. In 1901, 15,516,517 tons were carried and $18,208,515 received in gross freight earnings. These figures have increased during each year in the period to, in the year just closed, 20,546,826 tons and $21,808,070 gross freight earnings. This makes a total increase in the five years of 3,030,255 tons carried, or 17 per cent., and of $3,599,555 gross earnings, or 19 per cent. During this time 3,024 new freight cars, a number clearly disproportionate to the increase in freight traffic, have been bought in replacement and as additions. Both for this reason, and particularly because the greater and most profitable part of the Boston & Maine's freight traffic is local and domestic and must be forwarded and delivered as quickly as possible, the 6,000 new cars are required. The new shops are to be built at Somerville, Mass., where 100 acres of land have already been purchased and improved. This site has a navigable water approach on the Mystic river and is on the Boston terminal division, thus having convenient access by water and from all of the company's lines. The second-track construction recommended is on key sections of the Eastern and Western divisions, where the lack of second track now causes frequent and expensive delays, particularly in freight service. The amount apportioned to grade crossing elimination will, it is expected, be sufficient to provide for the Boston & Maine's proportion of the total cost of this work during the next six years.

Assuming that 7 per cent. dividends shall be paid upon the additional $5,331,900 of stock, the estimated annual charges on the issue will be $433,000; but, as there will be at the same time an actual saving of $343,000 in first charges through refunding operations, the total net increase of the combined annual dividend disbursements and fixed charge obligations will be not more than 90,000 greater than at present, a sum only slightly in excess of the surplus earnings of the past year. The added amount, however, will undoubtedly be supplied from the increased income which will result from the enlarged facilities furnished.

During the past year, the Boston & Maine has asked authority from the Massachusetts Legislature to acquire and control electric lines. As yet, although at various points in its highly populated territory there has been severe competition and large losses from electric competition, the company has not fallen in with the New Haven policy of acquiring such branches, with the exception of two electric lines which it built and owns as branches of its steam lines. One of these is 18 miles long, in the city of Portsmouth, and the other 28 miles long, connecting Concord and Manchester. With permission granted by the Legislature to make such investments, and particularly following the good showing recently made by the New Haven's electric lines in their first reported year of operation, it is not unlikely that the Boston & Maine will follow the Mellen policy and before many years be in control of its various electric competitors. This will be one of the most interesting developments to watch, especially in comparison with the New Haven's electric policy. With the passenger business furnishing 34 per cent. of the revenue, there surely is inducement for taking care of electric competition. The Boston & Maine serves such a highly developed territory and serves it so completely that it can hardly afford to have anything else than a complete monopoly of the transportation facilities.

The Maine Central, which the Boston & Maine controls by the ownership of more than 50 per cent. of its stock, earned during the year $7,251,536 gross, against $6,912,982 in 1904, and $2,375,334 net, against $1,811,438 in 1904. Of the gross earnings $2,809,854 were passenger earnings and $4,289,365 freight earnings. The net income after charges was $2,110,066, an increase of $219,988 over 1904. During a period of ten years, the company's gross earnings have increased by $2,240,917, or 44.72 per cent.; operating expenses, 49.04 per cent., and taxes, 166.31 per cent. Improvements to cost between $400,000 and $500,000 are projected, to provide for a part of which $300,000 has been set aside out of the current income for the year. Most important among these are new terminal facilities at Bangor, Me.

For the Boston & Maine, the principal statistics of operation follow:

	1905.	1904.
Mileage worked	2,288	2,288
Passenger earnings	$14,291,615	$13,971,273
Freight earnings	21,808,070	788,779
Gross earnings	36,213,246	34,894,608
Maint. way and structures	4,501,378	3,828,702
Maint. of equipment	3,396,380	3,295,832
Conducting transportation	17,117,307	16,975,565
New equipment	807,782	350,988
Total operating expenses	26,619,740	25,271,908
Gross income	36,800,834	35,471,492
Net income	1,883,572	1,849,456

NEW PUBLICATIONS.

Maple Leaf Bulletin, St. Paul, Minn.

This is the title of the first number of a magazine which the employees of the Chicago Great Western propose to issue, if they find sufficient support and encouragement. The first number contains 32 pages and is dated September. The price is 50 cents a year, but the frequency with which the magazine is to be published is not stated. The committee of publication consists of Messrs. J. H. Sayle, T. N. Flynn and J. F. Richards. The first number contains interesting reading on the use and abuse of the "19" order; on congested terminals, and on the handling of freight to reduce damage claims; the latter being in the shape of a report of a meeting of agents recently held. An extract from this report is given in another column. There are also a half dozen pages of miscellaneous matter. The front cover bears a fine portrait of the President of the road, Mr. A. B. Stickney.

TRADE CATALOGUES.

Electric Cars.—J. G. Brill Company, Philadelphia, Pa., has issued a large general catalogue of electric cars and trucks, which aside from being a handsome piece of book work is a valuable record of current practice in electric interurban and city railway car construction. More than 40 standard types of cars for almost every class of service are illustrated and described with tables of their principal dimensions. The cars shown are characteristic of the output of this company's large plant and represent the latest developments in this important field. More than 20 pages in the back of the book are devoted to descriptions of the various types of trucks which are made by the same company, including the well-known maximum traction and 27-E patterns. A number of car specialties, such as doors, brake handles, etc., are also shown. Copies are being distributed to railroad officers in this country and abroad, and will be sent on application. Cloth, 10 in. x 14 in. Ninety pages.

Graphite Paint.—The Detroit Graphite Manufacturing Company, Detroit, Mich., sends a neat little booklet, entitled "Rust, and How to Prevent It." A brief explanation of the causes producing rust is given and the method of protecting steel structure by the use of a properly prepared paint is explained. Illustration of the cantilever bridge at Niagara Falls and other well-known structures which are painted with Superior Graphite paint are also given.

Mechanical Stokers.—The Under-Feed Stoker Company of America, Chicago, sends a handsomely gotten up catalogue in which is given detailed illustrations and descriptions of the Jones under-feed stoker. The methods of installation and of operating the stoker, as well as of the economical results obtained by its use, are set forth, and numerous illustrations of plants equipped with the Jones stokers are also shown.

Tie Plates and Spikes.—Dilworth, Porter & Co., Pittsburg, Pa., send a handsomely illustrated catalogue descriptive of its "Glendon"

longitudinal flange tie plate and the "Goldie" claw tie plates, as well as of the "Goldie Perfect" steel railroad spike, and of boat and dock spikes. Aside from the illustrations and descriptions of the above the catalogue contains various tables of interest to track men, such as the number of tons of rails of various weight that are required per mile of track, the number of cross ties per mile of track when placed at different distances apart, and the number of splice joints per mile for different lengths of rails.

Locomotive and Car Journal Bearings.—The A. C. Stiles Anti-Friction Metal Co., Baltimore, Md., and New Haven, Conn., sends an illustrated catalogue descriptive of the "Stiles" patent car journal bearings and of the "Stiles" anti-friction locomotive driving journal bearings. A detailed description of these bearings will be found on another page of this issue.

Metallic Packing.—The United States Metallic Packing Co., Philadelphia, Pa., sends an interesting catalogue descriptive of its metallic piston rod and valve stem packings. Halftone illustrations showing elevation and sectional views of the Gollmar bell ringer made by this company are also given.

Generators and Air-Brake Equipments.—The National Electric Company, Milwaukee, sends two pamphlets, one describing its direct-current belt-driven generators, and the other describing and illustrating the "Christensen" air-brake equipment, of which more than 15,000 are in successful operation on high-speed electric cars.

Copper and Metal Gaskets.—Frederick Goetz, New York, sends an illustrated folder descriptive of the Goetz's elastic profiled copper and metal gaskets. These gaskets are made of copper and asbestos, and it is claimed that they are especially adapted for use in high temperature work.

Car and Track Jacks.—The Duff Mfg. Co., Pittsburg, Pa., sends a small pamphlet bearing the title "Frenzied Jack-Sense," which contains a number of comic verses inspired by Archimedes and the "Barret" jack.

CONTRIBUTIONS

E. B. Phillips.*

Tenafly, N. J., Sept. 29, 1905.

To the Editor of the Railroad Gazette:

Please state that Mr. E. B. Phillips was elected President of the consolidated Lake Shore & Michigan Southern Railroads, not a Vice-President, as I said in a previous communication.

CHARLES PAINE.

Forms of Signals.

To the Editor of the Railroad Gazette:

I have read the editorial on "Forms of Signals" with a great deal of interest, and it certainly impresses me as a very timely article. From personal experience I have realized the growing difficulty of instinctively differentiating between the various characters of signal indications. A further cause for confusion, not mentioned in your editorial, is the difference in the form of blades between controlled manual and automatic block signals, the latter having pointed ends and the former square ends. I thoroughly agree with you that the first consideration for an ideal signal system is the simplicity that will enable the engineman to act instinctively rather than by a process of mental reasoning. Just how this shall be done is, as you say, open to a wide difference of opinion, but I think that your editorial is excellent for the purpose of drawing the attention of all railroad men to the necessity for discussion and a general adoption of a simplified form of signals.

VICE-PRESIDENT.

To the Editor of the Railroad Gazette:

I have read with considerable interest the editorial entitled, "Forms of Signals." It seems to me that the semaphore is the ideal form and it should be used for all indications. Certainly if we attempted the use of the semaphore, we will say, only for interlocking, a banner signal for switches, some form of disc signal for block signals and some other form of signal for train orders, we would make the matter worse rather than better. There are two forms of semaphore signals, the stop and the slow signal. If these signals are respected, no harm can come, but if we are going to change the form of signals and have one signal under which an engineer will understand he is not required to stop immediately, another where he is going to turn off at a junction, and another where it is simply a train order and he can run by the station if he wants, we are going to have a worse condition than now exists. There is nothing so simple as a semaphore, and my judgment is we better stick to it. If the men do not understand the signal or get confused, they can take the safe side and run slow, or stop, as the signal may require. A very large part of the train movement is at night and must necessarily be governed by lamp signals, of one form. The same thing is indicated in daylight by the semaphore. Why attempt to change a day signal which is used during the time of less danger, when the night signals cannot be successfully changed?

PRESIDENT.

To the Editor of the Railroad Gazette:

I have read with great interest your editorial article on "Forms of Signals." The subject is unquestionably one of great importance, and one which, unfortunately, has had altogether too little consideration. On many important railroads an effort has been and is being made to transmit to an engineman in charge of a rapidly moving train a great number of indications by means of semaphores of various forms displayed in different positions. In general the engineman who is thoroughly acquainted with the line, correctly interprets these various indications, but in many cases serious accidents have occurred through misinterpretation, and it seems to me that if a system of signaling can be devised that is so simple as to require no conscious mental effort on the part of the engineman for its correct and instant interpretation, the adoption of such system would lead to a material lessening of train accidents.

You have suggested as a line of study, the consideration of two types of signals for general use, one type to

"indicate the physical condition of the track considered as a structure, and to be used for switches, drawbridges, and interlockings" and the other type "to direct train movement, or to restrict it by reason of the occupancy of the track and to be used as block, starting and train order signals."

If it be conceded that two types of signals are necessary, it would still be open to question as to whether the grouping suggested by you for each of the two types might not be improved. Might it not, for example, be a much more natural and better classification to have one type indicate automatic and the other non-automatic operation? I incline very strongly toward the opinion that we should not try to indicate to the engineman by means of high-speed, fixed signals, so many things that he is altogether likely, sooner or later, to misread or misinterpret such indications, and for this reason I believe the number of indications given by such signals should be the smallest possible, having due regard not only to the safety, but also to the facility of train movement, and, further, I believe that signals of similar form by day, or of similar color by night, should give identical indications at all times and under all conditions to the engineman.

It is pretty generally admitted that the most satisfactory means for giving night indications is found in employing "color" signals; that no color should be used for high-speed signaling that is not readily distinguishable from colors ordinarily employed for illuminating purposes; that each color used for high-speed signaling purposes shall be readily distinguishable under all atmospheric conditions from all other colors employed for the same purposes; that a single color for a single indication is more readily readable and requires less mental effort for its correct interpretation than combinations of two or more colors. Assuming the above statements to be correct it is practically certain that at the present time we have but three usable colors for high signal night indications, viz., red, yellow and green. If this be true and if, for an average of 12 hours out of every 24 we are limited to three single color indications, it would seem to me entirely logical and consistent to limit to the same number the day indications, and it is my belief that the indications of high fixed signals may be limited to this number both by day and by night without undue delay to train movement, and with material reduction in the liability to having enginemen mistake such indications, since they may be given in such a simple and unvarying manner as to enable the engineman when running at the highest possible speed, to correctly identify each indication as soon as he receives it and without any conscious effort of memory. If, for example, the colors red, yellow and green be invariably employed to correspond respectively with the horizontal, the 45 degree, and the vertical positions of a three-position signal arm, not only the engineman but all trainmen would very quickly learn to associate the position with the color, and it is altogether likely that in describing any given day signal it would be spoken of always as a red, a yellow, or a green signal, rather than by reference to its position.

Personally, I do not doubt our ability to give to enginemen on trains moving at high speeds three unmistakable, clear, arrestive signal indications both by day and by night; but I do question the possibility of giving more than three, and I am not at all sure that it would be wise to attempt to employ more than three, even if we had them available.

If the number of such indications be limited to three, it seems to me these indications, corresponding respectively to the colors, red, yellow and green, should mean the following, viz.:

(1.) Stop.

*The obituary of Mr. Phillips was published in our issue of Sept. 22.

(2.) Proceed under full control, prepared to stop at the next
d high signal.

(3.) Proceed at regulation speed.

Objection may be made to the employment of a signal of in-
iable form and position to indicate "stop" In view of the fact
t at the present time "stop" signals of varying forms and posi-
ns are employed to impart to the engineman not only the in-
mation that he is to stop, but, at the same instant, to tell him
hy he is to stop." I believe that as this special information
given only by the day signals, it is much better, for the sake
uniformity and simplicity, to eliminate it by day, making the
and night indications absolutely identical in meaning. It will
et all reasonable requirements if means be provided whereby
engineman secures such special information after or imme-
tely before bringing his train to a stop, and this can be done
a variety of ways, one of which would be by fixing to the signal
st, under the signal, a large outline letter, as for example, "A"
automatic, "I" for interlocking, and "O" for order signals.
e headlight illumination will suffice to enable the engineman to
d such letter by night.

Other objections, too numerous to discuss in this brief criti-
n of your article, may be anticipated with respect to the above
gested plan; but I believe it to be practical and that any
erican railroad willing to assume the expense of installing a
tem of high, fixed signals, designed to give but three indica-
ns to the engineman, could secure better results than are had
er present practice. Unquestionably, at certain points, as for
mple, at main line junction points, with diverging tracks out
each main track, and with possibly a joint station located at
h junction, it might be found necessary, in order not to depart
n the "three indication" plan to require certain trains to pro-
d more slowly than they would do under usual practice; but
elieve that the loss of time due to this cause would be of little
ment in comparison with the uniformly safer and simpler opera-
n at all other points; and by carefully studying the traffic re-
rements at each such point, designing the track layout to suit,
perly locating the high and dwarf signals, and by providing
ck circuits where required, very little, if any delay need be
asioned by the adoption of such a plan, even at the points of
ximum complication.

All the foregoing has had particular reference to the *high*, fixed
nals, and while it is not within the scope of this letter to detail
fy feature of the "three indication" scheme, as suggested for
h high, fixed signals, it may be proper to suggest that low sig-
s, such as dwarfs, may be used for diverging route signals at
foot of high signals governing over a main track having facing
nt switches, and that dwarfs so employed may be provided with
lass of other color than the three above named, for the "proceed"
ication by night and when the signal is not set in the "pro-
d" position no color indication need be given, since the high
nal provides all the "stop" indication that is required. This ar-
gement eliminates the necessity for trains running at high speed
t a "red" signal. For "back up" movements the dwarf signal
y give two color indications, the "proceed" indication being of
fourth color, as above indicated, and the "stop" indication being
d" as on the high signal. In this connection it may be well to
e that whereas three colors only are readily distinguishable
n each other by night, at considerable distances and under
ordinary variations of atmospheric conditions, other colors are
rly distinguishable from these three at the short distance at
ch it is necessary for an engineman to get his dwarf signal
ications.

Under the plan proposed, an engineman would, by night, have
e other than the following high signal indications, viz.:

One red light only.
One yellow light only.
One green light only.

With present practice the following are a few of the many
r indications given by high signals on certain important rail-
ds:

red light only.
" " above a white light.
" " " a green light.
" " " a red light.
" " " two red lights.
" " " one red and one white light.
" " " " green and one red light.
" " " " " and one white light.
" " " " " one red and one green light.
" " " " " one white and one green light.
" " " " " and two white lights.
" " " " " one red, one green and one red.
" " " " " one red, one green and one white.
" " " " " one white, one green and one red.
" " " " " two white and one red.
white light only.
" " above one white light.
" " " " red light.
" " " " green light.
" " " two red lights.
" " " one green and one red light.
" " " " one white and one red light.
" " " " green, one red and one green light.
" " " " white, one red and one green light.
" " " " green, one red, one green and one red light.
" " " " white, one red, one green and one red light.

There are numerous other color combinations regularly employed, but enough have been noted to show what some enginemen are required to observe and interpret in a single night's run, and when it is borne in mind that a single signal means not only one thing, but may mean several things, the situation is not at all improved. For example, a single white light displayed in connection with a fish-tailed blade means to the engineman that his line is clear up to the second succeeding home signal; but, displayed in connection with a square ended blade, it means that the line is clear up to the next succeeding home signal; or it may mean neither the one nor the other of the two things above noted, but may, on the contrary, be the lower light of a two-arm signal, the upper light of which has been extinguished, in which case the signal is almost certain to be falsely interpreted and to result in a dangerous condition, or it may be a falsely displayed clear signal due to the breaking of a glass in a signal spectacle, which might also cause serious trouble.

I thoroughly believe this whole matter should have the consideration of the best signaling and operating men on our railroads, and I feel sure that the *Railroad Gazette* can do much toward calling attention to the need for simplification of signaling in its relations to the engineman, and that whatever is done in this direction cannot fail to greatly benefit the railroads and their patrons.

W. W. SALMON,
President General Railway Signal Co.

To the Editor of the Railroad Gazette:

Your editorial on "Forms of Signals" is timely and should have the serious consideration of railroad managers before adopting schemes for individual lines. As signals multiply it will be apparent that some plan is necessary or at least desirable to simplify the rules, and minimize the requirements for a correct reading of signal indications in all cases. It will be easier to standardize such a plan now than at any future time. Managers will adopt a standard much more readily than they will change to one after local plans have been worked out and put in operation, especially if a change carries with it any considerable expenditure. The history of all standard codes will bear out this statement. The questions raised in your editorial are well worthy of the attention of the American Railway Association through its Committee on Safety Appliances. Seemingly it will not be difficult to arrange a standard practice satisfactory to all railroads if undertaken before varying practices are adopted by different managements.

In this connection it may be well to refer to one difference in practice that obtains on American railroads, that is, the arrangement of semaphore arms on masts carrying two or more signals. Some railroads contend, and enforce their contention by their practice, that the top arm should govern the route to the farthest right-hand side lower arms for routes from right to left in that order, usually having the arm governing the high-speed route of larger size than the arms for subordinate routes. This may be a sufficient distinction for day indications, but is not satisfactory to all for night indications even though a larger lens is used for the high-speed route. The order of right to left is quite satisfactory for yard signals or where no distinctively high-speed route is involved, and some maintain that there should be only one arrangement and rule for all signals. Other roads contend that the high-speed route is of paramount importance and that there should be but one place for the signal governing it, at the top of the mast, regardless of the fact as to whether it is to the right or left or intermediate, and that all subordinate routes should be governed by a lower arm, or if necessary for more than one such signal the arms should be placed in the order of right to left. This difference in practice is mentioned to illustrate the fact that other differences in practice will likely arise, especially along the line suggested in the editorial under consideration, and also to suggest that the questions now raised be broadened to include the location and arrangement of signals where more than one is used on the same support.

It is obvious that any new standards should conform as far as possible to the general existing practice providing there are no serious objections to it either as to its safety, practicability or comparative simplicity. Fortunately there is little to change to secure uniformity at the present time. The rules of the American Railway Association are simple and direct and cover as briefly as practicable the necessary regulations both as to the semaphore and disc signals and their indications. The colors and positions are as few as possible and easily remembered, but thus far no uniform provisions have been made for distinguishing between interlocking, manually controlled, automatic, train order, drawbridge, route and siding signals. The first two can be easily and safely combined without any change as they are both absolute, and operated under the "stop and wait" rule, i.e., these signals are not to be passed when in the danger position, the indications being given by the square end semaphore arm. The distant, or caution signals, are distinguished by the forked or fish tail end.

Automatic signals are operated under an entirely different rule

providing that after a stop has been made a train may proceed under the restrictions contained in the rules. It is quite clear that signals used for this purpose should be easily distinguished from those operated under the first mentioned rule, otherwise the knowledge of the enginemen as to the location of different signals as unnecessarily required and their memory unduly taxed, with the possibility of error and consequent delay or danger. Some roads have adopted a pointed semaphore arm for automatic signals. This change can be readily made and with inconsiderable expense. Should this become a recommended practice where semaphores are used by the action of the association no doubt uniformity in this particular would quickly follow. The disc signal is more distinctive and no change either in rule or practice is necessary or even desirable.

Train order and drawbridge signals are operated under the absolute rule, but it is at least desirable for the engineman to distinguish between them and block eignals without bringing any special knowledge or their memory into requisition. In the case of train order signals it is necessary to do more than stop. Orders must be obtained with the least delay. Perhaps all that is necessary in this connection is to paint the words "Train Orders" or "Drawbridge," as the case may be, plainly on the semaphore arm. This special knowledge is only required after the stop has been made and the enginemen are in plain view of the signal. The question of route signals in yards can be easily disposed of. They should be, and usually are, placed on the right of and immediately adjoining the track they govern, or in the case of overhead supports, immediately over the track they control.

An arrangement of outlying route signals adopted by at least one important road has many advantages and is well worthy of consideration as recommended practice by the association. The route signals are placed on the high-speed semaphore mast at least 10 ft. below the high-speed signal. Such an arrangement would meet the main objections to both practices already referred to and settle a much debated problem.

It is probable that there would be no serious objections raised by any one to a further rule that all route signals should be placed in the order of right to left. The top arm governing the route to the farthest right, the second arm the next route to the left; other arms, if any, in the same order to the left.

Interlocked switch or siding signals are sufficiently covered by what has been said in regard to route signals. Siding signals not interlocked or switch targets are foreign to the present discussion, uniformity is desirable but not practicable or necessary at the present time. This question will settle itself when lines are completely signaled.

Referring more directly to the principal suggestion in the editorial above mentioned, a possible simplification by using one form of signals to indicate the condition of the track and another form to indicate the occupation of the track, such an arrangement would seem to complicate rather than simplify. In the first place these two facts, whether the track is safe or occupied, are not sufficient to enable an engineman to act intelligently in all cases. Take the single question as to the occupation of the track. Some lines and parts of lines are signaled on the absolute principle, others on the permissive, some by manually controlled and others by automatic signals each requiring a distinct indication to secure the desired results and all different from signals indicating the condition of the track.

The essential requisites are when to stop, what to do after a stop has been made, when and how to proceed and what route to take, regardless, in a measure at least, of whether the control is exercised on account of the condition or occupation of the track. A careful study of the foregoing suggestions for standard practice, taken in connection with the rules and regulations of the American Railway Association, will, I think, sufficiently indicate a comprehensive plan of securing the desired results with a minimum change in the present practice on any line interested, and at the same time eliminating any unnecessary special knowledge or undue exercise of memory on the part of enginemen.

OFFICER.

New Station of the B. & O. at Youngstown, Ohio.

The Baltimore & Ohio is completing a new passenger station at Youngstown, Ohio. The intention to rebuild its passenger stations all over the system as fast as possible was announced some time ago, and the Youngstown station is the first built in the execution of this policy.

The building follows the antique German style. It is 148 ft. long by 50 ft. wide and is two stories high. The tracks are on a level with the second story, which leaves the railroad facade one story high, while the main facade is two stories high. A wide driveway of limestone with a 10-ft. cement walk, fringed with a lawn and flower beds, leads from Mahoning avenue to the station. The building material is gray pressed brick with brown sandstone trimmings. The interior is finished with quartered oak with a marble mosaic floor in the main waiting room. The roof is covered with red tile of Spanish design. The spacious platforms between the tracks are protected by steel umbrella sheds with red tile roofs. The general waiting room, which occupies the center of the building and is two stories high, has accommodations for seating 150 people. Connecting with it on the main floor are the ticket office, news stand and telephone and telegraph booths. The women's retiring room, men's smoking room, baggage room and various offices of the railroad company are on the second floor. There is a subway leading from the general waiting room to each track, which relieves passengers of the necessity of crossing the tracks in going to and from trains.

New Passenger Station of the Baltimore & Ohio R. R. at Youngstown, Ohio.

Governmental vs. Private Ownership of Public Utilities.

A CONTRAST IN THE EXPERIENCE OF THE STATE OF ILLINOIS.

In much, if not all that has been spoken or written on Governmental, state or municipal ownership of public utilities there has been a tendency to advance theories rather than to cite facts as to known cases of success or failure. This is especially true as to our own State of Illinois, the history of which, with one possible exception, records nothing but failures, wherever and whenever governmental ownership has been tried.

In its earlier years, Illinois tried public ownership in various business experiments, among the most important of which were the internal improvement schemes, including the banking enterprises, which figured so largely in and about the year 1837. All collapsed with heavy loss and almost no tangible result, and in 1842, the state was on the verge of total bankruptcy and repudiation, having previously defaulted in the payment of interest on its bonds, said default continuing until 1853, if not later, the state debt reaching on Jan. 1, 1853, by accretions of unpaid interest, its highest point—$16,724,177.

For the history of the internal improvement craze, the subsequent period of financial depression and insolvency, with sundry references to the state's experience in operating state banks, we are indebted largely to John Moses' History of Illinois.

The most exciting subject of discussion in the session of the Second General Assembly in December, 1820, was the passage of a law to escape existing financial difficulties. A state bank was chartered, based entirely on the credit of the state, to be located at Vandalia, with branches at Shawneetown, Edwardsville and Brownsville. Notes of various denominations were authorized to be issued, bearing 2 per cent. interest per annum, payable by the state in ten years, and the banks were directed to loan the bills to the people in sums of not less than $100 on personal security. These banks were at first very popular, everybody being accommodated without much regard for the kind of security offered—$300,000 was soon in circulation. In the meantime, payments of loans were uncertain—no such thing as redemption being thought of, and the bills gradually decreased in value until not worth over 30 cents on the dollar. In 1825 the state issued auditor's warrants at the rate of three dollars for one, to defray current expenses, and lost about $75,000, which expensive system must have cost the state altogether nearly a sum at least equal to the amount of bills issued by the banks, $300,000.

During Governor Cole's administration (1822 to 1826) the financial condition of the state had grown rapidly worse, the public expenses having nominally increased three-fold by reason of the depreciation of the state bank paper. In the winter of 1830-31, the Legislature passed a law authorizing the state to borrow $100,000 to redeem outstanding circulation of the old State Bank. The Bank of the State of Illinois was incorporated in the winter of 1834-35.

Governor Duncan, in his message to the Ninth General Assembly (second session), referring to the demand for internal improvement said, "I would most respectfully suggest the propriety of leaving the construction of all such works . . . to individual enterprise."

In the winter and spring of 1836, there was almost a universal demand on the part of the people for various forms of internal improvements, and at one of the most important meetings held in Vandalia, attended by delegates from all over the state, the legislature was urged to act without delay. Stephen A. Douglas was the first member to introduce a series of resolutions specifically describing improvements to be constructed and owned by the state, and recommended the loan of millions of dollars to be negotiated on the faith of the state. A bill embodying substantially the plan recommended was finally passed February 27th. The Governor in returning the bill with his objections again expressed his well-known views, "*that such works, in his opinion, could only be safely and economically consummated by independent corporations.*" The more important of the proposed public works were the following railroads:

The "Central Railroad", from Cairo to Galena	$3,500,000
Branch of "Central Railroad" to Terre Haute	650,000
Alton to Mt. Carmel	1,600,000
"Northern Cross" Railroad	1,800,000
Peoria to Warsaw	700,000
From Alton to connect with "Central" R. R.	600,000
Belleville to Mt. Carmel	150,000
Bloomington to Mackinaw Town	350,000

Before adjourning, the Tenth General Assembly also passed laws increasing the capital stock of the State Bank $2,000,000, and that of the Shawneetown Branch Bank $1,400,000.

There immediately followed an era of unprecedented speculation, which advanced in intensity until, when, the advocates of an advanced system of improved transportation, beheld in the passage of the above described act, the materialization of their wildest dreams, the fever developed into mania and the folly of inflation held high carnival. Soon after the Illinois banks were forced, as were other banks throughout the United States, to suspend specie payments, and as the law incorporating these Illinois banks provided that if they refused specie payments for 60 consecutive days they should forfeit charter privileges, the Governor called a special session of the Legislature and a bill legalizing the suspension was passed, although another bill to repeal the internal improvement system was laid on the table.

Governor Duncan's administration began in 1834, with the state debt $217,000. At its close, December, 1838, the debt had increased to $6,688,000, including:

Bonds sold for bank stock	$2,665,000
Bonds for internal improvements	2,204,000
Bonds for canal construction	1,000,000

The Governor, in his valedictory message, again emphasized his opposition to the internal improvement system, and again recommended that "*all such works be left to the prosecution of individual citizens of the state or to corporations created by law.*"

Sentiment in the Legislature as to internal improvements was with the incoming Governor (Carlin), and with the retiring Governor as to banks. All efforts to repeal or modify the internal improvement system failed, but resolutions in favor of the expediency and constitutionality of a national bank were adopted.

On Dec. 1, 1839, the state debt presented the following appalling appearance:

Bonds sold to the State Banks, invested as capital therein	$2,665,000
Internal improvement bonds, sold in the U. S. and London	4,687,000
Canal bonds sold	3,400,000
Due to contractors and interest on loans	1,458,000
Other items	1,020,550
Total	$13,230,550

In the fall of 1839, the people began to express dissatisfaction at the outlook of state affairs, and public meetings were held in 15 counties. A special session of the Legislature was finally called to "consider the grave crisis" and laws were passed which abrogated the entire system. Thus came to a disastrous conclusion in Illinois *the attempt of the Commonwealth to own a system of public improvements.* As a result of these stupendous schemes, only a portion of one of the projected improvements was completed—the railroad from Meredosia to Springfield, 51 miles. That road was leased to individuals and operated generally at a loss until 1845, when it became practically useless on account of absolute lack of maintenance. This road, which had cost the state nearly $1,000,000, was finally sold at public auction for $21,000.

That a body of lawmakers could be found who could be induced to sanction a system so crude in inception, so extravagant in dimensions and so impracticable in details, is hard to understand, although their actions cannot be ascribed to any lack of earnest conviction or genuine integrity of purpose, but rather to headlong rashness, due to want of experience in affairs. In the selection of routes, clear foresight and sound judgment were shown, all the lines marked out having long since, through private enterprise, become important and successful arteries of commerce.

The attention of the legislature was again called to the state debt by Governor Edwards in November, 1840, the amount being stated as $12,307,182, and the annual interest charge thereon $732,430. The Governor set forth clearly and fairly the embarrassing situation, admitting the extravagance and error which had attended this attempt at state ownership. Some members were, however, still in favor of at least completing the "Central" and "Northern Cross" railroads, while others were opposed to doing any more work, and still a few others even favoring repudiation. Entering into the controversy were questions relating to the state banks, which had again suspended specie payments. Ever since the abandonment of the internal improvement schemes, the state had been passing through a remarkable period of financial depression. In February, 1842, the state bank, followed in June by the Shawneetown bank, "exploded with a great crash. Over $3,000,000 of the paper of these banks depreciated until it was worth only 50 cents on the dollar. The state debt, including interest, was in December, 1842, estimated by Isaac N. Arnold, of the House Finance Committee, to amount to $15,657,950. Public men of all parties stood appalled by the financial problems which confronted them. At the Democratic state convention in June a resolution against repudiation was laid on the table.

Among the bills passed by the Thirteenth General Assembly were the compromise bills, drawn by the Governor, requiring the State Bank and its Shawneetown branch to go into liquidation. Companies were also chartered to complete the "Central" and "Northern Cross" railroads, but the incorporators failed to comply with the terms imposed by the state.

A more complete appreciation of the financial depression during the period 1830-1848, may be had from the following statement showing the state debt during the years named:

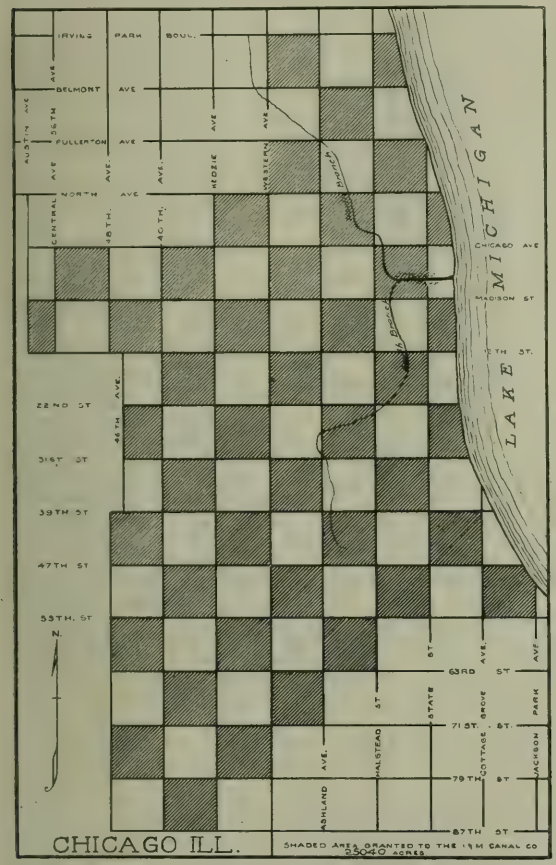
1830-32	$150,000	1836-38	$6,688,784	1842-44	$14,633,969
1832-34	267,000	1838-40	13,039,572	1844-46	16,389,817
1834-36	378,286	1840-42	15,657,950	1846-48	16,661,795

On Jan. 1, 1853, the debt amounted to $16,724,177—its highest point.

To summarize: The system of internal improvements contemplated the building of 1,342 miles of railroad at a cost of $12,000,000.

Before repeal the state was unable to pay the interest on its bonds. The credit of the state was a by-word all over the commercial world, and the people were driven almost to the extremity of repudiation. During the period 1839 to 1847 hard times and high taxes made capital and settlers absolutely shun the state. Nearly ten years after the system had been repealed, i.e., in 1850, but 110 of the 1,342 miles contemplated had been built. Most of the work seems to have been done on the rivers, but for the debt of $12,000,000 the people received practically nothing.

The second constitutional convention was held in 1847, and the new constitution submitted to popular vote and ratified in March, 1848. One of its most important articles was No. XV., providing for a two mill tax, the avails of which were to be exclusively applied to the payment of the state's indebtedness, other than canal and school indebtedness. Thus was the tendency in the public mind to honorably liquidate the vast debt created under the internal improvement system strengthened, and the matter placed beyond the power of legislative tinkering. There still, however, existed an active minority favoring whole or partial repudiation.



Land in Chicago Granted by Congress in 1829 and 1833 to the State for a Canal or Railroad from Lake Michigan to Illinois River.

Having outlined the physical and financial failure of Illinois in its attempt at state ownership of banks and railroads, we will consider its one enterprise which at any time attained any degree of success, however partial, the Illinois and Michigan Canal, and by contrast, the realization of the state's early dream of a "Central Railroad," worked out by private capital and private ownership under the charter of the Illinois Central Railroad Company.

The Illinois and Michigan Canal is an artificial water-way, constructed and owned by the state, extending from Chicago to La Salle, and connecting the Chicago and Illinois rivers, and is stated to be about 96 miles in length.

More than 200 years ago, the earliest French explorers of Illinois claimed the feasibility of such a water-way. In 1801, Albert Gallatin recommended in a report to the Federal Congress its construction, and in 1811 a bill for its construction was introduced in Congress, a Governmental survey being made in 1816. On the admission of Illinois to the Union, the attention of the state authorities was directed to the enterprise.

By an Act of Congress approved March 30, 1822, the state was authorized to survey and mark through public lands the route of a canal to connect the Illinois river with the southern bend of Lake Michigan, 90 ft. on each side of the canal to be reserved and vested in the state for such purpose.

In 1823, Commissioners were appointed by the state and $6,000 appropriated for investigation and survey. In 1825, a canal company (the Illinois and Michigan Canal Association), with a 50 year franchise, was incorporated by the General Assembly, with authority to build and operate the canal. The company did nothing and its charter was repealed in 1826.

The state petitioned Congress for a grant of land to aid in the construction of a canal, then estimated to cost $600,000. By an Act of Congress, approved March 2, 1827, there was granted to the State of Illinois, for the purpose of aiding in opening a canal to connect the waters of the Illinois river with Lake Michigan, a quantity of land equal to one-half of five sections in width on each side of the canal (alternate sections being reserved to the United States) from one end of the canal to the other. The canal was to be begun in five years and completed in 20. It was further provided that the canal might be built by the state, or by "other person or persons," and that "the state might sell the lands in whole or in part," etc.

The Act of March 2, 1827, was amended by an Act approved March 2, 1833, so that the lands granted thereby might be disposed of "by the state for the purpose of making a railroad instead of a canal," and by postponing the time for completing the canal or railroad, "whichever the state should elect to build," for a period of five years, thereby fixing the time for commencing at March 2, 1837, and for completion at March 2, 1852.

Three hundred and twenty-four thousand three hundred and twenty acres in all were donated by Congress to the state for canal purposes. As will be seen by reference to the map submitted herewith, approximately 25,040 acres of this grant lay in what is now the city of Chicago, and a large part thereof in the original city. Considering their location, the statement that these lands were then and are now the most valuable in the state admits of no question.

In 1829, Commissioners were appointed to sell the canal lands and apply the proceeds to its construction. In 1833, the Canal Commission was abolished and its affairs placed with a board of state officers. Actual construction began in 1836, and in 1848, twelve years later, the canal was opened for navigation. That is to say, the state consumed in building this canal, 96 miles long, either 26 years from the time that Congress in 1822 granted a right of way, or 21 years from the time that Congress in 1827 passed the Act granting such valuable lands in aid of the canal.

The affairs of the canal were, subsequent to its completion and until May 1, 1871, administered by a Board of Trustees vested with full power to operate the canal in the interest of the holders of the securities issued by the state until all such indebtedness should be wiped out, etc., and thereafter by commissioners appointed by the Governor; or say, in effect by receivers in trust for the state's obligations, which at the opening of the canal were, and had been for years, in default.

It is stated in the Illinois Blue Book, 1903, that the canal cost $6,000,000, or ten times the original estimate; also that an additional $6,000,000 has, since 1852, been spent for improvements and repairs. As nearly as can be ascertained from the records in the office of the State Auditor, the Legislature authorized the following issues of bonds in aid of the canal, interest not to exceed 6 per cent.:

1836—On the State's credit	$500,000	
1837—On the State's credit	300,000	
1839—On the State's credit	4,000,000	
		$4,800,000.00
1843—Canal property as security	$1,600,000.00	
1847—Canal property as security	70,730.91	
		1,670,730.91
Total		$6,470,730.91

In explanation of the fact that the above exceeds the amount stated to have been the total cost of the canal, including the proceeds from the sale of canal lands, it is suggested that such proceeds were used to some extent to pay the interest on and the principal of the bonds. Possibly the whole issue was not sold.

However, for the purpose of argument from a conservative standpoint, we will assume the original cost of the canal as $6,000,000, against which the state issued obligations bearing 6 per cent. interest, calling for an annual interest payment of $360,000, regardless of sinking fund for their redemption.

From the Chicago Board of Trade report for the year 1904, p. 106, the following results of operating the canal are shown:

For the whole period of 55 years, 1850 to 1904, inclusive,

The tolls amounted to	$6,427,566
And the gross expenses to	4,594,991
Excess of tolls over expenses in 55 years	$1,832,575

or $33,320 per annum, which is but little over one-half of 1 per cent. per annum on $6,000,000.

While it is true that in each of the 27 years from 1850 to 1876 inclusive, the tolls exceeded the expenses, and that the

Tolls received in those years to	$5,036,176
And the gross expenses	2,221,761
Was in excess for those 27 years	$2,814,415

or $104,238 per annum, such excess instead of providing the 6 per cent. interest payable on the bonds and a proper sinking fund for their retirement, did not provide 1¾ per cent. per annum on the $6,000,000.

On the other hand, in no one of the remaining 28 years, 1877 to 1904, inclusive, have the tolls equalled the gross expenses, and

In them the expenses amounted to	$2,373,230
And the tolls to	1,391,390
Leaving excess of expenses over tolls, last 28 yrs.	$981,840

This shows an average annual payment by the taxpayers of $35,066 for the privilege of maintaining the canal.

On Sept. 20, 1850, the State of Illinois then being and having for years been in default on its public debt, Congress passed "An Act granting the right of way, and making a grant of land in the States of Illinois, Mississippi and Alabama, in aid of the construction of a railroad from Chicago to Mobile," and the state having accepted said grant, on Feb. 10, 1851, passed "An Act to incorporate the Illinois Central Railroad Company, which begins with a preamble reading:

"Whereas, in the judgment of this General Assembly, the object of incorporating the *Central Railroad Company* cannot be attained under general laws, etc."

This taken in connection with various legislation prompted by the existing insolvency of the state, clearly shows that the people of that day had had a sufficiently disastrous experience with governmental ownership of public utilities to induce their representatives in the General Assembly to adopt the sound policy of turning the grant of lands, made by Congress in aid of the railroad, over to a private corporation.

Under the Act of Feb. 10, 1851, to incorporate the Illinois Central Railroad Company, the state reserved to itself forever, in lieu of taxes upon the 705.5 miles of railroad to be built thereunder, 7 per cent. of the gross receipts of said railroad from all sources. At that time the taxes paid by railroads in Illinois were very low, amounting to less than 1 per cent. of the gross receipts. It appears from the report of the Railroad and Warehouse Commission that during the year ended June 30, 1904, the gross receipts of all railroads in the State of Illinois, excluding the 705.5 miles built under the Illinois Central charter above referred to, amounted to $117,684,080, and that said railroads paid as taxes $3,649,576, being $3^1/_{10}$ *per cent.* upon their gross receipts.

The report of the Chicago Board of Trade for 1904 shows (at page 164) that from 1855 to Oct. 31, 1904, the amount paid by the Illinois Central Railroad Company into the State Treasury, in accordance with the provisions of its charter, was $22,730,529.53, and that the amount so paid for the year ended Oct. 31, 1904, was $1,062,571.86. Deducting therefrom three and one-tenth per cent. upon $15,179,598.09, which, as stated in the said official report, were in that year the gross receipts of the 705.5 miles of railroad built under the Illinois Central charter, there remains as the profit made by the State of Illinois in that single year by turning over the Congressional grant in aid of the railroad to a private company, over and above what ordinary taxes on the railroad would have amounted to, the sum of $592,004.32.

But from the point of view of the public, the real question is, how much service did the Illinois Central Railroad Company render on those 705.5 miles of railroad during the year 1904, in the transportation of passengers and freight and at what rates?

There were carried over the 705.5 miles of the Illinois Central Railroad which were built under its original charter (Act of Feb. 10, 1851), during the year ended June 30, 1904, 15,184,414 passengers for an average distance of 12.78 miles, making 193,998,218 passengers carried one mile, and 12,280,327 tons of freight for an average distance of 179.70 miles, making 2,206,777,585 tons carried one mile.

For this service the company received an average rate per passenger per mile of 1.79 cents, and an average rate per ton per mile of less than half a cent, or to be exact, .482 cent per ton per mile.

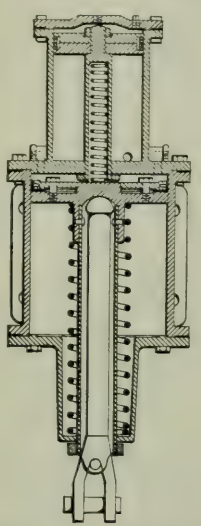
We have, therefore, as a guide for the future, this experience in the past with regard to state ownership of public utilities. The Illinois and Michigan Canal (96 miles in length) cost the state at the outset $6,000,000. Under state ownership and state management it has in the 55 years failed to pay an average return of 1¾ per cent. on its original cost, and in each of the past 28 years, it has annually cost the taxpayers for bare maintenance more than it has brought in, regardless of interest on its cost. It carries practically no passengers and an utterly insignificant tonnage, and has ceased to be a public utility.

The Illinois Central Railroad (705.5 miles in length) was built by private capital to which the state contributed no pecuniary assistance. Under the ownership and management of a private corporation it has paid to the state in the past 50 years more than twenty-two and a half millions of dollars, having in the last year, 1904, alone returned to the state more than $592,004 *in excess* of what ordinary taxes would have amounted to, and having in that year moved 1,263 times as many tons of freight one mile as were moved on the canal, and having rendered that service as well as its very large passenger service at the exceedingly low rates heretofore stated.

We should be glad to hear from the advocates of governmental ownership of public utilities of any instance which they can give from authentic records as above, where it can be shown that Government ownership and Goverment management of public utilities have resulted in a fair return upon the capital invested, after deducting current expenses and proper allowance for taxes.

A Steam Auxiliary Driver Brake Attachment.

The San Antonio & Aransas Pass is equipping its freight locomotives with an auxiliary steam brake attachment designed by the Superintendent of Motive Power and Machinery, Mr. G. W. Butcher. A sectional view of the device is shown herewith, from which it will be seen that it consists merely in the addition of a steam cylinder tandem to the air driver-brake cylinder. The arrangement is such that the brake may be operated independently by air or by steam.



Auxiliary Steam Driver Brake

The primary purpose of the attachment is for use in such emergencies as an air pump failure, or for holding the brake while recharging on a heavy grade. Also it provides a safety feature at terminals while men are working under the locomotive. The steam cylinder can be cut in and the brakes will hold as long as there is steam in the boiler.

The attachment requires the removal of the brake cylinder head, which it replaces. Some extra piping and a three-way cock in the cab completes the application. Mr. Butcher has patented the device.

The Cost of Locomotive Operation.

XIII.

BY GEORGE R. HENDERSON.

RENEWALS.

(*Continued from page 274.*)

This may or may not be an operating charge, depending upon the policy of the road. In the strict sense of the term "renewal" it would be an operating expense pure and simple, that is, if new locomotives were purchased only as the old ones were worn out. The actual life of a locomotive is a very uncertain thing to compute. The author recently saw an engine 38 years old that had just been withdrawn from active service, having the original rods, frames, etc., and in England engines are said to be running in the neighborhood of 50 years old. Generally in this country, when a locomotive is 20 years old, it is supposed to have reached the limit beyond which it is not considered policy to spend much money for repairs, and if the same size and price of engine were purchased with which to replace it, an annual charge of 5 per cent. would create sufficient funds to effect a renewal at the end of the 20 year period. This would be a true renewal charge, and should be added to the ordinary cost of repairs. If the cost price of the engine were $10,000, and a mileage of 50,000 were made per year, we should have an addition of $\frac{10{,}000.00 \times .05}{50{,}000} = .01$ or 1 cent a mile to the repair charges to take care of the regular renewals. But renewals are never handled in just this manner. The new locomotive invariably is larger and costs more money than its earlier prototype, and this in itself constitutes a betterment, instead of an ordinary renewal.

On some lines it is the avowed policy to scrap a certain num-

ber of old engines every year, it, of course, being ascertained that there are a large number that are worn out or antiquated and of questionable service value. When the scrap engines are so reported each month, an arbitrary amount, in one case known to the author, of $17,000 an engine, is charged to the repair account and credited to a replacement fund. It is evident that such an amount as that named above is far in excess of the original cost of the engines which it is used to replace, and if the number scrapped each year be large and the average mileage small, the charges against the repair account may easily reach 2 or 3 cents per mile over and above the normal or actual cost of repairs. There is no criticism intended of the wisdom of such a policy, as it is doubtless the proper one to adopt, and many roads are burdened with a large number of "antiquated freaks" which are worth more as scrap than as motive power, but the importance of the method of replacing locomotives to the cost of repairs must not be overlooked, and it should always be considered in making comparisons of one road with another.

Very often it is not stated in the reports whether replacement figures are included in the repair charges or not, and this fact shows the uselessness of compiling large quantities of statistics when the method of computing them is not known, nor is it even at all likely that they have been worked up on the same basis. While 20 years has been referred to as the probable limit of useful life of a locomotive, it, of course, should be more a question of service than of years. On very few roads will the average annual mileage of all the locomotives exceed 50,000, although some engines may make 8,000 or 10,000 miles a month. The author remembers when engine 1,001 made two round trips a day on the Pennsylvania Railroad between Harrisburg and Altoona, as an experiment, and kept this up for a number of months. This amounted to 15,000 miles a month. Very frequently schedules are so arranged that a round trip of 150 miles, and in some cases 200 miles each way, can be covered every 24 hours in passenger service. This would correspond to 9,000 or 12,000 miles a month, as the case might be. Under such conditions we should expect these engines to wear out twice or three times as fast as the average for all the engines, and although they would have to be replaced that much sooner, the cost of such renewals, distributed over the mileage performed, would be no greater per mile run. Fifty thousand miles a year for 20 years would make a total of 1,000,000 miles, and if some engines ran 9,000 miles a month, they would reach this figure in about 10 years. The road could just as well afford to replace them then, as to wait 20 years at one-half the annual mileage, and better, because if such service were obtained from all the engines, it is evident that only one-half as many would be needed to operate the road, and only one-half as much capital would be tied up in equipment of this kind. The author believes in wearing locomotives out as fast as possible. By this he does not mean wearing them out by improper treatment or careless maintenance, but by the legitimate work of hauling trains. The faster they can be worn out the sooner they will be replaced with modern machines, and the strides made in the power and type of locomotives in the last few years have been such that an engine only 10 years old is of comparatively little use, except for branch service. It is very much better, if it be possible to so operate the road, to have, say, 50 engines which must be replaced in 10 years, than to have 100 stay in service for 20 years. This is what is meant by wearing them out as fast as possible, so as to reap the benefits of new and improved power.

But there is still another phase to the question which can best be illustrated by an actual case. An important line, having a number of 1 and 1¼ per cent. grades, was operated with power so light that only short trains could be hauled, or of respectable length by double heading. An analysis was made of the freight train movement for a calendar year, and it was found that if 20 new engines of larger size were purchased the saving in engine crew and train crew mileage in one year would be sufficient to pay the cost of the 20 new locomotives. It was no doubt good policy to make the substitution, and as the line in question was part of a large system, the lighter engines thus replaced could be used or other portions with easier gradients, but the difference between the price of the new engines and the credit received from the old ones would constitute a very large addition to the repair account, unless the difference were charged as a betterment to capital account, where it really belonged. Some roads like the Pennsylvania are continually improving the property and adding to its initial value out of the profits, all of which is sound business, but if these betterments are charged to repair accounts, as they often are, it is absolutely useless to compare operating expenses between different roads or different periods.

Apropos of this discussion a number of new and powerful passenger engines were put on a part of one of our western systems, displacing lighter engines, which were sent to other territories. These being replacements were naturally charged to the repair account. The first year that they were in service, each locomotive saved $5,000 by reducing the number of sections and double headers. This saving naturally accrued to the credit of the transportation department, as it was principally in train crew wages, but motive power costs had risen by the charges made against maintenance to provide for the purchase of the engines.

There are still other times when renewals are required, that is, when from collisions or wrecks the locomotives are either destroyed or so badly damaged that it will not pay to repair them. Such incidents throw heavy charges into repair accounts.

Rebuilding of locomotives, such as the application of larger boilers, cylinders or wheels, constitute what may be termed extraordinary repairs, and will greatly increase the cost, unless specifically treated. Even the application of driver or truck brakes, if introduced very generally for a year or so, will add quite a perceptible figure to the repair account. Where statements are regularly prepared and are used for comparisons it is advisable and proper to state whether wreck repairs, extraordinary repairs and renewal fund charges are included in the regular repair expenses, and if so, what they amount to, otherwise the comparisons of one year with another are valueless. As an example of how the repair figures may be affected by such charges, a large western road for one month had a *real* locomotive repair account of $90,000. During the same month there were charged to repairs and credited to the replacement fund $35,000, or 40 per cent.! Another road included $6,300 of wreck repairs in a total of $48,000, so that the wreck damage cost one-eighth of the total repairs for the month.

Under these conditions it is evidently impossible to make any general estimates which are likely to conform to the ordinarily published statements of the cost of repairs, as so much depends upon the policy pursued. It is no doubt fair to allow an ordinary amount, such as one cent a mile for renewals, but it would be out of the question to attempt to carry wholesale purchases of heavier power by any arbitrary figure that might be assigned without knowing the detailed operations and methods followed.

(To be continued.)

Cross-Tie Record of the Santa Fe.

E. O. Faulkner, Manager of the Tie and Timber Department of the Atchison, Topeka & Santa Fe, has prepared his regular semi-annual statement, for the first six months of 1905, of the tie insertions for the period mentioned and the removals for the entire period over which records have been kept. The figures for removals are given by divisions and by years, the reasons for removal being noted and the average life of the ties computed in each case. The following tables are made up from the information contained in the statement.

TIES REMOVED.

	Treated			Untreated			Av. life of
	Rotten.	Other causes.	Total.	Rotten.	Other causes.	Total.	treated ties, yrs.
Eastern Grand Division.							
Illinois Div.	748	19	767	58,181	190	58,371	5.5
Missouri Div.	3,840	219	4,059	52,936	200	53,136	5.0
Kansas iCty Div.	513	1	514	9,067	....	9,067	5.9
Eastern Div.	1,830	561	2,391	79,589	1,869	81,458	5.9
Middle Div.	11,936	209	12,145	110,054	902	110,956	6.8
So. Kansas Div.	6,174	1,571	7,745	131,900	6,700	138,600	6.2
Oklahoma Div.*	15,557	35	15,592	54,657	....	54,657	7.2
Western Grand Division.							
Western Div.	12,716	374	13,090	78,197	1,748	79,945	10.9
Pan Handle Div.	3,015	347	3,362	88,029	1,176	89,205	6.7
Colorado Div.	8,893	188	9,081	17,815	504	18,319	10.9
New Mexico Div.	40,183	2,156	42,339	9,401	866	10,267	10.9
Rio Grande Div.	33,589	743	34,332	8,922	831	9,753	15.1

*Including Eastern Oklahoma Ry.

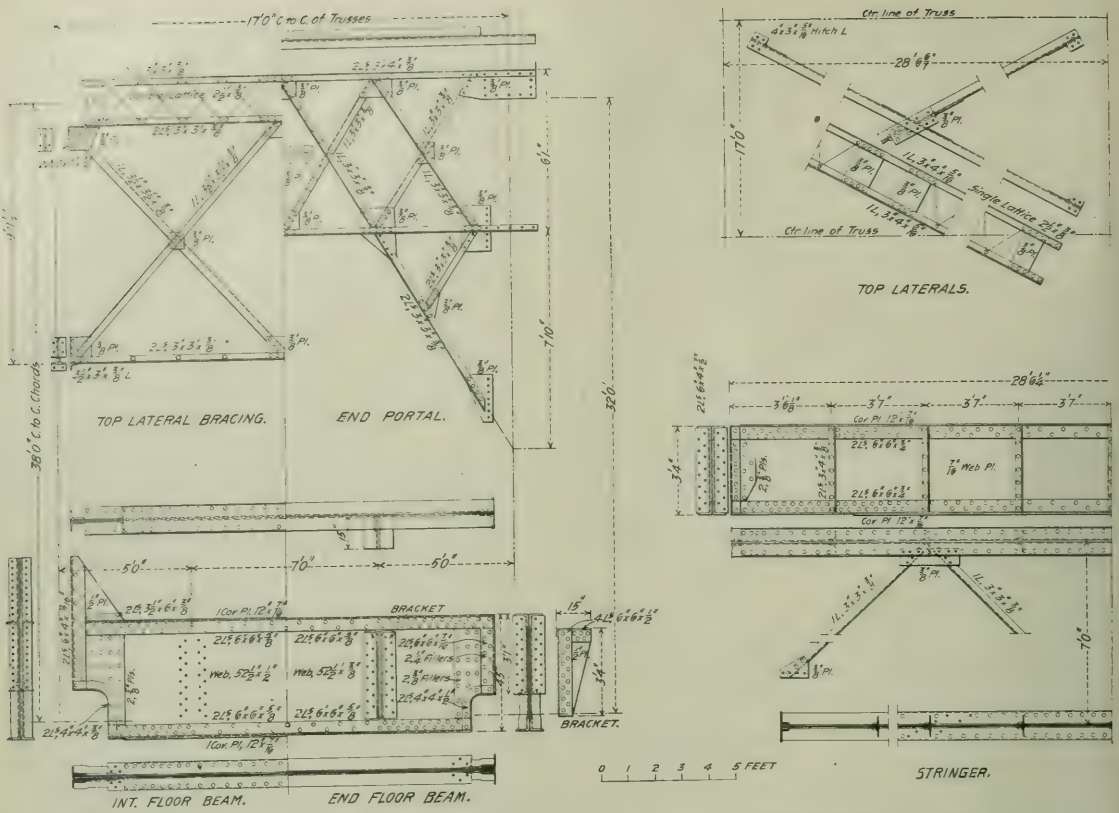
TIES INSERTED.

Eastern Grand Division.	Treated.	Untreated.	Total.
Illinois Division	111,894	111	112,005
Missouri Division	72,048	1,605	73,653
Kansas City Division	29,093	....	29,093
Eastern Division	110,002	830	110,832
Middle Division	124,041	219	124,260
Southern Kansas Division	190,219	....	190,219
Oklahoma Division	70,891	....	70,891
Total	708,188	2,765	710,953
Western Grand Division.			
Western Division	111,090	1,095	112,185
Pan Handle Division	95,197	....	95,197
Colorado Division	32,958	....	32,958
New Mexico Division	45,386	44,312	89,698
Rio Grande Division	52,983	394	53,377
Total	337,614	45,801	383,415

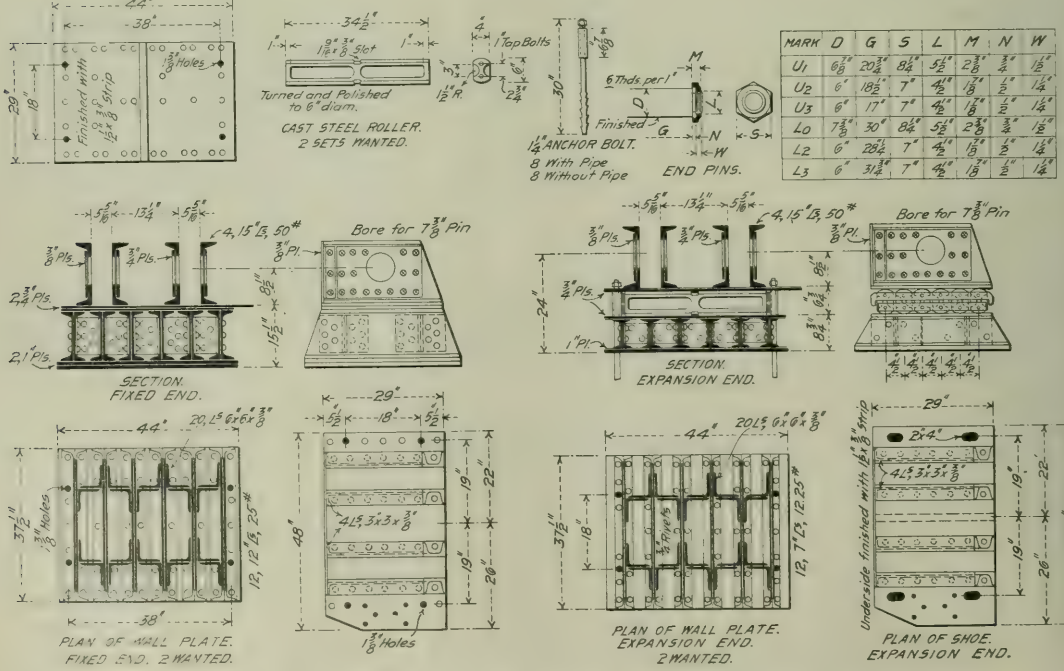
Standard Bridges on the Harriman Lines.*

The 200-ft., pin-connected span shown this week is the longest of the standard designs for the Harriman Lines. The principal differences in its design over the 180-ft. span shown September 22, are in the substitution of a partly curved top chord for the straight top chord of the Pratt truss and in the fabrication of the verticals. The details of the end bearings have also been changed somewhat

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, August 11, 18, 25, Sept. 1, 8, 15 and 22.

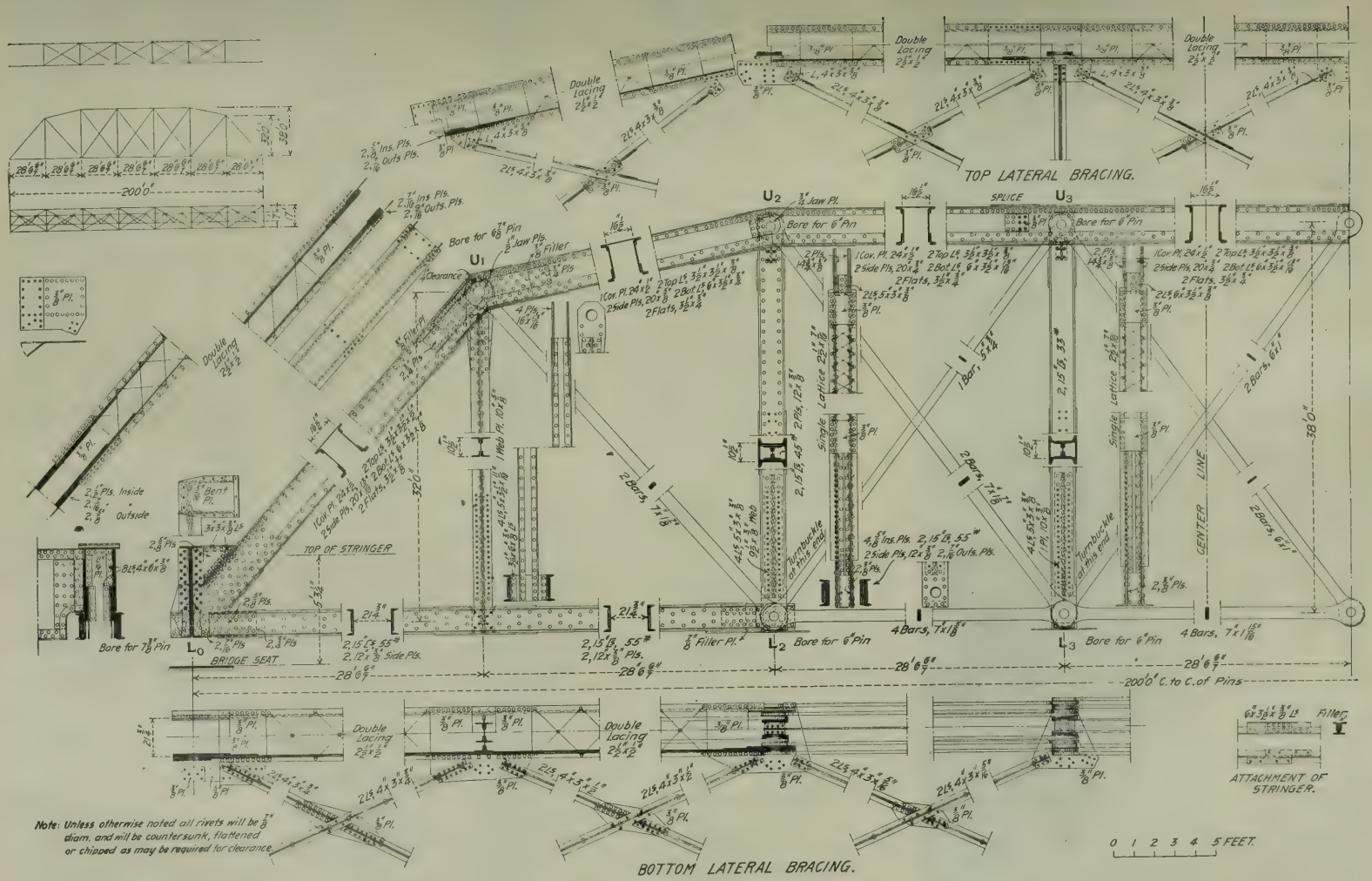


Details of Floor and Lateral Bracing of 200-ft. Pin-Connected Through Truss—Common Standard, Harriman Lines.


CAST STEEL ROLLER. 2 SETS WANTED.
1¼ ANCHOR BOLT. 8 With Pipe 8 Without Pipe
END PINS.
SECTION. FIXED END.
SECTION. EXPANSION END.
PLAN OF WALL PLATE. FIXED END. 2 WANTED.
PLAN OF WALL PLATE. EXPANSION END. 2 WANTED.
PLAN OF SHOE. EXPANSION END.

MARK	D	G	S	L	M	N	W
U1	6⅝"	20¾"	8¼"	5½"	2⅜"	¾"	1⅛"
U2	6"	18½"	7"	4½"	1⅞"	1"	1¼"
U3	6"	17"	7"	4½"	1⅞"	1"	1¼"
L0	7⅜"	30"	8¼"	5½"	2⅜"	¾"	1⅛"
L2	6"	20¼"	7"	4½"	1⅞"	1"	1¼"
L3	6"	31¾"	7"	4½"	1⅞"	1"	1¼"

Details of End Bearings for 200-ft. Pin-Connected Through Truss—Common Standard Harriman Lines.



Note: Unless otherwise noted all rivets will be ⅞" diam. and will be countersunk, flattened or chipped as may be required for clearance.

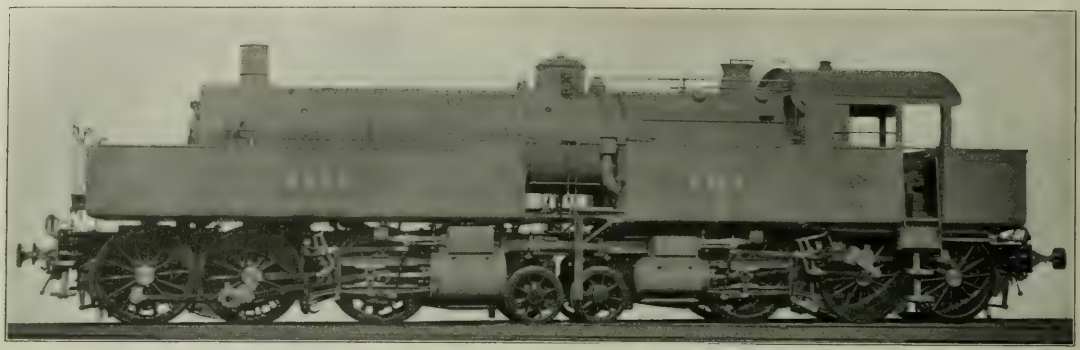
Details of Trusses for 200-ft. Pin-Connected Through Span—Common Standard, Harriman Lines.

to allow for the wider packing in the bottom chord of the truss. The top lateral struts have been made deeper but of no heavier material. The estimated weight of the span is 485,000 lbs.

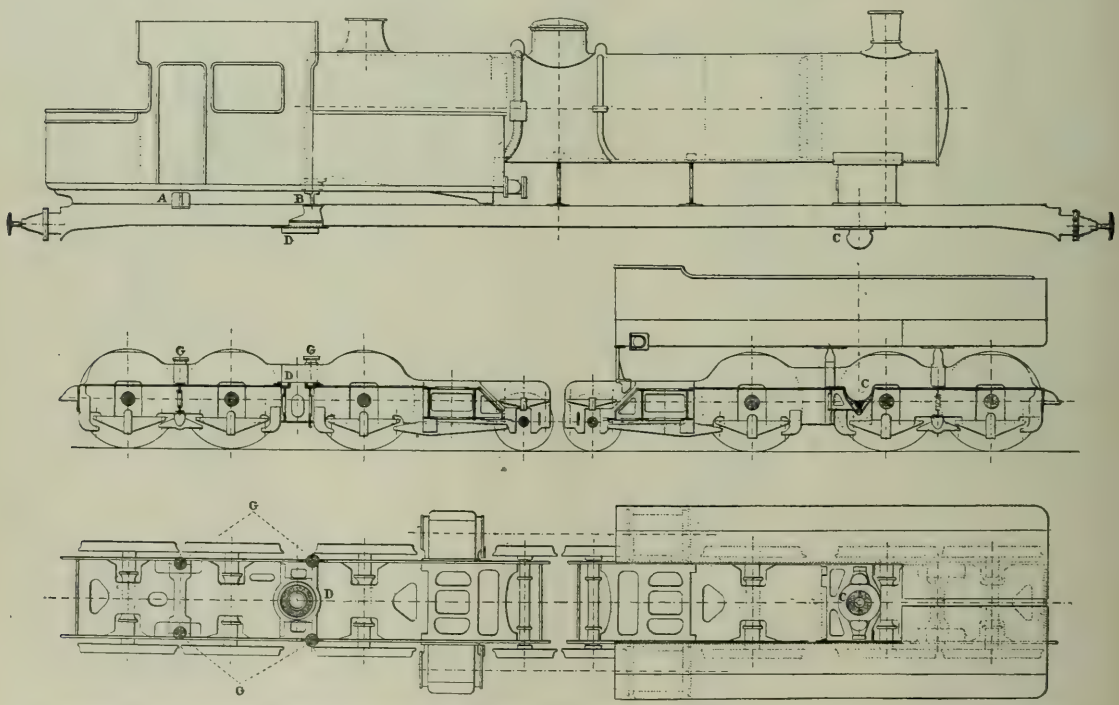
This article completes the series. For long crossings, skew bridges and at other places where the standard designs cannot be used special designs are, of course, worked out but the eight lengths of plate girders from 20-ft. to 100-ft. span, the five lengths of riveted through trusses from 100-ft. to 150-ft. span and the four longer pin-connected trusses from 150-ft. to 200-ft. span provide for a very large proportion of the steel bridge work which is required for

Sixteen-Wheel Double Tank Locomotive for the Northern Railway of France.

The Northern Railway of France had a locomotive at the recent Exposition at Liege, Belgium, that is a notable departure from the practice of the road. At first sight it appears to be a modification of the Mallet type, or a combination of two 2-6-0 or mogul locomotives whose frames have been brought together head on, and the two then supplied with a boiler of extraordinary length. The immediate reason for the production of this machine is to be found



Sixteen-Wheel Compound Bogie Locomotive—Northern Railway of France.



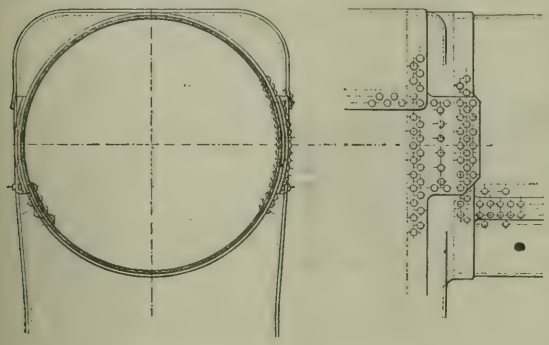
Elevation of Superstructure, Longitudinal Elevation and Plan of Bogies for the Sixteen-Wheel Compound Bogie Locomotive Northern Railway of France.

railroads. These designs are the result of careful study on the part of the large number of competent engineers on the Harriman Lines and they embody the best modern practice in bridge construction. The drawings which have been shown give sufficient details of the material and dimensions to enable any engineer to utilize them as a basis of comparison for calculating new work of similar size or even as a complete general working drawing from which the shop drawings could be readily made. The young engineer will find them well worth careful study. We wish to again acknowledge our indebtedness to Mr. John D. Isaacs, Assistant Engineer of Maintenance of Way of the Southern Pacific, from whom the drawings were obtained.

in the importance of the coal traffic, and the grades over which it is hauled.

This traffic has been increasing ever since 1857, when it was handled by 0-8-4 engines weighing 136,000 lbs., including the tender, of which 85,800 lbs. were on the drivers. In 1897 some 4-6-0 or 10-wheelers were built, of which the total weight of engine was 135,800 lbs., with 95,500 lbs. upon the drivers. The traffic originates in the north and is sent out over two routes. On one the curves are of long radius and the grades light (0.6 per cent.); on the second there are grades of 1.2 per cent. The trains on the latter, running by way of Valenciennes, weighed 950 tons and were handled by compound locomotives. But when they reach Valenciennes or

Busigny, they had to be cut in two as the company had no engines with sufficient power to take them up the 1.2 per cent. grades to follow. It was to avoid this trouble that the engine illustrated has been designed. It was necessary in order to work the crews to the best advantage that they should be able to take the trains from Lens to Hirson via either Busigny or Valenciennes. Upon the easy portions of the run the engine is to utilize its power in speed, where it is expected to run at from 30 to 37 miles an hour, while on the heavy grades the power will be utilized in traction and the speed will be reduced to from 11 to 13 miles per hour. These conditions require that the diameter of the driving wheels shall be comparatively large (59 in.); an economical hauling power; stability at speeds that may rise as high as from 45 to 50 miles an hour, and a high tractive power. These all point to a heavy machine carried on a large number of wheels in order not to overload the track.



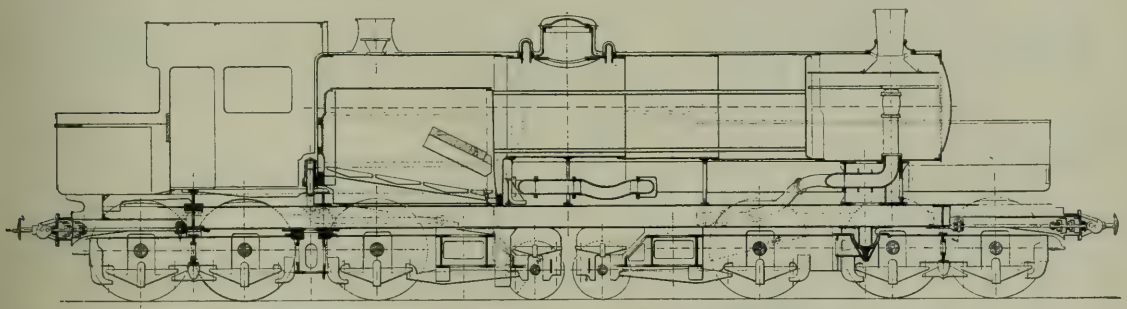
Joint Between Fire-Box and Boiler Shell.

An examination of the permanent way led to the decision that neither the load per wheel nor the present rigid wheel base should be exceeded, with the result that 6-wheeled motors and a total length of 58 ft. 6 in. between drawheads were adopted.

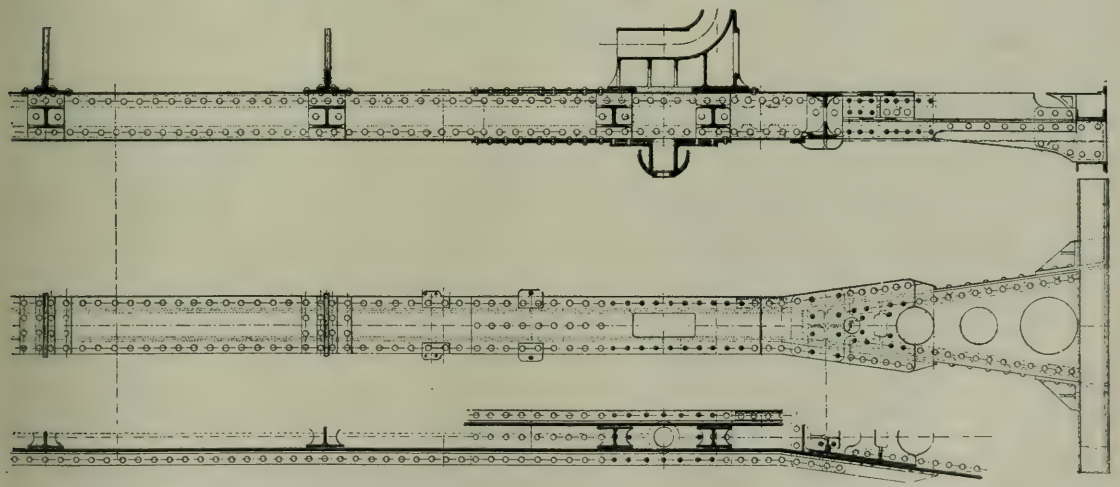
The doubtful advisability of placing two 6-wheeled motors in the same frame led to their division into two perfectly independent groups, so that the engine should be as flexible as possible. The compound system was used, the high-pressure cylinders being placed upon the leading and the low-pressure on the rear trucks. In order to avoid a condensation of the steam in passing from one group to the other, the two sets of cylinders were placed next to each other at the center of the machine.

Steam passes directly from the high to the low-pressure cylinders through an expanding or extending connection. As these cylinders are large and as they are located at the extreme ends of the bogie frames, it was important that there should be little or no overhang, so that a single pair of trailing wheels was placed beyond each one, thus giving the appearance of the two mogul engines already alluded to. These wheels also add to the stability of each bogie truck, which really forms in itself a complete locomotive frame. The tanks and coal spaces provide for about 1,200 gallons of water and 5½ tons of coal.

The engine is so constructed that it consists of three main parts: The two bogies with their engines; the boiler and its connections, and a central frame which is of a peculiar construction. The latter is formed of plates and angles and runs along the center line of the machine, extending from end to end. It carries the boiler and its attachments, and, resting upon the bogies, connects them together. It is flared at each end where the bumpers and draw gears are attached. The illustration shows the boiler resting upon the frame, and the two bogies; the angular displacement of the latter being about the pivotal points. The frame thus rests upon the two pivotal points of the bogies as well as upon four side bearings at the back which are marked G. It is, of course, essential that the forward bogie should have perfect freedom of motion as compared with the one at the back. In order that this may be insured the central frame rests upon the center plate only.



Longitudinal Section of Sixteen-Wheel Compound Bogie Locomotive—Northern Railway of France.



Central Frame of the Sixteen-Wheel Compound Bogie Locomotive—Northern Railway of France.

As these plates have spherical bearing surfaces, the forward truck can thus assume any position whatever relatively to the frame and the other bogie. However, as some limitation to rolling must be imposed two cushioned buffers are inserted to steady the machine.

The four engines are identical in every particular and have valves balanced in accordance with the rules followed by the Northern Ry. The balanced portion of the high-pressure valves are put in communication with the high-pressure exhaust port and that of the low-pressure valves, through an automatic valve, either with the exhaust, when the throttle is opened or with the steam chest when the throttle is closed. This arrangement has the advantage of permitting the throttle to be closed while the engine is in motion as with the ordinary valve, and lessens the resistances that are set up by the ordinary balanced valve at that instant.

The dimensions of the boiler do not vary to any great extent from those of the high-speed express locomotives on the road. The firebox is of copper and the staybolts are all of manganese bronze. The smokebox has a length of about 6 ft. and has a flat netting extending across the whole of its upper portion, set at a height of 11 in. above the axis of the boiler. The exhaust nozzle is circular with a conical head and helical webs. The boiler is bolted at the front end to a steel casting that is, in turn, fastened to the central frame. The shell is fastened to the frame by two supports each formed of two vertical sheets bolted to Ts fastened to the boiler. These act in exactly the same way as the buckle plates that now form the approved method of carrying the boilers on American locomotives. The back end of the boiler rests upon a cast-steel bolster just over the truck pivot.

Owing to the length of the boiler and the method of supporting it, it has been necessary to design a special connection for uniting the shell to the firebox. For this purpose the side sheets of the latter have been extended out over the throat sheets to the back course of the shell, as shown in the engraving.

The dome is very low and contains not only the main throttle but the valve admitting live steam to the low-pressure cylinders. The two are in a single piece and serve to admit steam to both sets of cylinders through special pipes on the outside of the shell.

In case of the rear bogie truck, which has no side play beneath the frames, the steam pipe passes down through the center plate and through two vertical sleeves telescoping into each other. The upper sleeve receives the steam by way of two lateral pipes, and the lower one delivers it to two others that lead it to the cylinders. The joint between the sleeves is metallic and can be tightened when worn.

Steam passes from the high to the low-pressure cylinders through two side pipes, each of which connects the cylinders on one side of the machine, and at the same time forms the receiver. In order to permit of a relative side motion of the two bogies each pipe is fitted with an expansion joint and swinging connections, made with white metal surfaces.

Besides these pipes there is a transverse copper pipe connecting the low-pressure steam chests. The pipes carrying live steam to the low-pressure cylinders enter this pipe, which has a safety valve at each end set to open at a pressure of 92 lbs. per sq. in., a pressure that cannot be exceeded in the low-pressure cylinders. The steam escaping through these valves is led direct to the exhaust from the low-pressure cylinders.

The final exhaust passes through two reinforced rubber pipes to the center forward support of the boiler and thence directly to the exhaust pipe by passages cast in this support. The methods followed in the making of these rubber pipes leads to the expectation of a long life, and they possess the two-fold advantage of requiring only the very simplest of connections, and of being cheaper and lighter than metallic pipes. A similar arrangement will be tried for connecting the high and low-pressure cylinders.

The admission of live steam under a pressure of 92 lbs. per sq. in. to the low-pressure cylinders takes place through a steel pipe attached to the shell of the boiler and extended by a reinforced rubber pipe to the intermediate connection.

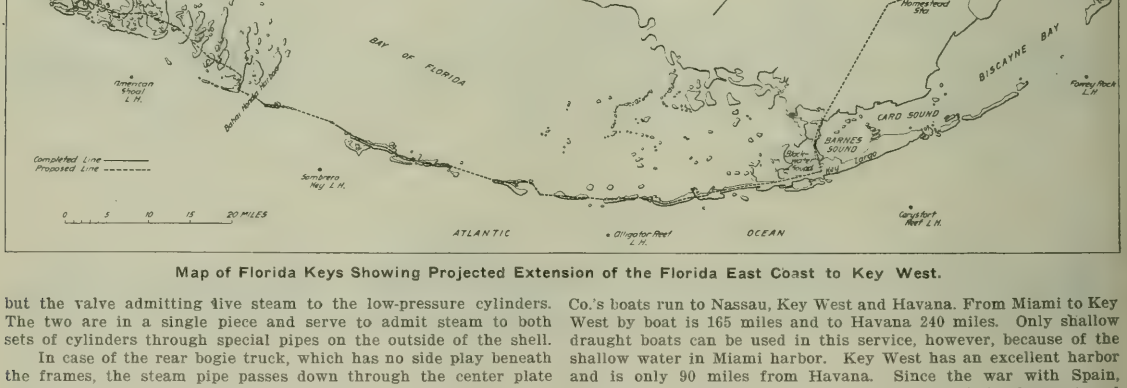
The screw reverse gear is used and is attached to the lifting shafts of both bogies. It can be turned by hand or by an air motor as desired. In the tests that have been made with this machine it has hauled trains of more than 800 metric tons (1,760,000 lbs.) up grades of 1.31 per cent. at speeds of 12.5 miles per hour.

The principal dimensions of these engines are as follows:

Boiler pressure	225 lbs.
Grate area	32.25 sq. ft.
Heating surface, firebox	128.89 "
" " tubes	2,400 "
" " total	2,528.89 "
Tubes—Number 130; type	Serve.
Tubes, outside diameter	2.75 in.
Tubes, length between sheets	15 ft. 7 in.
Boiler, inside diameter of shell	57.32 in.
Cylinders, diameter—H. P. 15.75 in.; L. P.	24.80 "
Piston stroke	26.77 "
Wheels, diameter, driving	57.28 "
Wheels, diameter, truck	33.46 "
Weight of locomotive (empty)	171,600 lbs.
" of locomotive (working order)	224,400 "
" on drivers (supplies exhausted)	158,400 "
Maximum theoretical tractive power (compound)	40,935 "
Maximum theoretical tractive power (simple action)	52,941 "
Tank capacity	1,200 gals.
Coal capacity	5½ tons.

The Florida East Coast Extension to Key West.

The project of Mr. H. M. Flagler, President of the Florida East Coast Railway, to build a railroad over the Florida Keys to Key West, after a number of years of careful estimate and study, has finally reached the stage of actual construction and grading is in progress on some of the northern islands over which the road will run. The present southern seaport terminus of the Florida East Coast is at Miami, from where the Peninsular & Occidental Steamship

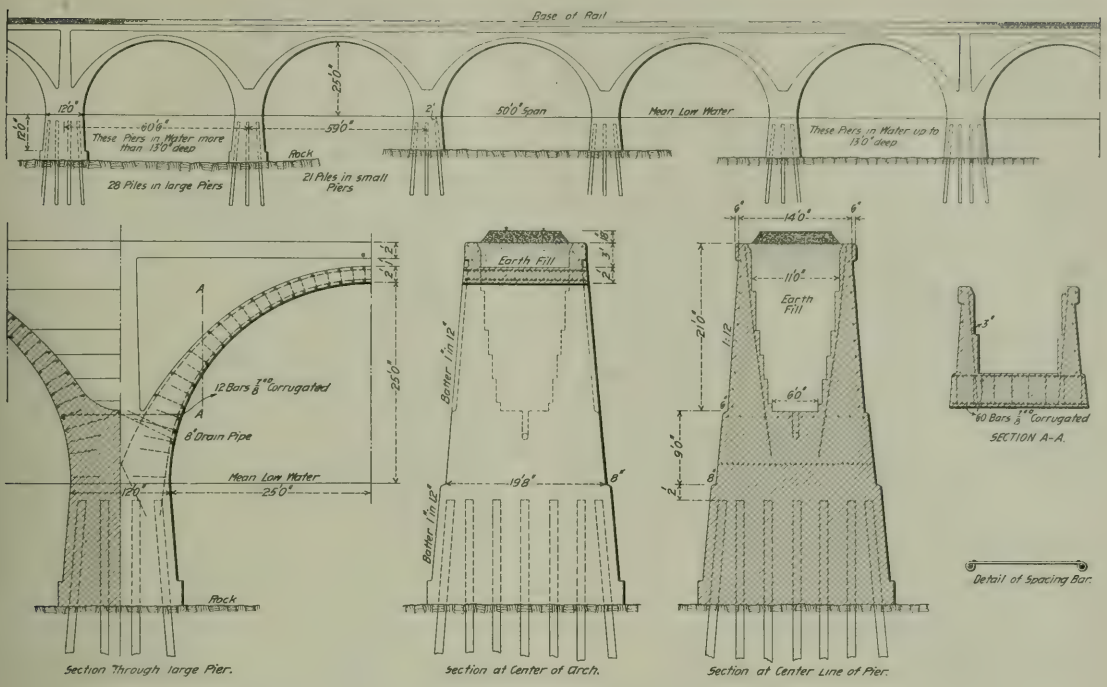


Map of Florida Keys Showing Projected Extension of the Florida East Coast to Key West.

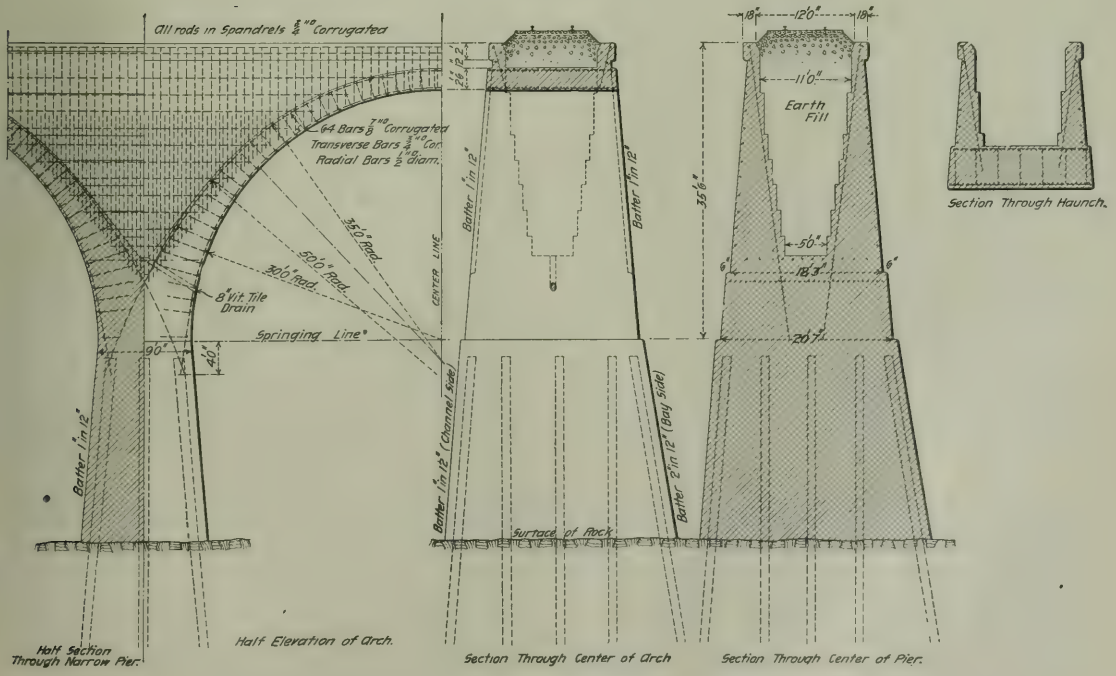
Co.'s boats run to Nassau, Key West and Havana. From Miami to Key West by boat is 165 miles and to Havana 240 miles. Only shallow draught boats can be used in this service, however, because of the shallow water in Miami harbor. Key West has an excellent harbor and is only 90 miles from Havana. Since the war with Spain, Cuba has experienced a tremendous commercial development and as a winter resort it has also become very popular. For these two reasons the new line, which promises to afford much better facilities for communication between Cuba and the mainland, seems to justify the hopes of its promoter as to future traffic.

The accompanying map shows the route of the projected road over the Keys from Homestead, Fla., the present terminus, 28 miles south of Miami, to Key West 126 miles. The long chain of islands extending out from the mainland has been made use of as far as possible, but only about 65 miles will be built on a natural foundation. The remainder of the line is to be built on rock embankments and reinforced concrete arch viaducts. Starting from Homestead the line runs southeast leaving the mainland at the crossing of Jewfish creek and on out onto Key Largo, the longest of the keys. For about 15 miles it runs through the center of this narrow island and then follows the line of the Keys out to Key West. Nearly 30 islands are used for short stretches. Where the intervening water is shallow, a rock embankment will be built, but where the water is deeper and the opening is exposed to storms by breaks in the outer reef, the concrete arch viaduct construction will be used. In the rock embankments there will be a number of 25-ft. openings to allow for the passage of row boats and small craft, and where the line crosses three important channels drawbridges will be put in to pass larger vessels.

The most difficult part of the work will be, of course, the construction of the concrete arch viaducts. There are four of these, aggregating 5.78 miles in length, as follows: From Long Key to



Details of Standard 50-ft. Reinforced Concrete Arch Spans for Key West Extension.



Details of 60-ft. Reinforced Concrete Arch Spans for Key West Extension.

Conch Key 10,500 ft., Knight's Key Channel 7,300 ft., Moser Key form of construction to be used is 50-ft. reinforced concrete circular arch spans and piers, but in some places 60-ft. spans will be used. The water is shallow in most places, from 10 to 30 ft. deep, and the bottom is limestone, but as these waters are frequently disturbed by severe and sudden storms much difficulty is looked for in placing the concrete. A further difficulty lies in the fact that all material, including the broken stone for the concrete, must be shipped by boat from Miami. A good quality of limestone is quarried near Miami and this will be used on most of the work.

The drawings show the details of the arches and the method of reinforcement. On account of the severity of the storms which prevail it will be necessary to firmly anchor the piers to the bottom to prevent shifting out of line. Piles will be sunk into the rock and carried up to within 2 ft. of the springing line of the arches. In the abutment piers which are to be put in at every fifth arch 28 piles are used and in the intermediate piers 21 piles are used. The arches are reinforced with circumferential square corrugated bars near the outside surfaces and with transverse bars which are tied together with ½-in. round radial bars. Earth filling will be put in between the spandrel walls and the ballast laid on top of this above the level of the concrete coping. This will bring the base of rail about 31 feet above the mean low water level. The estimated amount of material to be used in the concrete arches is 206,100 cu. yds. of sand, 286,800 barrels of hydraulic cement, 176,900 cu. yds. of stone and 4,810 tons of steel. A working base will be established at Bahia Honda Harbor, 40 miles north of Key West, where there is from 18 to 28 ft. of water and a good entrance channel. For construction work the following floating equipment will be used:

6 tugs.
1 stern-wheel steamer.
16 barges, 25 ft. x 100 ft.
24 barges, 30 ft. x 100 ft.
12 barges, 20 ft. x 80 ft.
1 sand dredge.
1 earth dredge for filling the concrete viaducts.
8 barges, 40 ft. x 70 ft., with concrete mixers and hoists.
8 pile drivers.
8 towing launches.
1 despatch boat.
4 quarter boats
100 dinghys.

Were it not for the commercial importance of Key West and the fact that a Government naval base has been established there, Bahia Honda would offer an excellent seaport terminus. It is 40 miles from Key West, but only 20 miles farther from Havana. The outside reef is broken by a wide, deep approach channel from the ocean and deep draught vessels could enter the harbor without danger. Pending the completion of the line from this point to Key West a temporary steamship service will probably be inaugurated to Havana.

At Key West extensive docks and terminals will be built. These will include a dry dock and 10 wharves, each 800 ft long and 100 ft. wide, with basins 200 ft. wide between. The 10 piers will furnish berths for 40 boats 400 ft. long, with a depth of water of from 20 to 30 ft.

Until traffic conditions warrant the establishment of a car ferry, a line of fast passenger and freight steamers will be operated between Key West and Havana, to which all freight will be transferred from the railroad. It is the ultimate intention to put in service a car ferry having a capacity of 30 cars, which will also have accommodations for passengers, and which will make the trip of 90 nautical miles in from 4½ to 5 hours. While the railroad, even after the car ferry is put in service, can hardly expect to compete with the steamers from Havana to New York and New Orleans in heavy through freight traffic, it is expected that a large proportion of the passenger, fast freight and express traffic between Cuba and the United States will be secured.

The construction work is in charge of Mr. J. C. Meredith, Constructing Engineer. It is hoped to have the line completed and in operation in about three years. The estimated cost is between $10,000,000 and $12,000,000. We are indebted to Mr. Flagler for the information and the drawings.

The Austrian State Railroad authorities have issued new regulations providing for a stricter physical examination of employees, especially with regard to their hearing and vision. Locomotive engineers, firemen, trainmen, switchmen, signalmen, track watchmen and car inspectors must have perfect normal vision (6/6 by the Snellen system) in both eyes; station men and other track men are to have the vision indicated by 6/9—not quite perfect; and in both cases without spectacles. Near-sighted men will not be eligible for out-door service. Methods for testing the hearing are prescribed and also the eyes for color-blindness. Tests must be repeated every five years until the age of 45, and after that every three years until 60; then every two years. A considerable degree of far-sightedness is permissible.

Mr. Fink on Federal Rate Legislation.

Mr. Henry Fink, Chairman of the Board of Directors of the Norfolk & Western Railroad, has issued a book on rate regulation, which is noticed on the editorial page of this issue. Mr. Fink's suggestions as to what legislation is necessary and practicable are as follows:

1. The most important legislation that is needed, is an amendment of the Anti-trust Act that will restore to the railroads the right to organize efficient traffic associations for the purpose of establishing and strictly maintaining reasonable rates, and to co-operate with the Interstate Commerce Commission in the enforcement of the laws which prohibit unjust discrimination.

An amendment of the fifth, or anti-pooling section of the Act to Regulate Commerce, so as to permit so-called pooling, is no longer necessary, if it were practicable.

2. If the railroads are unable to deal with the private car lines, Congress should bring these lines under the jurisdiction of the Act to Regulate Commerce and the Elkins Act; and it should also strengthen the present laws by amendments specifically covering all devices for paying rebates, including the allowances made to private sidings, switches, etc.

3. To bring water routes under the jurisdiction of the Commission, as suggested in the President's message, would be a serious legislative mistake. These routes should be left untrammeled by any Government regulation.

4. Good results would follow a reorganization of the Interstate Commerce Commission. The number of members should be increased from five to seven, as provided in the Townsend Bill. But the appointments should be made with a view to the qualifications that are essential in the discharge of their duties, rather than from political considerations. For example—three of the members might be railroad men, three lawyers, and one a business man. Four members, say, two lawyers and two railroad men, should be appointed for life, or during good behavior—the remainder for six years, as under the present law.

5. The Commission should be relieved of the duty of acting as detectives and prosecuting attorneys, and also of the work connected with the safety appliances acts: and its work should be confined to the investigation and decision of cases that come before it.

6. As legislation in this country is responsive to public sentiment, the most important element of success in the effort to regulate rates, is a better understanding by the public of the railroad problem. I would suggest, therefore, that Congress order the reprinting and distribution of a new edition of the Report of the Senate Select Committee of Jan. 18, 1886, together with the forthcoming Report of the Senate Committee on Interstate Commerce, of the Fifty-eighth Congress.

Signal Lenses.

BY A. G. WILSON.

The moulded glass lens used in railroad signal and switch lamps seems to have been a subject attracting little attention, taken for granted and passed by. A lens is to refract the light striking its surface from a given source and project it into the direction from which it is to be observed. Since these lenses have to do duty in all kinds of weather, they should be as efficient as they can be made. The adoption in recent years of lamps burning less oil and the consequent diminished amount of light adds to the importance of this consideration.

Lenses as now applied to railroad lamps are of the Fresnel type, having their corrugated, or stepped surface on the side of the lens next to the source of light. These lenses have three, four and five steps, most of them but three. The reason for the change from three steps to four and five steps is the same as for changing from a plane convex or double convex lens to one having three steps, namely, greater accuracy in design. The improved form gives much less aberration, and the reduction in the thickness of the glass reduces the amount of light absorbed. It is also easier to produce in accurate form.

A plano-convex lens used for this purpose would be very thick and heavy because of being so short in focus compared to its diameter, and would have an aberration so great as to make part of its area of little value.

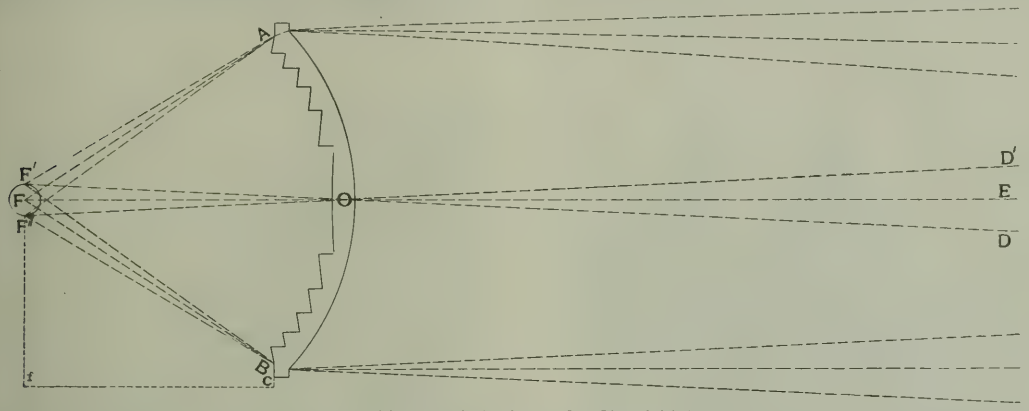
The lens illustrated in Fig. 1 is of the five-step design, and it "can be filled by a very small source of light." In other words, if we place a small flame in the principal focus of this lens and then take a position on its axis about 100 ft. from its face we shall see every step in the lens illuminated, and therefore projecting the light in the direction from which it is to be observed. Should the lens, when so observed, exhibit wide dark concentric rings, crescents or spots, they are evidence of defect either of design or workmanship.

If, with a source of light as small as, or smaller than the

diameter of the flame of the lamp in which the lens is to be used, the illumination of the lens be found perfect, the lens will give satisfactory results in service. The smaller the source of light used in any test of illumination, the more severe will be the test; and a lens giving a good illumination with a small source of light may be assumed to have been accurately designed and skilfully made.

Precise tests ought to be made to determine the actual value of lenses of three, four and five step designs when observed at a distance of half or three-quarters of a mile. Such a test would settle the question of the number of steps. They should be conducted with both a flat wick burner and also with the round burner used in the long-time lamps. After the most suitable form of lens is determined, we have for consideration the most suitable diameter.

In Fig. 1 let us assume, first, that the angle A F B is as large as is desirable, for there is a practical limit to this angle in the design of a lens. Let the lens be so designed that its principal focus falls at, or near, the center of a circular flame, and also let us assume that the lamp is so made that the fount is held in a fixed position and that the distance f c from the center of the flame to the face of the lamp against which the lens rests, conforms closely to the dimension given on the rim of the lens indicating the distance from the plane of the rim to the focus. This being the case, all light from points at a greater distance from the lens than the distance f c will converge to points on the axes after passing through the lens. These points of convergence become farther from the lens and approach infinity as the point from which the light emanates approaches the point F, when, if we disregard aberration, the light passing through the lens from



The Flame and the Lens of a Signal Light.

point F leaves the face of the lens in parallel rays. Light from any point in the focal plane as at points F′ or F″ will be parallel to the secondary axes F′D and F″D′. Therefore, as long as the source of light has dimensions, we shall still have some light converging along the axes and forming a pencil, which when it strikes the eye of the observer, conveys not only the impression of light, but also of magnitude, because the rays are converging. Light from a source less than the distance f c will diverge after passing through the lens and spread over a considerable area, giving a wider range of vision for an observer.

A question frequently asked is as to the angle within which an observer may stand and be able to see the light clearly. Since the lens gives the maximum effect with its principal focus at the center of the flame, we can say with perfect safety that the diameter of the field of light at any given distance from the lens depends on two factors, the distance F O and the diameter of the light, as follows: The horizontal diameter covered by the projected light at the distance O E from the lens will be equal to $\frac{O\ E}{F\ O}$ × diameter of flame. Therefore, if at any required distance O E the light does not cover sufficient area and is more brilliant than is needed, we can substitute a lens of smaller diameter in which the angle A F B is the same as before and the distance O F will be shorter. The angle A F B being the same as before, we shall get the same amount of light that we did before, but $\frac{O\ E}{F\ O}$ × diameter of flame will be greater, therefore the light will be spread over a greater area than before, but no portion of this area will be as brilliantly illuminated as before.

Suppose, on the other hand, that in the case first considered the light is spread over a greater area than is desired and that we would prefer it more brilliant, we take a lens whose diameter is greater, keeping the angle A F B the same as before, and have the distance F O greater; and $\frac{O\ E}{F\ O}$ × diameter of flame will be less than before, therefore the area will be more brilliantly illuminated.

If we take two cases in which the quotients of $\frac{O\ E}{F\ O}$ × diameter of flame are 9 and 10 respectively, the light striking the eye of the observer will be 24 per cent. greater in the former case than the latter. If the area of illumination obtained by this method is sufficiently great, and the illumination more intense than is desired, we may substitute a lens of smaller diameter but whose focal distance F O is the same, and obtain the desired results. The lens of larger diameter will give to the observer the impression that the source of light is greater because the angle of the pencil of light entering the eye is greater. However, the difference between lenses of equally good design of 4 in. diameter, 4⅛ in. diameter, and 4$^{3}/_{16}$ in. diameter would hardly be distinguishable; nor between 5 in. diameter and 5⅜ in.; or 6 in. and 6⅜ in.; or 8 in. and 8⅜ in. The lenses of commerce do not conform strictly to the theoretical angle A F B, but they come so close to it that there is little, if any, practical difference in them.

A number of railroads—few or many—having like interest, that is an interest in uniformity, could do much good by deciding, once for all, the most suitable diameter and focus of lens to use with a given size of flame. Then, by proper inspection and care to see that the lamps and lenses conform to these requirements, uniformity would be accomplished. Until recent years there has been a great discrepancy in pressed glass, but it is now possible to obtain lenses which could hardly be improved except by grinding.

Fixing the diameter of the lens as above noted, makes it a standard diameter and focus for all lamps. The use of anything larger than is actually needed is a useless expense. Once the size of lens is fixed, the size of glass for the semaphore is fixed, and uniformity can then be secured, giving the desired results at minimum expense.

Railroad Law Cases Decided in September.

The following abstracts cover cases decided by the United States Supreme and Federal Courts in August:

Railroad Aid Bonds.—A provision of the Nebraska constitution makes registration of railroad aid bonds by the State Auditor a condition of their validity, without which they are unenforceable though authorized by the voters and issued by the proper authorities. In a recent case it developed that the auditor refused registration on the ground that the proposition to issue the bonds was submitted in the alternative; that is, they were to be issued to either one of two roads which first complied with the conditions of the proposition voted upon, and, consequently, in his view there was uncertainty as to the identity of donee of the bonds. The Supreme Court of the state upheld the auditor's action, and the Federal Court in this case refused a holder of the bonds any relief on the ground that having waited more than 20 years to invoke the aid of the court he had lost any right open to him had he acted with diligence. Frank vs. Butler County, Nebraska, 139 Federal Rep. 119.

Limited Liability—Bills of Lading.—A shipper of goods under a contract limiting the liability of the carrier for loss by fire based on a reduced rate, who did not request the carrier to furnish a rate without such a condition, cannot, after a loss has occurred, disregard the condition and recover the value of the goods lost on the ground that he did not believe that the rate would have been conceded if he had asked for it. Arthur vs. Texas & Pacific Railway Co., 139 Federal Rep. 127.

Railroad Bridges Over Navigable Waters.—The lawfulness of

the Pittsburg, Fort Wayne & Chicago bridge over the Allegheny river is the subject of a recent Federal Court decision. The bridge was built under a State legislative grant which antedated the congressional act assuming control of navigable waters. The court holds that the authorization was sufficient and was not affected by the later Federal statute, and that the original grant being sufficient, carried with it the right to reconstruct the bridge when necessary without asking the consent of Congress. This conclusion was necessary to the decision of a case where a steamboat was injured by collision with piles used in the reconstruction of the bridge, the vessel owners contending that the bridge was an illegal structure. Rogers & Co. vs. Pittsburg, Fort Wayne & Chicago Railway Co., 139 Federal Rep. 7.

Special Stock Trains.—The well-grounded rule of courts that a written contract cannot be varied by other testimony is applied to a shipping contract, and it is concluded that where the contract for transportation of cattle is silent as to the time and manner of transportation, that it can be shown that it was customary to furnish an independent train for the transportation of stock amounting to ten cars or upward when demanded. In other words, the case stated did not violate the principle. Northern Pacific Railway Co. vs. Kempton, 138 Federal Rep. 992.

Railroad Shop Tools.

MILLING MACHINES.

(*Continued.*)

The accompanying illustration, Fig. 1, shows a 32-in. x 26-in. x 10-ft. planer-type milling machine made by the Becker-Brainard Milling Machine Co., Hyde Park, Mass. This machine is of a new design and is of heavy construction. The spindle is made of hammered crucible steel, 5 in. in diameter. It has a threaded nose and runs in self-centering bronze boxes, which are fitted with nut and

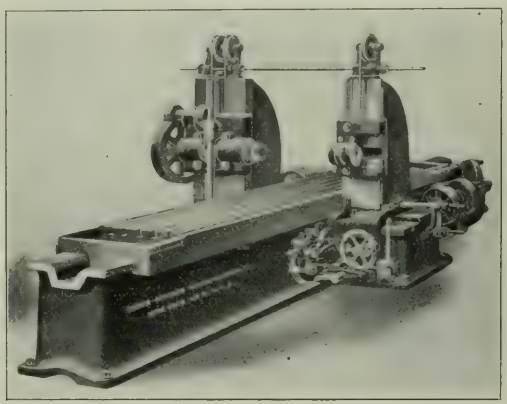


Fig. 1—Becker-Brainard Planer-Type Milling Machine.

check nut to compensate for wear. The spindle carrier is heavy and is held firmly to the upright by long gibs. It is elevated by a screw with adjustable dials graduated to thousandths of an inch and has counterbalance for ease of operation. The spindle is driven by a 5-in. belt on a five-step cone, the largest step of which is 23 in. in diameter and the smallest 13 in. in diameter, giving gear ratios of 13½ and 27 to 1, thereby allowing 20 changes of speed. By means of a hand lever and quick change gearing, the speed is easily adjusted. The table is made with five longitudinal T slots and is provided with an oil channel its full length and at each end. It travels on flat ways securely gibbed and has a quick return operated by power from a separate countershaft. It can also be moved by the usual hand wheel. The feed of the table is directly operated through gearing from the main driving cone, giving a range of feed through eight changes from $^{2}/_{44}$ in. to ⅜ in. These changes of feed can be made by a lever, without stopping the machine. The head may be adjusted from either side of the machine, so that it is not necessary to take the cutters off the arbor in order to change their position in relation to the work. The bed is extra deep, extending to the floor and making a solid foundation. It is securely braced by heavy cross girders which are evenly spaced throughout the entire length. The bed can be made any length desired. The principal dimensions of the machine are as follows: Working surface of platen, 120 in. x 26 in.; length of bed, 168 in.; longitudinal feed, automatic in both directions, 120 in.; maximum distance from center of spindle to table, 28 in.; minimum distance from center of spindle to table, 2 in.; greatest distance from end of spindle to center of table, 16⅜ in.; shortest distance from end of spindle to center of table, 6¾ in.; greatest distance from end of spindle to tail stock spindle, 37 in.; least distance from end of spindle to tail stock spindle, 17 in.; net weight, 25,000 lbs.

These machines can be fitted with motor drive when desired, in which case the motors are conveniently located in the rear of the machine and out of the way of the operator. They are secured

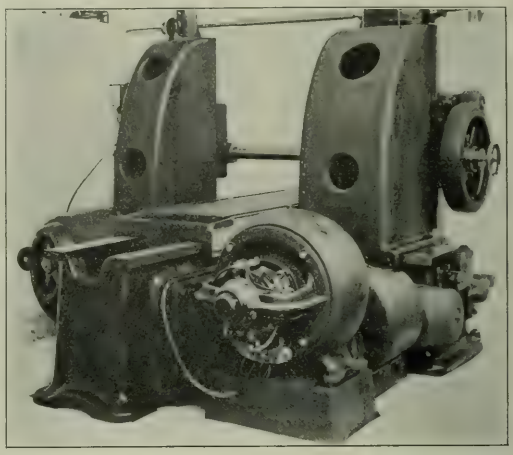


Fig. 2—Becker-Brainard Heavy Planer Type-Milling Machine With Motor Attached.

to a special base by means of four bolts, as shown in Fig. 2, and the controller is then placed in a convenient position on the outside of one of the uprights.

Fig. 3 shows a horizontal spindle milling machine made by the Beaman & Smith Co., Providence, R. I. This machine is used to a large extent in milling keyways in locomotive axles. It has but one spindle, which is carried in a vertically adjustable cross-head. The spindle is also provided with horizontal adjustment and a tapered hole for holding cutter shanks and arbors. The table is provided with automatic feed its full length, and the working surface of the table is surrounded by a trough to collect the lubricant. From the trough the lubricant runs into a tank and is returned to the cutters by a pump. The table has a working surface of 14 in. wide by 8 ft. long. The spindle is 2⅜ in. in diameter and has a horizontal adjustment of 1 in. The maximum capacity of this machine between uprights is 19 in. The maximum distance from the center of the spindle to the top of the table is 20 in. and the minimum distance is 3 in. Cutters up to 8½ in. in diameter can be used. The power is transmitted through gearing having a ratio of 6:1. The cone pulley has three steps ranging from 14 in. to 20 in. in diameter, and is driven by a 3½-in. belt. The countershaft has one tight and one loose pulley 18 in. in diameter for a 4½ in. belt, and it should run at 200 r.p.m. The machine complete weighs about 10,000 lbs.

(*To be continued.*)

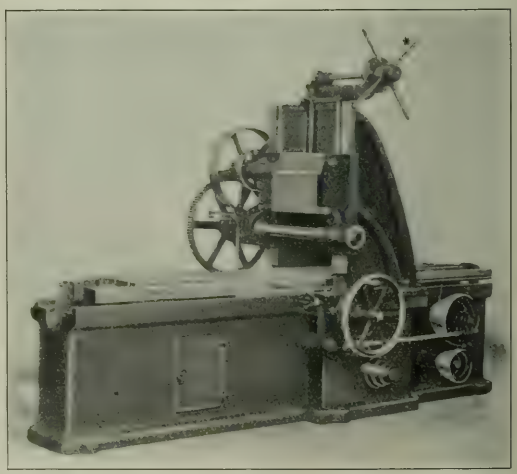
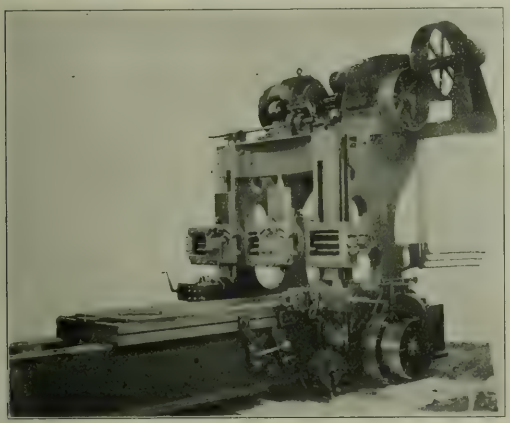


Fig. 3—The Beaman & Smith Horizontal Spindle Milling Machine.

A New 48-in. Variable-Speed Motor Driven Planer.

The accompanying illustration shows a 48-in. variable speed motor-driven planer made by the Cincinnati Planer Co., Cincinnati, Ohio. This machine is of an entirely new design throughout and contains several noteworthy features. It is driven by a constant speed motor, and by means of a speed box is arranged to furnish six cutting speeds ranging from 22 ft. to 51 ft. per minute, with a constant return speed of 80 ft. per minute. The changes in cutting speeds can be made either while the machine is in operation or standing idle by means of the three levers shown at the right in the photograph. The gears in the speed box are of steel and are completely encased in a cast-iron box, which holds several gallons of oil. This oil is also used for lubricating the bearings; the gears carry it to the top of the box, and it passes into the various oil chambers which have openings at the bottom, allowing it to drain back after encircling the shafts, and thus keeping a constant flow of oil on all the revolving parts and reducing the wear and noise to a minimum. The beds are made of extra length, so that there is very little overhang of the table when planing at full stroke. The V's are also made much wider than usual. The tables are deep, and have a set of dogs and a complete shifting mechanism on each side. The housings are carried down to the floor, and in addition to the usual bolts and dowel pins are secured to the bed by a long tongue and groove. The cross rail has a very large bearing on the housings, and is strengthened by an arch-shaped brace at the back. The heads are of a new shape, the end of the tool block and slide being made round to avoid projecting corners on angular work. They are provided with taper gibs and the slides are hung on ball bearings. An automatic tool lifting device is also furnished, which is not shown in the illustration. The side heads are controlled by handles which travel up and down with them, and are therefore always convenient to



The Cincinnati 48-in. Variable-Speed Motor Driven Planer.

the operator. These side heads are similar to those used on the cross rail, are very rigid, and may be run below the level of the top of the table when not in use. The cross rail is raised and lowered by means of the patent power lifting device, which was described in detail some time ago. The driving pulleys have been increased in width, and are furnished with oil reservoirs, which insure their being properly oiled with a minimum amount of attention. The pulley shaft, which is the only high-speed shaft in the machine, is made ring oiling and has Lumen bronze bearings.

The Wabash as a Competitor of the Missouri Pacific.

In reply to a published statement that if the Wabash should cease to be a Gould road, it would get no more traffic out of Chicago than it is now getting and would lose a large amount of business that now comes to it at Kansas City and St. Louis, Mr. Ramsey has written a letter in which he says: "The Missouri Pacific gives practically nothing to the Wabash at Kansas City; on the contrary, the Missouri Pacific is the sharpest competitor the Wabash has between St. Louis, Kansas City and Omaha; and it has a great advantage over the other competitors of the Wabash by having its traffic head also in control of Wabash traffic. The Rock Island, the Santa Fe, the Union Pacific and the Kansas City Southern were all formerly the close allies of the Wabash at Kansas City, for St. Louis and other traffic, which traffic and friendly relations the Wabash has lost, since it is supposed by these lines to be dominated by Missouri Pacific interests. The Frisco; Missouri, Kansas & Texas and Rock Island all reach St. Louis, and whereas the Wabash formerly received a goodly portion of the traffic of these lines for eastern points at St. Louis, they now favor the lines competitive with the Wabash, because the other 'Gould lines' west of St. Louis are competitive with them. The Missouri Pacific and Iron Mountain can deliver traffic to the Wabash only at St. Louis, and if they delivered all their traffic at that point to the Wabash for eastern points, it would help somewhat to make good the loss from other lines; but the Missouri Pacific works quite closely with the other strong eastern lines—the Big Four, Vandalia, Baltimore & Ohio, and others—in order that the Missouri Pacific may get some of these lines' westbound traffic west. The Wabash is also a heavy loser in traffic at Chicago and Omaha on account of being a 'Gould line.' Every large western system and Pacific coast line reaches Chicago, and naturally they desire to bring their traffic to that point for the 'long haul.' The Missouri Pacific and Iron Mountain do not reach Chicago. The Wabash has a good line eastward from Chicago and, naturally, like all other Chicago-New York lines, looks to the lines west of Chicago for traffic—to the Santa Fe, Rock Island, St. Paul, Burlington, Union Pacific, Northern Pacific and Great Northern lines, etc.—but as all these lines are in direct, or, at least, indirect competition with the other Gould lines west, they 'throw down' the Wabash and turn to its competitors east, who are not in competition with them in the west. The traffic statistics of the Wabash will show, since the placing of all the 'Gould lines' under one traffic head, a great loss to the Wabash from other sources (and the records will not show all of it), and this loss would have been greater if I had not prevented the entire control of traffic passing from my hands. This was really the cause of the first difference between Mr. Gould and myself, and Mr. Gould not only admitted to me some four months ago that I was right in my views, and that the results during the two years had 'justified your (my) position,' but the traffic department of the Wabash has practically been divorced from the other Gould lines by Mr. Gould's own action in the last three months. When I declined to let Wabash cars be taken from our good paying local traffic to go into this joint Wabash-Missouri Pacific traffic, when the Wabash was losing money on it, I was advised by Mr. Bird that he was acting on Mr. Gould's orders."

Mr. Ramsey on October 2 filed a suit for an injunction in the Circuit Court at St. Louis, Mo., against the St. Louis, Iron Mountain & Southern and the Wabash railroads and George J. Gould and others. He asked the court to grant him an injunction restraining the defendants from holding the proposed annual meeting at Toledo, October 10, on the ground that one result of this meeting would be to stifle competition in traffic between the Wabash and Missouri Pacific, between St. Louis and Kansas City. The ownership of parallel and competing railroads by the same interests is forbidden by the constitution of Missouri. (See also editorial columns.)

The Twenty-Fourth Annual Meeting of the American Street Railway Association and Affiliated Associations.

The twenty-fourth annual meeting of the American Street Railway Association and its affiliated associations, which include the American Railway Mechanical and Electrical Association, the Street Railway Accountants' Association of America and the American Association of Street Railway Claim Agents, was held in the Philadelphia Museum, Philadelphia, Pa., Sept. 25 to 30. The third annual meeting of the American Railway Mechanical and Electrical Association was held Sept. 25 and 26. President C. F. Baker, Superintendent of Motive Power and Machinery, Boston Elevated Railroad, called the meeting to order and introduced Hon. John Weaver, Mayor of Philadelphia, who made a brief address in which he welcomed the Association to the city. Following Mayor Weaver, President Caryl Ely, of the American Street Railway Association, spoke to the members in regard to the reorganization and betterment of the Street Railway Association, and also referred to the interesting and well arranged exhibits displayed by the various members of the American Street Railway Manufacturers' Association in the exhibition room of the museum. President Baker then made his annual address, after which the following papers and reports were read: "Power Distribution," by C. H. Hile, Superintendent of Wires, Boston Elevated Railway Company, Boston, Mass.; "The Power Station Load Factor as a Factor in the Cost of Operation," by L. P. Crecelius, Chief Electrician, The United Railways Company, St. Louis, Mo.; report of the committee on "Controlling Apparatus," by J. S. Doyle, Chairman, Master Mechanic, Interborough Rapid Transit Co., New York, N. Y.; report of the Committee on Way Matters, "Welding of Rail Joints," Chairman, F. G. Simmons, Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; report of the Committee on "Maintenance and Inspection of Electrical Equipment," Chairman, William Pestell, New York, N. Y.; "The Power House," Fred N. Bushnell, Chief Engineer, The Rhode Island Company, Providence, R. I.; "The Track Brake," by F. F. Bodler, Master Mechanic, The United Railroads of San Francisco, San Francisco, Cal.

The American Street Railway Association's twenty-fourth an-

nual meeting was held Sept. 27 to 28. The meeting was opened with an address by President Ely. The Secretary and Treasurer, Mr. T. C. Pennington, reported a total membership of 206, and stated that the cash on hand up to Sept. 15, 1905, was $6,732.20. Mr. Pennington concluded his report by stating that probably this would be the last year that he would serve the Association as its Secretary inasmuch as the Executive Committee desired a technical man and a man who could devote his entire time to the office. At the conclusion of the Secretary's report the following papers were read: "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," Arthur West, Westinghouse Machine Co.; "The Application of Gas Power to Electric Railway Work," J. R. Bibbins, Westinghouse Machine Co.; "Single-Phase Railway System," Chas. F. Scott, Westinghouse Electric & Manufacturing Co.; "Electric Railway Equipment," W. B. Potter, General Electric Company; address on Organization, Henry L. Doherty, National Electric Light Association; remarks on Diesel Engine, Mr. E. D. Meier, American Diesel Engine Company.

The annual convention of the Street Railway Accountants' Association of America was held Sept. 28 to 30, inclusive. A number of interesting papers were read, a partial list of which follows: "The Cost of Carrying a Passenger," C. L. S. Tingley, Second Vice-President, American Railways Company, Philadelphia, Pa.; "Interurban Fare Collections," Irwin Fullerton, Auditor, Detroit United Railway, Detroit, Mich.; "Interurban Ticket Accounting," J. H. Pardee, General Manager, Rochester & Eastern Rapid Railway, Canandaigua, N. Y.; "Accounting with Four Departments," H. M. Beardsley, Secretary and Treasurer, Elmira Water, Light and Railway Company, Elmira, N. Y.

An important feature of this year's American Street Railway Convention was the adoption of the new constitution and by-laws by practically a unanimous vote. The name of the Association hereafter will be the "American Street and Interurban Railway Association," and its headquarters will be in the City of New York. The Association will do all in its power to promote the welfare of its affiliated associations, or other associations organized with its approval to investigate technical matters connected with street and interurban railway construction and operation.

Among the exhibits at the convention were the following:

Adams, Westlake & Company, Chicago.—Signal lamps, lanterns, head lights and car trimmings.

Allis-Chalmers Co., Milwaukee.—Reception room and photographs of various departments of its works.

American Brake Shoe & Foundry Co., New York.—Brake shoes for electric railway and steam road service.

American Car & Foundry Co., New York.—One of 134 all-steel electric passenger cars made for the Long Island Railroad. Total weight of car 67,600 lbs.

American Locomotive Sander Co., Philadelphia and Chicago.—Pneumatic track sanders for both steam and electric roads.

American Railway Supply Co., New York.—Merchandise checks, conductors' and trainmen's badges, buttons, metal plates, etc.

Atlas Railway Supply Co., Chicago.—Complete line of "Atlas" braces, tie plates, step joints, insulated joints and straight track joints.

Baldwin Locomotive Works, Philadelphia, Pa.—Electric trucks for heavy street car service; also an electric truck built for the South Side Elevated Railroad Co., Chicago. Track exhibit of an electric yard engine built for the Yale & Towne Mfg. Co.

Baltimore Railway Specialty Co., Baltimore, Md.—Ball-bearing center and side bearings.

J. G. Brill Company, Philadelphia, Pa.—One of 200 electric street cars built for the Chicago City Railway Company; Brill's patent semi-convertible street car built for the United Railways & Electric Co., of Baltimore; and a Brill's patent convertible "all-year round Car;" also a No. 23 freight car truck and a No. 27-E-2 truck with solid forged frames; also a steel street car for the New York City Railway Co.

Buda Foundry & Mfg. Co., Chicago.—Paulus track drill with special spindel and chuck fitted with a "Rich" high-speed bit; Buda track drills, switch-stands, car replacers, ratchet, friction and ball-bearing jacks, track signs, switch clips, switch rods, rail braces, insulated rods and stub-switch fixtures.

Bullard Automatic Wrench Co., Providence, R. I.—The Bullard automatic pipe and nut wrench.

Chicago Pneumatic Tool Company, Chicago.—Duntley electric drills, Keller & Boyer pneumatic hammers, "Little Giant" and Boyer piston drills, Keller rotary drills, pipe-bending machines, and air forges.

Consolidated Car Heating Co., New York.—Direct steam and hot water car heating systems.

Continuous Rail Joint Co., of America, Newark, N. J.—Samples of rail joints.

The Curtain Supply Co., Chicago and New York.—Curtains for both open and closed cars, fitted with Acme, Climax, Forsyth, Burrowes, Keeler pinch-handle and eccentric, and a new type of open car ring fixtures.

Dilworth, Porter & Co., Ltd., Pittsburg, Pa.—Descriptive matter and samples of "Goldie's" claw and "Perfect" tie plates; also the Glendon flange tie plate and samples of spikes.

The Joseph Dixon Crucible Co., Jersey City, N. J.—Graphite lubricants, lead pencils, graphite paint, etc.

Dressel Railway Lamp Works, New York.—Signal lamps, long-burning founts and semaphore lamps—all steel.

The Duff Mfg. Co., Pittsburg, Pa.—Barrett motor armature lifts (two types); Barrett jacks and the Duff roller bearing screw jacks.

The O. M. Edwards Co., Syracuse, N. Y. Car window and curtain fixtures; also platform trap doors.

The Electric Storage Battery Co., Philadelphia, Pa.—Chloride accumulators, including one of the type of cells installed at the Hammel substation for the electrification of the Long Island Railroad; also a New York Central type of cell which will be used in the substations, and which will have a total capacity of 20,000 h. p. per hr. A new type of regulating booster with the "Entz" carbon regulator; a pilot cell fitted with a displacing tank, an automatic cell filler, signaling hydrometer, recording hydrometer and compensating hydrometer; also special batteries and switchboards.

The Electro-Dynamic Co., Bayonne, N. J.—A 5-h. p. 550-volt "Inter-Pole" reversible variable speed motor, with a speed variation of 350 r. p. m. to 1,400 r. p. m., belt connected to a 5-h. p. "Inter-Pole" generator acting as load.

Franklyn Railway Supply Co., Franklyn, Pa.—The Western water-jacket car heater.

Galena Signal Oil Co., New York.—Samples of oil for electric railway use; also large reception room.

General Electric Co., Schenectady, N. Y.—Alternating and direct-current car equipment, as applied to four a.-c. and d.-c. 75-h. p. railway motors mounted on two of Brill's No. 27-E-2 trucks fitted with G. E. Co.'s air brakes; type "M" automatic train control equipment; two G. E. 69,200 h. p. railway motors, which have been in service on the New York Subway for about one year, one of them having run 45,248 miles, and the other 53,005 miles; a 500-k. w. Curtis steam turbine and two 30-ampere mercury arc rectifiers.

Goldschmidt Thermit Co., New York.—Samples of rails welded by the Goldschmidt Thermit process; also demonstrations of rail-welding.

Gould Storage Battery Company, New York.—Several types of stationary and portable battery plates; also an "S" 49 element in an "S" 49 lead-lined tank; also photographic views of a number of recent installations.

Indianapolis Switch & Frog Co., Springfield, Ohio.—Descriptive matter only.

Johns-Manville Co., H. W., New York.—All types of fuses; asbestos boiler and pipe coverings and asbestos packing; also "Transite" and "Electrobestos;" electric car heaters, third-rail insulators, underground fuse and service-boxes for lighting systems, and a full line of trolley material.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.—The "Root" track scraper, and Kalamazoo track jacks and gages.

David Lupton's Sons Co., Philadelphia, Pa.—Lupton's fireproof automatic windows for buildings.

Manning, Maxwell & Moore, New York.—Injectors, safety valves, Hancock inspirators, valves, gages, indicators, etc.

Miller Anchor Co., Norwalk, Ohio.—The Miller anchor for railroad wrecking purposes.

The National Brake Co., Buffalo, N. Y.—The "Peacock" hand brake for both steam and electric equipment.

National Lock Washer Co., Newark, N. J.—Samples of the "National" lock washers; also several types of window and curtain fixtures.

Oliver Machine Co., Grand Rapids, Mich.—Wood-working and pattern shop machinery.

The Pantasote Company, New York and Chicago.—Pantasote curtain materials.

Pennsylvania Steel Co., Philadelphia, Pa.—Spring rail frog, split switch, switch point-locking device, reinforced split switch with adjustable connecting bar; "New Century" adjustable and non-adjustable switch stands and the "New Era" switch stand.

Philadelphia Rapid Transit Co., Philadelphia, Pa.—Showing the various stages of the construction of its standard track work as used on heavily traveled streets; also special trolley poles made by the Standard Tube Co., of Pittsburg.

Pressed Steel Car Company, Pittsburg, Pa.—An all-steel electric surface car built for the New York City Railway Co.

The Railway Journal Lubricating Co., Chicago.—The Economy lubricator and dust guard.

Standard Railway Track Appliance Co., Kalamazoo, Mich. (successors to Merrill-Stevens Mfg. Co.).—Track and car jacks, cattle guards and the "Cook" collapsible third-feed rail drill.

Standard Steel Works, Philadelphia, Pa.—Cast-steel wheels and gear complete as furnished to the Interborough Rapid Transit Co., New York; also mounted rolled steel electric truck wheels.

The T. H. Smyington Company, Baltimore, Md.—Journal boxes.

The A. G. Stiles Anti-Friction Metal Co., New Haven, Conn.—The "Stiles" patent car journal bearings and anti-friction metals.

The Sherwin-Williams Co., Cleveland, Ohio.—Samples of paints and varnishes; also a large display of sample boards demonstrating the use of surfacers, colors and varnishes.

John Simmons Co., New York.—Steam separators, iron pipes, and pipe fittings.

The Standard Paint Co., New York.—Ruberoid roofings, Ruberoid motor cloth, P. & B. insulation, P. & B. electrical compounds, S. P. C. flexible iron paint and "Rexite" metal preservative paints and P. & B. insulating tape.

Underwood Typewriter Co., New York.—Various types of the Underwood visible typewriting machines.

The U. S. Metallic Packing Co., Philadelphia and Chicago.—Metallic piston rod and valve stem packing for all services, including both steam and gas engines.

The Weber Railway Joint Mfg. Co., New York.—Full-sized samples of the Weber rail joint for both steam and street railroad service.

The Westinghouse Traction Brake Co., Wilmerding, Pa.—A new automatic air brake equipment for handling a motor car and trailer, combining the advantages of automatic application and straight air-brake release. Straight air-brake equipment with automatic application on emergency and a combined straight and automatic air brake equipment for electric locomotives.

Westinghouse Electric Co., Pittsburg, Pa.—The Westinghouse multiple unit system of street car control, showing a complete car equipment operating 2 200-h. p. motors. M. T. lightning arrester with apparatus for subjecting it to static bombardment with either a. c. or d. c. line voltage, simultaneously impressed over the terminals.

Yale & Towne, New York.—Chain hoists and blocks, including duplex, triplex and electric, ranging in capacity from 1 to 20 tons.

C. G. W. Station Agents' Meeting.

A committee of employees of the Chicago Great Western has started a magazine called the *Maple Leaf Bulletin*, which, it is hoped, will find sufficient favor to become a permanent medium of communication between the men in different departments and on different divisions of the company's lines; and the first article in the first number is an abstract of the discussion which took place at a meeting of about a hundred officers and agents at Oelwein, August 6. We note some of the points brought out, Mr. C. T. Banks, Freight Claim Agent, being the principal speaker.

Of all the loss and damage claims presented, 44 per cent. are for less than $5; and 19 per cent. between five and ten dollars. This indicates that it is a great number of little things which makes the most trouble; the careless handling of packages; dropping them from cars to platforms; carrying perishable freight past its destination, etc. Of over-charge claims 67 per cent. are under $10; being due largely to careless weighing and improper classification. The annoyance caused to consignees in these cases may be more costly to the road than the money loss of settling the claims. Mr. Banks impressed upon the agents the necessity of promptly reporting errors and losses, especially damage to freight caused by improper loading or putting it into dirty cars. Freight carried past its destination should always be reported, even if it is at once returned. In five months Mr. Banks had paid many hundreds of dollars for losses on account of damage by snow and water getting into cars, largely through the end doors. He asked the agents if it would not be practicable to have fewer and smaller end doors.

Mr. Banks called attention to delays, sometimes resulting in claims, which had been caused by holding freight at junctions waiting for the connecting line to furnish a car. Another costly error was that of agents in failing to check shippers' errors in marking

tubs of butter. If a tub of creamery butter goes wrong and has to be sold without its trade-mark, it brings about five cents less a pound.

A New Car for the Canadian Government.

The accompanying illustration shows the car "Alexandra" which was recently delivered by Messrs. Rhodes, Curry & Co., Ltd., Amherst, N. S., to the Canadian Government. The car is for the use of the Governor General, and it is stated that the construction and equipping of it by the makers was more a matter of pride and patriotism than a money consideration. The design and specifications were furnished by S. King, formerly Master Car Builder of the Government railroads. The cross section shows that evidently the tunnel clearances in the United States and Mexico were considered in designing the general outline. The principal dimensions are as follows:

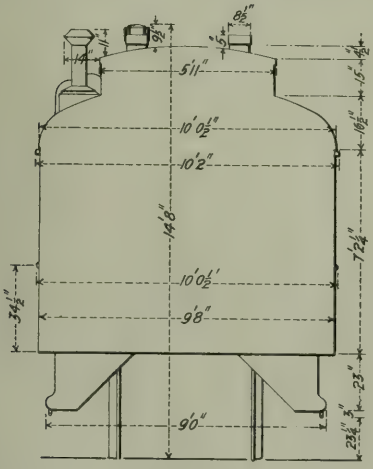
Length over platform	79 ft.	4½ in.
Length over end sills	72 "	0 "
Width over side sills	9 "	10 "
End sill to center of bolster	8 "	0 "
Bolster centers	5 "	0 "
Needle beam centers	10 "	6 "
Transom centers	30 "	8 "
Wheel base	10 "	6 "
Total wheel base	66 "	6 "

The special equipment includes: The Standard Steel Company's platforms; Westinghouse high-speed air-brakes; Tower couplers; National hollow brake-beams; Pullman system of water delivery; Electric Train Lighting Syndicate, Pintsch system of train lighting; the Baker double coil heating system with commingler; the O. M. Edwards sash balance and trap door fixtures; the Dayton Mfg. Company's platforms, rails and gates, and Miner tandem draft rigging.

The car is finished throughout with St. Jago mahogany. The corner post sheathing, window sills and sign boards being solid and finished in natural wood; the interior in mahogany veneers in marquetry with tulip and white holly. The head linings are of veneered whitewood, enameled and highly polished. The bedrooms, A, B and C, are fitted with all the modern appliances, including electric fans, curling irons, etc. All of the interior metal fittings are of heavy silver plate. The trucks are of the usual six-wheel type fitted with 36 in. wheels and with 4¼ in. x 8 in. journals. The total weight of the car is about 123,000 lbs.

The Canadian Government's New Car Alexandra.

General Plan of New Car for the Canadian Government.



Clearance Outline of New Car for the Canadian Government.

Record Discipline.

The following paragraphs are copied from a monthly bulletin recently issued by one of the Superintendents of the Galveston, Harrisburg & San Antonio, containing notes of discipline administered in the cases of 27 men. It will be observed that of the items which we quote, the first four are commendatory.

A conductor and crew found a bad order car in their train when leaving a terminal, and, to avoid delay, set the car out. The yard engine crew was at the other end of the yard working on another train and was unavailable for prompt service. For this commendable action, a conductor, two brakemen, engineer and firemen are given suitable credits. Such action as this is always appreciated and if brought to notice will always be recognized.

For assisting a yardmaster in setting out a car in a terminal yard, an engineer and fireman are each given suitable credits. In this case the switch engine had been turned in for the day, and a serious delay would have resulted had the engineer and fireman not acted promptly.

For discovering a leak in an oil pipe and taking prompt action in stopping it, an engineer and brakeman are given suitable credits.

For discovering and reporting a broken rail in a switch in a terminal yard, a brakeman has been given credits. This brakeman was not on duty at the time, and his action probably prevented a serious accident.

For standing at and unlocking a switch while a train was passing over it on the main line, a fireman of a light engine on a siding has been given 10 days' record suspension.

For reporting sick when called, a fireman has been given a record suspension of 10 days. Train and engine employees should arrange to notify the office in advance of their inability to go out, as failure to do so frequently results in delays of trains.

For failing to register their watches at terminals, four engineers have been given a record suspension of 10 days each.

An agent at an intermediate station has been reprimanded for not showing the proper interest in connection with a manifest load, set out at his station in bad order. While the conductor was primarily at fault, yet the agent is likewise to blame for the excessive

delay suffered by the car in consequence of his erroneous report.

A conductor in making a terminal register check for his engineer failed to include thereon the information that was necessary, causing a delay to his train, which caused the engineer to go back to check the register for himself. This being his first offence of this kind, the conductor is given a reprimand.

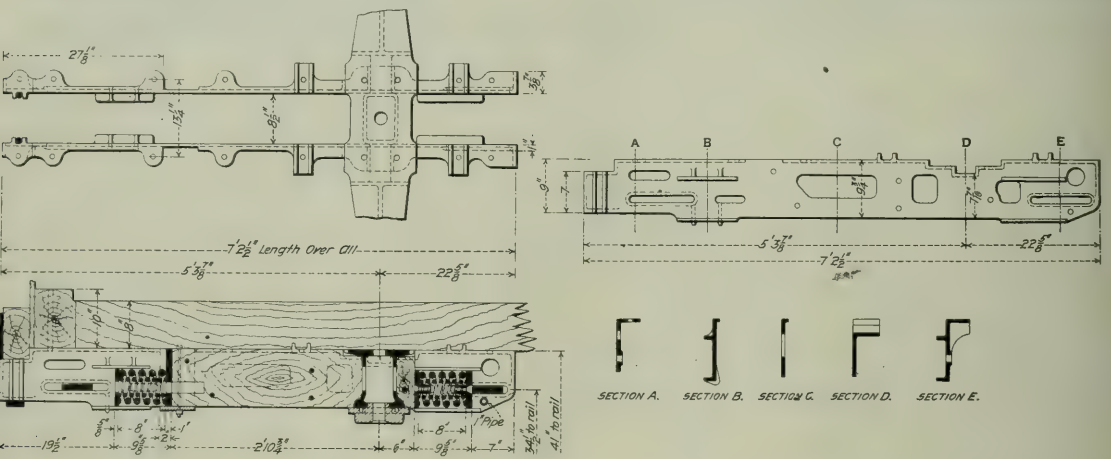
For improper handling of switch, causing derailment of caboose when train was going into a siding, a brakeman has been given 20 days' record suspension.

For going to sleep after being called and causing delay of 25 minutes to an important freight train, two brakemen have been given 10 days' record suspension each.

A New Spring Draft Gear.

A lot of 30-ton box cars recently built for the Missouri Pacific, and another lot of equal capacity refrigerator cars built for the St. Louis Refrigerator Company, are equipped with a new type of spring draft gear, drawings of which are shown herewith. As will be seen, the gear extends back of the body bolster, the object being to have the pulling and buffing stresses come directly against the body bolster and by it transmitted to all of the sills of the underframe. The design illustrated is for use with a separable body bolster. The draft sills, which are cast steel, are 7 ft. 2½ in. long and pass through and are bolted to the body bolster. When a solid bolster is used the draft sills are cast in two parts and bolted to the bolster in the front and rear.

Between the draft arms, in front of and bearing against the



The Busch-Wack Draft Gear.

bolster, is a buffer block of oak, reinforced on the end by a wear plate. A tail bolt passes through the coupler, follower, spring, wear plate and into the buffer block. The follower plates move in channel slides, keeping the spring and tail bolt in alinement.

The rear spring has a small buffer block between it and the bolster. Connection is made from the coupler to this spring by two draft rods attached to keys through the coupler shank and back of the spring respectively.

The principal claims regarding this gear are: Distribution of stresses avoiding shearing and breaking of bolts, couplers, sills, etc.; saving in repairs and reduction of maintenance cost; greater ease in rounding curves and therefore reduced rail, wheel and truck wear; reduced delays in transit; ease of application. It is made by the Busch-Wack Draft Gear Co., St. Louis, Mo.

Foreign Railroad Notes.

They have had a regular head-on collision in Prussia, which killed 14 people—an almost unheard-of occurrence there. A train was going in one direction in two sections. After the first section had passed a station, the agent signalled a train which it met there to go ahead directly toward the second section. They met on a curve where the enginemen barely had time to set the brakes before they struck.

The Shantung Railroad (the German-Chinese line) for the seven months from its completion, June 1, 1904, to the end of the year earned gross $1,246,037 Mexican, equivalent to a little less than half that sum in gold. During the year 558,868 passengers and 179,270 tons of freight were carried. The freight was largely coal, but the company reports increasing shipments of agricultural products. The working expenses were 51 per cent. of the earnings. The net earnings were about $200,000 gold, five-eighths of which were applied to a renewal fund.

The railroad from Pekin south to Hankow, which a Belgian company is building, is so far advanced that there is talk of opening it through next November. To celebrate that event suitably, and doubtless to secure the highest official approval of this innovation by the foreign devils, the company has had manufactured in France and Belgium a passenger train for the special use of the dowager empress, which is said to be something magnificent.

The Austrian Prime Minister announced to the Parliament July 7 that the government purposes to take over the property of three of the great railroad companies of the country to add to the State system, and eventually a fourth; and that in submitting a bill to effect this he would also submit a plan for the reorganization of the State railroad administration. The present State system consists largely of comparatively unprofitable lines. The three systems which it is now proposed to acquire are the oldest and most important in Austria.

The German railroads—whose fixed year begins with April—on about three-fourths of the mileage, earned in the three months ending with June, nearly 6 per cent. more from passengers and nearly 4 per cent. more from freight than last year. French railroads, which had a somewhat unfavorable business last year, show about 2 per cent. increase in earnings this year. The Austrian railroads have almost exactly the same earnings as last year (½ per cent. more). In Hungary earnings increased 3½ per cent.

The Russian Minister of Transportation reports that at the end of 1904 the total length of railroad open for traffic in the empire (not including the Chinese Eastern) was 32,650 miles, an increase of 240 miles during the year. At that date there were also 3,907 miles under construction, and on 792 miles of this, trains were running, though not fully open for public traffic. Charters had been granted for 2,076 miles more. The gross earnings were about 2 per cent. less in 1904 than in 1903.

The French have completed 515 miles of railroad in Indo-China, mostly in Tong-King. The building of some 1,900 miles was authorized by the French Parliament in 1898. The principal line, from Hanoi up the valley of the Red river to the Chinese border at Laokai was to be done last April, but the country is so unhealthy that the natives would not work there, and it was necessary to import Chinese, who seem willing to work anywhere. Sixty miles of this line remain to be completed.

In Germany, as in England, when grouse shooting opens (Aug. 9), an immense holiday traffic begins, making it very difficult to handle the traffic, and especially the baggage. To help in this latter matter, a train of baggage exclusively was dispatched from Dusseldorf to Erfurt and another from Cologne to Hamburg, and passengers were invited to forward their baggage by these trains before starting themselves, being assured that in such case they would find it on arrival at their destination, which would be much less certain if they had it labeled for the passenger trains on which they started themselves.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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The criticisms made in these columns of forced violations of the law by public officers, and of the proposition to entrust rate making to the Interstate Commerce Commission, should not be misunderstood to mean that government control of rates is not desirable. It is Government's right, and, when necessary, it is its duty. It seems to us that a strict enforcement of the present laws would be for the benefit of the public and of the railroads to such a degree that we should properly do this much before enacting new laws. Perhaps it is trite to again say that the interests of the public and of the railroads are identical. Three years ago in his message to Congress President Roosevelt said:

"It must not be forgotten that our railways are the arteries through which the commercial lifeblood of this nation flows. Nothing could be more foolish than the enactment of legislation which would unnecessarily interfere with the development and operation of these commercial agencies."

This is broad-minded and statesmanlike. A candid expression of a kind that we have learned to expect from this President of great qualities, who is, we believe deservedly, the most popular man in the world. But no one is perfect, and the legislation upon which he seems determined is not at all consistent with his own principles. His attention should be called to the needs of the railroads, which are surely in this one respect exactly in accord with the interests of the public. These needs are (1) protection from each other. They could protect themselves from each other by means of traffic agreements or by pooling, but both of these methods have been declared unlawful, and therefore they need the protection of the law. (2) Protection from the shippers. Freight rates are now largely made by the shippers, and the big shippers get rates at the expense of the small shippers. The law is not enforced. Because of this non-enforcement of the law, the railroads are so suspicious of each other that they are quick to suspect rebates given by another. For example, a large shipper at a competitive point demands a lower rate than that given to others. It is refused by all competitors. Then the large shipper concentrates his shipments on one line, paying, of course, the full rate. The other companies soon look upon this as conclusive evidence that that line is cutting the rates, and they feel bound, in order to protect their stockholders, to give the large shipper a lower rate and get their share of the business. Nothing in the proposed legislation meets the needs. It is rather that which the President has expressly condemned; namely, legislation "which would unnecessarily interfere with the development and operation" of the railroads.

"Instructions have been posted on several divisions of the Pennsylvania and will probably be made effective on the entire system east of Pittsburg, that the practice of exchange of signals by the enginemen and firemen, which has long been customary and is generally observed by all engine crews, though not strictly enforced, shall hereafter be compulsory. This is said to be the direct outcome of the recent accident at Paoli. Riding with any careful engine crew one observes that if the engineman sees the signal first he calls out "white," "green" or "red," as the case may be, and this is repeated by the fireman; and *vice versa* if the signal is on the left-hand side. The new instructions are that the engine crews shall be scrupulously careful thus to call out the signals and this will be done, except in the obviously impossible case when the fireman is firing."

It is desirable that such an order be issued and much more desirable that the superintendent who issues it shall take pains to learn how fully it can be carried out. The theory of oral communication between engineman and fireman is favored by many railroad officers, but of the results in practice we know little. The "obviously impossible" proviso, when the fireman is busy, deters many from trying to enforce such a rule, and it is commonly left to the fireman and the engineman to decide when it is and when it is not impossible for the fireman to look for a signal and "holler" its indication to the engineman. Observations made two years ago on the Pennsylvania Lines West of Pittsburg give us some facts to work on. A competent inspector rode in the cab, and using a stop-watch, showed that on some engines the feeding of the fire—counting from the time the operation was begun until the fireman had returned to his seat—occupied only 10 per cent. of the fireman's time, while on the largest engines it took no more than 19 per cent. If these figures hold true generally, which from personal observation—without a stop-watch—seems to admit of some doubt, it should be possible for any fireman to observe and communicate to the engineman the position of all signals, except in yards with very frequent signal indications. The cases in which, if at all, it is most probable that the observed percentages of the time spent in actual firing are too small, are on heavy grades, which the inspector found affected the fireman's labor quite as much as the size of the engine. On up grades, however, the danger of accident from over-running a signal is less than anywhere else, and if necessary the fireman's check on the signals might here be dispensed with. Unless, in fact, it can be fairly proved on any given division that the fireman is never obliged to attend so continuously to his fire that he cannot take a look ahead on approaching a signal—and at night, when the glare of the fire temporarily blinds his eyes, he has a pretty strong argument against serving as lookout man—we must either trust to his judgment and discretion or else give specific instructions concerning every signal. As firemen's minds and consciences must in most cases have long and patient training before their judgment can be trusted in a matter of this kind, the logical way out of the dilemma is to make a list of all the signals on the run and order that certain ones shall be duly sighted, every trip, even if the fire has to be, for the moment, neglected. This is what firemen do now, at some signals, where the fire duty is not pressing. The question is, can such a rule be prescribed concerning all signals, or nearly all? We hope so, but most important, let inspection show whether

or not such an order can be faithfully carried out in all cases at all times. Accidents are rarely caused by the lack of good rules, but nearly always by a sporadic failure to obey a rule.

Progress in the design of solid or ballasted bridge floors is exemplified to good advantage in the track elevation work in Chicago. Most of the advance that has been made has resulted from the efforts of the engineers to produce a solid bridge floor design that would combine satisfactorily the qualities of water-tightness, preservation of the metal work, and noiselessness. With one or two exceptions, all of the designs used up to the present employ steel as the foundation for the floor. Upon this, in square-trough, V-section, plate, or some such form, have been placed preservative and water-proofing materials, over which the ballast is spread. But a bridge engineer concerned in this track elevation work recently made the statement that, with one exception, he knew of no case where absolute water-tightness had been secured with any of the designs in use. The amount of deterioration of the steel is not yet known, sufficient time not having elapsed to demonstrate the effects of deteriorating influences; but in cases where re-protection has been necessary the work has been costly. The use of reinforced concrete for solid bridge floors is new, but experience with it during the past two or three years has been quite satisfactory and encouraging. An experimental floor of this sort was tried by the Chicago & Western Indiana in its track elevation in the latter part of 1903. It stood the test of the following winter so well that it was adopted as standard. Other floors put in since that time have shown the same good results. The plan is simple, corrugated steel bars being placed on top of the I-beams and about 4 in. of wet concrete applied. The concrete projects below the tops of the I-beams about 1 in. and a concrete fillet is formed next to the girder web. These reinforced concrete floors have been treated to the same protective covering as was given to this road's previous design of timber deck, but this has been merely a precautionary measure to make their tightness doubly sure. The Chicago, Milwaukee & St. Paul and the Burlington have designs quite similar to this. The former began its use in its 1905 track elevation work, and the Burlington put in some floors a year ago. For a girder and I-beam floor construction it seems about the simplest and most satisfactory system that has been tried. It seems that in some form of reinforced concrete design is to be found the solution of the problem that has been bothering for so long, for in it are contained the qualities that hitherto have been sought. As indicative of the present trend in that direction, one Chicago road, which has been a pioneer in reinforced concrete designs, contemplates a radical departure in its bridges for some track elevation lately begun. Instead of a girder and I-beam floor construction, massive reinforced concrete slabs will be used. The only steel work will be the columns and cross girders for supporting the decks, and it is understood that the estimate shows a considerable saving over steel construction.

THE CORONER'S PRIVATE CAR AND THE PACKER'S PRIVATE FREIGHT TRAIN.

A Coroner in a railroad shop town, where heavy material and machinery are handled by many men, and lives are occasionally lost by somebody's carelessness, has, if he is an advanced thinker, a power to compel violations of the Interstate Commerce law quite like that of the President of the United States. It is like although it is less. A railroad officer gives exact details, with the assurance that it is simply typical, of the following incident:

A Coroner wrote asking for passes for himself and family for a summer vacation trip. The clerk, who received the letter, did not answer it but filed it alphabetically where similar foolish applications were kept. The Coroner wrote another letter in a tone to which the experienced clerk was not unaccustomed, and this was put with the General Manager's morning mail. The General Manager replied at once, enclosing the passes asked for, expressing his pleasure in doing so and asking the Coroner to address him personally for any future "courtesies."

The gap between the President of the United States and a village Coroner is considerable, but it is filled with a long line of officers, national, state and municipal, with varying degrees of power to compel violations of the Interstate Commerce law. In these columns two weeks ago a somewhat detailed account was given of the President's demand for a special train, free, when he traveled with his friends. This has been re-published or discussed by all of the important daily newspapers in this country as if it were an entirely new condition, instead of one which has prevailed for a generation, and is familiar to every railroad president and manager. Too frequently, the conclusion is drawn that Congress should appropriate $25,000 or $50,000 for a presidential train, its equipment and the cost of hauling it. The New York *Sun* says:

> "In the matter of his travels it cannot but be humiliating to him, and ought to be to the United States, that he must approach railroad companies in *forma pauperis* and billet himself upon them. He and they are forced to a violation of the Interstate Commerce law, which appears to be the chief palladium, and only genuine aegis of liberty in these days. This must be disagreeable to him, and even the railroad managers, black as their professional naggers and pursuers admit them to be, may have their feelings and at least some penumbra of rights. The president of a railroad has his private car. The President of the United States should travel at the expense of the United States, and not at that of the railroads. The President's train should be composed of all steel cars, solid, practically indestructible. It should contain, at any rate, a combination baggage car, dining car, a sleeping car, and a private parlor or saloon car, with an observation end. Its fittings and decorations should be in the best taste, in other words, not exactly according to Pullmanian canon. The President should be safe and comfortable; and even the difficult boon of occasional privacy should not be denied him."

This proposed remedy for a great evil would be amusing if it were not so pitiful. Would any one seriously propose to stop felony by singling out one felon and paying him such a salary as would put him out of reach of temptation to commit felony? There are congressmen, governors, legislators, mayors, justices of the peace, assessors, office holders and politicians generally, and coroners—don't forget the coroners—nearly all of whom have powers, and many of whom exercise them, to get exceptional favors from railroads. The coroner's function in this connection is peculiarly fascinating. With only a slight bias, his investigation of a fatal accident may make many thousand dollars—sometimes hundreds of thousands—difference in the amount for which the company is mulcted. He may so deal with the dead as to make a snap for the living. Ghastly and bland he looks forward to a cheap summer trip—perhaps with his friend the undertaker as his guest if the company "treats him right."

The logic of the proposed remedy is inevitable. If the President's lawlessness in the past is to be condoned by cash payments in the future; if Congress supports his "unalterable determination"—repeated last week as a reply to his exposure—to control railroad rates charged to all except himself; if the present righteous law for treating all alike continues to be enforced only sporadically; if favored rebaters and solicitors of rebates are to be let alone—then by all means let the remedy be extended to others than the President. Let each Senator and member of Congress and others all along down to the coroner have a special car. This courtesy to the coroner will appeal to every one. When all this is done, when with clean hands and a disinfected conscience the officers of Government make a new law giving the Interstate Commerce Commission authority to make changes in rates, effective until over-ruled by the courts (and every important decision of this Commission thus far appealed has been reversed by the Supreme Court), what is the result? We have simply shifted this responsibility from those who are vitally interested in making transportation cheap to a committee of inexperienced and not necessarily able men.

Assuming that all railroad officers are morally bad and that all Interstate Commerce Commissioners are good, nevertheless the officer has professional reputation at stake. Unless he serves the community well, builds up the industries along his line and helps so far as he can to make his customers well-to-do, and so increase his company's earnings, he loses his job. His profession is one in which this talent is in high demand and better paid than in almost any other profession. If five men, political appointees, can do this work better and serve the public better than thousands of picked men trained for the work, then the proposition may be justified, but it would have no effect in checking present rebates and discriminations forced on the railroads.

The logical sequence of the remedy proposed would seem to be an extension of the original one: Let not only the President and the coroner have his private car, but extend the courtesy of free freight trains to the packer and the pipe line owner—to every man and corporation who has power to dictate to the railroads.

Anomalous Electric Railroad Returns

Heretofore we have had occasion to point out infirmities of the Railroad Commission of Connecticut, especially in its attitude toward the electric railroad companies of the State. That commission is a "political" body and but recently has been made entirely partisan in its composition. Vested with large powers over electric railroads, particularly as to capitalization, it has never exercised them. It has had no definite policy. Its returns have been meagre and defective, and there have been serious and palpable flaws affecting even the simple computations; and its recommendations to the

State legislature have been few and its influence on law-making almost nothing. As a result one finds in the State—counting in a few gas and electric light companies merged with the electric railroads—the enormous capitalization in stock and debt of $86,612 a mile as stated in the last annual Commission report, and a variation of cost ranging between $15,000 and $165,000 a mile. In the case of many of the lines all the capital stock is water and a considerable percentage of the bonds also, the roads having been built on the "bond and bonus" plan.

By contrast, if we turn to the sister State of Massachusetts, we find a commonwealth not only careful and advanced in electric railroad law-making but a Commission very strict in the practical application of the statutes. We discover there a Commission non-political in character, with definite policies, alert, progressive, making very full and informative returns, so potent in statute making that its recommendations have almost the force of law and enforcing the rule of replacement value in capitalization. To use its own words in its last annual report: "In no case has there been an issue of stock or bonds in excess of the fair cost of the railroad property." One of the most vivid indices of the result is an electric railroad capitalization of Massachusetts in stock and debt of but $50,295 per mile, compared with $86,612 in Connecticut, as stated—and this in a commonwealth that includes the City of Boston, with its great suburban population and a commonwealth the cost of whose urban railroads in actual and honest cost of construction undoubtedly far exceeds the same cost in Connecticut.

What would be the natural inference from such a contrast of financial, statutory and administrative conditions? In Connecticut we should, of course, infer receiverships, staggering railroad corporations, fiscal decrepitude; in Massachusetts, prosperity, dividends for stockholders and a strong tendency toward new construction. In fact, on the face of the returns, one finds almost exactly the reverse. Last year out of 74 operating roads in Massachusetts 30 failed to earn expenses and fixed charges; only 25 paid dividends and only 14 earned them during the year, and but 10 companies have properly earned and paid a dividend, during the last five years, of at least 5 per cent. Five companies have been in the hands of receivers. In Connecticut, on the other hand, the returns since the beginning of the trolley "boom" some 12 years ago show that, out of some 35 original lines only one has gone through bankruptcy or defaulted in interest—and in that case because of an unprofitable contract with a large connecting and urban company rather than from actual lack of earning power. In the formal Connecticut list last year 26 companies appeared in the report of the commission of the State. Of these several were practically consolidated with larger companies and the 26 are, in fact, reduced now by consolidations to some 13. But allowing for dividends hidden by consolidations last year 10 out of the 26 paid dividends as compared with 25 out of 74 in Massachusetts. Last year in Massachusetts main track mileage increased but about 34 miles and in Connecticut about 58 miles.

Returns so anomalous and which, on their superficial face, seem to set at naught all theories of fiscal sanity in electric railroad development require explanation. In the list of qualifying facts stands first the comparative ratio of consolidation. This has been fairly extensive in Massachusetts—where, for example, there were five consolidations during the last year covered by the State Commission's report. But, if we may use the phrase, it "cuts no ice" compared with the extent of consolidation in Connecticut. In the latter state, as explained, some 35 originally independent companies, have now been reduced to about a dozen. One large corporation, itself controlled by the United Gas Improvement Company of Philadelphia, owns the trolley systems of the cities of Norwalk, South Norwalk, Bridgeport, Derby, Ansonia, Waterbury and New Britain. Another corporation controlled by the New Haven (steam) railroad company has the systems of Stamford, New Haven, Hartford, Meriden, Middletown, Willimantic, Norwich, New London and Putnam. On a rough estimate three-quarters of the trolley plants and a larger ratio of earning capacity of the Connecticut electric railroads are vested in two corporations. Just as in the history of steam roads; the result has been protective, fiscally speaking. Earnings of strong trolley roads have "washed" the earnings of weak ones, the big corporation standing as a kind of guarantee for all. The infirm trolley, which has found asylum in the swift consolidation of Connecticut, has gone to the receiver under the progress of slower consolidation in the sister State. The same rule holds true as to the disparity in construction. The large controlling company, at a time when immediate and profitable trolley territory seems exhausted has the money for extensions—the returns of which may be somewhat remote—at a time when private capital shrinks from the venture. The big proprietary company, in other words, often sees opportunity with keener, more far-sighted and wider vision.

Again, as against the paradox of the returns, is to be set the presumptively better public service of the average electric railroad in a State where the railroad commission is efficient and public complaints are thrust home. Thus the cost of operation in Connecticut is $4,797 per mile. In Massachusetts it rises to $7,145 per mile; and, even allowing for high cost of operation in Boston, the disparity remains great enough to be significant. Making a similar comparison in somewhat different form Massachusetts electric railroads return a percentage of operating expense to gross earnings of 70.20 per cent.; those of Connecticut 66.75 per cent. The latter is probably the better test of the two as it leaves in the form of a ratio the larger earnings of the Boston lines as connoted with larger operating cost. How equipment, including particularly character and condition of cars, compares in the two States would undoubtedly shed further light on the anomaly of the returns if it could be figured out. All that can be said is that it is one of the obscure factors to be reckoned in with the presumptions in favor of the commonwealth that enforces the more sharply the principles of public necessity and convenience.

Finally another feature of the Massachusetts returns both absolute and comparative is to be noted. It has been a State in which, with its great centralities of population east, say, of Worcester, electric enterprise has been peculiarly alluring and its territorial opportunities at first were very large. As against the initial rush into those enterprises a decade ago a strong railroad commission could do a good deal but it could not do everything. It could enforce honest capitalization and check the inflation tactics of syndicates inside the State as well as outside; it could not make over fiscal human nature and prevent rash enterprises of men who were willing to risk their money. The outcome shows that there were a good many investors of that stamp who would have been much more numerous and the results correspondingly disastrous if the policy of the Commission had been lax. When history is thus added to an exceptional local situation and both are joined with other facts which we have enumerated the anomaly in the returns of two divergent New England States, ceases to be such; and, incidentally, we get some fresh hints as to the importance of looking deeper than the face of railroad Commission returns.

Chicago & Alton.

The Chicago & Alton is one of the oldest and best known of the Chicago granger railroads. It has the rare distinction of not having passed through receivership or foreclosure since the civil war. In 1862, the Chicago & Alton Railroad purchased at foreclosure sale the St. Louis, Alton & Chicago, which then ran from Chicago to St. Louis. When, in 1879, a Kansas City connection was acquired, the property was considered complete by its owners, who refused to participate in the mania for extension in the late '80s, when granger railroads in particular were building thousands of miles of new line. When 1893, with its railroad disasters, came, this policy seemed to have been a successful one. The companies which had been concerned most largely in extending their lines (some of them had added 2,000 miles in a year) fell into financial difficulties. The Atchison and the Union Pacific went into bankruptcy. The Missouri Pacific was saved only by personal advances of its directors, "the Gould pride," as it has been called. The St. Paul, the North-Western, the Burlington, and others, suspended or reduced dividends. All this time the Chicago & Alton continued uninterruptedly its 8 per cent. dividends on its common and preferred shares.

It was only in the revival of business after 1896, following the depression, that the failure of the non-expansion policy came into sight. In 1899, when most roads were very greatly increasing their gross earnings over the lean years, the gross earnings of the Chicago & Alton were less than in 1893, 1892, 1891, 1888, 1885 or 1882. Net earnings were also less than in a number of previous years. These were vital facts for the management to face and required prompt action, which was taken in the reduction of dividends on the two classes of stock to 7 per cent. in June, 1897. This was at a time when western crops were exceptionally good and when neighboring and competing roads were enjoying heavy gains in income and enlarging their dividends. The result, in fact, of the period of expansion in railroad building was proved to be that many companies on which the Chicago & Alton had formerly greatly depended for traffic had extended their lines into, or beyond, its territory, and, with their new through lines, were carrying a large amount of traffic which the Alton had formerly obtained. In 1898 more than 80 per cent. of the freight and 90 per cent. of the Alton's passenger traffic was local traffic. Not only was the management brought face to face with this disquieting state of affairs, but nearby and direct competition was threatened. The St. Louis, Peoria & Northern, a local railroad in southern Illinois which had several times been bankrupt, and was in itself of little consequence, passed into the hands of new owners whose object was by north and south extensions to create a new through line between Chicago and St. Louis. Such a line, if built, would have paralleled and seriously hurt the Chicago & Alton.

At this time, when so many difficulties surrounded this old, conservative and very successful property, the Harriman interests bought the St. Louis, Peoria & Northern and at the same time, through an offer to the Chicago & Alton stockholders, in 1899 secured control of the Chicago & Alton itself, paying $200 a share for the preferred and $175 a share for the common stock. The road was re-

organized by them as the Chicago & Alton *Railway*, with a very large increase of capitalization and, incidentally, very large profits to themselves. This was done by substituting for small issues of high grade securities, large amounts of consequently less valuable stock. The new company leased the old Chicago and Alton, on whose stock it yearly receives 7 per cent. dividends amounting to $1,525,622, and bought the 57 miles from Springfield to Peoria, Ill., of the St. Louis, Peoria & Northern, its threatened competitor. Before the reorganization, on 844 miles of line there was $22,230,600 capital stock and $18,583,850 bonds, or $26,340 stock and $22,020 bonds per mile, a total capitalization of $48,360 per mile. At present, on 915 miles of line there is $39,086,800 capital stock ($42,719 per mile), and $27,000,000 funded debt ($29,508 per mile), a total capitalization of something over $72,000 per mile.

The present report is the fifth of the new company, and shows the increases in various departments since the reorganization. Gross earnings have steadily increased from $7,155,961 ($8,483 per mile) in 1899 to $11,797,314 ($12,893 per mile) last year. Net earnings have similarly increased from $2,992,384 ($3,584 per mile) in 1899 to $4,194,650 ($4,584 per mile) in 1905.

The first move of the new owners was to begin the entire reconstruction of the property, so as to make it most efficient from an operating standpoint. In pursuit of this policy the operating ratio has been increased from 58 per cent. in 1899 to 66 per cent. last year. The extent of the expenditures for improvements may be judged in another way from the following tables which show the expenditures for the two classes of maintenance per mile for 1899, the year in which the road was leased, and since that time. During this period there has been an increase of only 70 miles in the length of road operated.

Maintenance, per mile.			
—Way and structures.—		—Equipment.—	
Year.	Amount.	Year.	Amount.
1899	$824	1899	$658
1900	1,031	1900	711
1901	1,206	1901	956
1902	1,043	1902	1,113
1903	1,325	1903	1,301
1904	1,580	1904	1,345
1905	1,600	1905	1,460

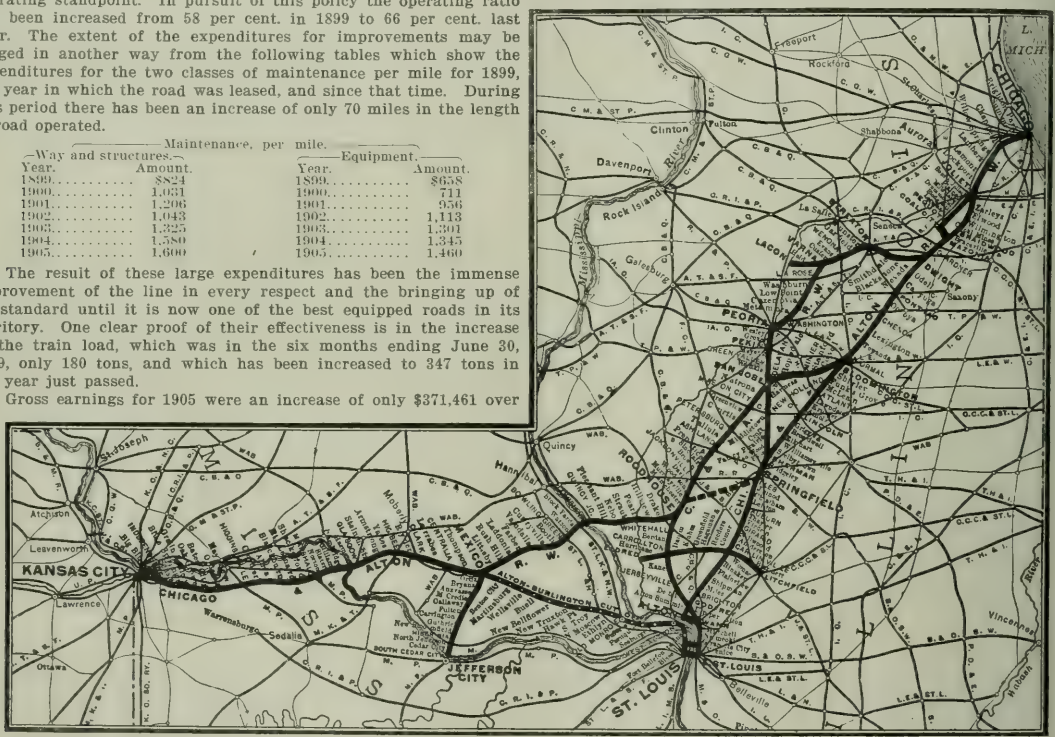
The result of these large expenditures has been the immense improvement of the line in every respect and the bringing up of its standard until it is now one of the best equipped roads in its territory. One clear proof of their effectiveness is in the increase in the train load, which was in the six months ending June 30, 1899, only 180 tons, and which has been increased to 347 tons in the year just passed.

Gross earnings for 1905 were an increase of only $371,461 over 1904, though in 1904 there was an increase in gross of considerably over a million above the 1903 figure. The freight revenue last year decreased $486,950, and had it not been for the increase in passenger revenue caused by the St. Louis Exposition and the very favorable situation of the Chicago & Alton in connection therewith, the unbroken record of increases in earnings would have been broken. Passenger earnings made up for the decrease in freight revenue by an increase of $833,618, or 25 per cent.

Changes in the expense account can be taken account of only in a general way, as detailed figures for expenses are not given. Maintenance of way cost $1,463,689 against $1,446,010 in 1904. There was an increase of 102 per cent. in expenditures for ballast, a decrease of 66 per cent. in money spent for spikes and fastenings, and an increase of 60 per cent. in expenditures on bridges and culverts. Maintenance of equipment took $1,336,211 of the total expenses, an increase of $105,448, or 9 per cent. over 1904. Repairs of locomotives increased $52,121, or 10 per cent., and repairs of freight cars, $37,244, or 9 per cent. Conducting transportation cost $4,469,846, or $4,884 per mile of road, against $4,559,731, or $4,982 per mile of road, last year. In 1904 conducting transportation was 40 per cent. and last year 38 per cent. of the total earnings.

The train load increased 11 tons, or 3 per cent. over 1904, being 347 tons in 1905 and 336 tons in 1904. The number of tons of freight carried one mile per mile of road was 1,103,069, a decrease of 97,785 tons, or 8 per cent. from 1904. The number of passengers carried one mile per mile of road was 264,337, an increase of 76,325, or 41 per cent. over 1904. There was an increase in the average number of passengers per train mile of 15, or 26 per cent., and in the average distance passengers were carried of 19 miles, or 35 per cent. The average passenger traveled 73 miles against 54 miles in 1904, while the average ton of freight was carried 153 miles against 165 miles in 1904, a decrease of 12 miles, or 7 per cent. The revenue per passenger increased from 1.06 cents to 1.27 cents, or 20 per cent., at the same time that the revenue per passenger mile decreased from 1.95 cents to 1.73 cents, or 11 per cent. With the increase of 25 per cent. in total passenger earnings, the passenger car mileage increased only 16 per cent., showing that trains were better filled.

The number of passengers handled by the Chicago & Alton during the seven months of the Exposition was 2,355,307, of which 857,158 passengers were carried to and from St. Louis. As an interesting comparison, the aggregate business handled by the old Chicago & Alton in 1893 in connection with the World's Fair at Chicago was 530,458 passengers. President Felton points with gratification to the fact that the enormous passenger movement to and from St. Louis was handled without injury to a single passenger.



Chicago & Alton.

No statement of classified tonnage is given. Freight traffic earnings are given in some detail and show decreases in every class, except in lumber and other forest products, earnings from which increased $26,500 (6.7 per cent.) following an increase of $30,650 (8.4 per cent.) in 1904, and miscellaneous merchandise, earnings from which increased $42,850 (3.55 per cent.) following an increase of $104,500 (9.47 per cent.) in 1904. Some of the decreases are not at all surprising in view of large increases in 1904 over the preceding year. Earnings from live stock, for instance, decreased $36,000 (5.2 per cent.) after an increase of nearly $200,000 (40 per cent.) in 1904. Similarly earnings from flour and other mill products fell off about $40,000 (15 per cent.) last year after an increase of $122,000 (85.5 per cent.) in 1904. The largest actual and proportionate decrease during the year was in grain earnings which fell off $240,000, or 22 per cent. Earnings from coal and other mine products at the same time decreased $213,000, or 12 per cent.

There was expended for betterments during the year $434,646, but no hint is given as to whether this was charged to income or to capital account. There were no extraordinary improvements, but

the continuous betterment of the line was carried on. Counting in last year's installations, electric block signals are now in use on 351 miles of main track. The largest single expenditure was one of $124,664 for terminal yards. Fifty-seven miles of second main track are now under construction, and at the same time grades are being reduced to secure a 3.3 per cent. grade between the Illinois coal fields and Chicago. Of the 781 miles of main line, 692 miles are laid with 80-lb. rails and 529 miles ballasted with stone, the latter clear evidence, in comparison with other western roads, of the fine condition of the line.

From a local line with decreasing earnings in prosperous times the new Alton has been brought as a Harriman road to be a strong through line which has yearly since the reorganization increased earnings along with operating efficiency. An interesting development of the past year has been the buying of a half interest in the road by the Chicago, Rock Island & Pacific, the present board including at least four Rock Island directors.

The more important statistics of operation follow:

	1905.	1904.
Mileage worked	915	915
Freight earnings	$6,958,927	$7,445,877
Passenger earnings	4,185,561	3,251,943
Gross earnings	11,797,314	11,425,853
Maint. way and structures	1,463,689	1,446,010
Maint. of equipment	1,336,211	1,230,762
Conducting transportation	4,469,846	4,559,731
General expenses	332,917	288,097
Operating expenses	7,602,663	7,524,600
Net earnings	4,194,651	3,901,253
Other income	1,794,139	1,766,273
Surplus for the year	151,407	123,908

Missouri, Kansas & Texas.

The Missouri, Kansas & Texas runs from St. Louis to Kansas City and from St. Louis and Kansas City south to San Antonio and Galveston, Tex., with various branches and feeders extending into Kansas, Missouri, Oklahoma, Indian Territory and Texas, and to Shreveport, La., where connection is made with the Queen & Crescent (Southern). It is an independent road, and is therefore handicapped in obtaining its share of competitive traffic, for most other roads in this territory are allied with some stronger interest. In 1881 the Missouri, Kansas & Texas acquired the International & Great Northern by exchange of stock and was itself in the same year merged with the Missouri Pacific, which indirectly guaranteed its bonds and was to operate the road on a long lease. Interest, however, was defaulted in 1888, the lease was cancelled and receivers for the M., K. & T. appointed, the International & Great Northern becoming again a separate organization, although control of its stock was sold to the Missouri Pacific. In 1900 the Missouri, Kansas & Texas was finally reorganized without foreclosure.

At the time the road went into the hands of receivers in 1888 it had about 1,600 miles of line, with terminals at no important point. It was made up of six separate and disconnected parts, the longest running from Hannibal, Mo., to Dallas and Jefferson, Tex. Important terminals and much construction were necessary to bring the road into anything like effective shape. More than this, like most lines at this time, particularly in the southwest, there was great need of very complete improvements. The weak point in the reorganization was the fact that no funds were provided for this necessary rehabilitation of the road.

Since 1900, however, as will be seen from the accompanying map, the Missouri, Kansas & Texas has been extended and unified so that it has only one still unconnected line and now reaches important terminals. At the same time there has been much improvement of the line. By 1901 there were 2,480 miles in operation, reaching St. Louis, Kansas City, Houston, Galveston and Shreveport. During that period of ten years more than $4,000,000 had been expended on bridge maintenance and renewal. In the next year important extensions were made into Indian and Oklahoma Territories to counteract extensions of the Rock Island, Santa Fe and Frisco into the same territory. One of the most serious problems which the new management has had to face has been the competitive extension of rival companies. In 1893 the Rock Island extended its line into Texas. In 1897 the Kansas City, Pittsburg & Gulf (Kansas City Southern), which proved to be an irresponsible and dangerous competitor, was completed to Port Arthur, Tex. Later the Southern Pacific extensions and acquisitions in Texas were made. The St. Louis & San Francisco extended its lines to Fort Worth and secured control of the Fort Worth & Rio Grande, thus creating an extensive system of competitive lines through northern and southwestern Texas. The Choctaw, Oklahoma & Gulf, which as an independent line was the most important ally of the Missouri, Kansas & Texas in coal traffic, was acquired by the Rock Island. These are only examples of extensions and acquisitions by rival lines on M., K. & T. territory.

With all these difficulties to face it is remarkable that the present management should have been successful in building up gross earnings from $9,750,564 in 1892, the first year of their operation of the road, ($7,922,444 in 1889 under the receivers) to $20,041,095 in 1905. Not only is this a remarkable increase, but during the past year alone has come a very large part of it, gross earnings in 1904 being $17,766,595, which makes the increase for the past year $2,274,500. This favorable showing had the effect of raising the quotation on the preferred stock of the company, on which no dividends have ever been paid, but which is entitled to 4 per cent., if earned, from 30 about a year ago to 70 in September, continued and definite rumors of payments on the preferred shares accounting for the rise in price.

All reports that dividends will soon be paid should be set at rest by the statement of Chairman Rouse in the report, who gives the position of the management on this question. The defective plan of reorganization, he says, has made it necessary to apply to the improvement of the property all surplus revenue, and to use the company's credit in paying for necessary equipment, on which notes amounting to $4,591,536 are now outstanding. With a profit and loss surplus of only $940,891 and a provision in all existing bond issues that they shall be available only for new expenditures, it is clear that no distribution on the stock can be thought of until these equipment notes are met and cancelled. Until this is

Missouri, Kansas and Texas.

done, unless there should be an exceptional increase of revenue, the present state of affairs is likely to continue, and the preferred stockholders must, apparently, possess their souls in patience until the southwest has developed enough and the road has been improved enough so that earnings can be paid out instead of being turned back into the road in improvements which are made necessary in order to put the road in shape to cope with the sharp competition which it must face.

In 1892, at the end of the first year under the present management, with an operated mileage of 1,674 miles, gross earnings were $9,750,564, and net earnings, $2,369,996. In 1905, gross earnings were $20,041,095, an increase of $10,290,591, or 106 per cent., and net earnings, $5,113,375, an increase of $2,733,379, or 115 per cent. Passenger earnings during these 13 years have increased 164 per cent. and freight earnings 93 per cent. In view of the large amount of new mileage built in recent years, it is characteristic of the road's recent prosperity that gross earnings per mile of road have increased from $5,825 in 1892 to $6,586 in 1905, and net earnings per mile of road from $1,416 in 1892 to $1,677 in 1905.

Operating expenses were $14,568,436 last year against $12,659,-

470 in 1904, an increase of $1,908,966. This ate up most of the increase in gross earnings, but more was spent on maintenance than in the preceding year. Maintenance of way cost $3,643,201 in 1905 against $2,690,226 in 1904, an increase from $933 per mile of road in 1904 to $1,197 per mile of road in 1905. Maintenance of equipment, which took $1,925,195 in 1905 against $1,613,969 in 1904, similarly increased from $560 to $633 per mile of road. Conducting transportation, on the other hand, shows an increase gratifyingly small in comparison with the large increase in business moved. Conducting transportation cost $8,114,061 in 1905 and $7,521,054 in 1904, an increase of $593,000 or less than 8 per cent. against an increase of over 12 per cent. in gross earnings.

There were 1,273,145,491 tons of freight moved one mile, an increase of 43,317,926 ton miles over 1904. The average revenue per ton mile also increased from 1.065 cents in 1904 to 1.110 cents in 1905. The train load increased from 199 tons in 1904 to 205 tons in 1905. In this respect much remains to be accomplished. One step soon to be taken is the reduction of grades between McAlester, Ind. T., and the Red river (Indian Territory-Texas boundary) where the largest volume of traffic is handled.

There were 238,600,721 passengers carried one mile, an increase of 66,537,663 passenger miles. The average revenue per passenger mile decreased considerably from 2.210 cents in 1904 to 2.069 cents in 1905. At the same time the average distance which each passenger traveled increased from 58 miles to 66 miles.

Of the tonnage carried, 10 per cent. was lumber and 18 per cent. manufactures and merchandise, the latter an encouraging increase from 16 per cent. in 1904 and probably responsible for the higher average freight rate received. Coal furnished 31 per cent. of the total traffic against 33 per cent. in 1904. Live stock furnished 7 per cent. of the total.

Operating expenses were largely increased by the severity of the winter in the southwest, and what President Finney refers to "as the annual interference with traffic and losses by floods in Kansas." In connection with the floods, 6.7 miles of track have been raised, water openings strengthened and additional bridges built.

Through funds supplied from the refunding first mortgage, the company has bought at Kansas City, 58 acres for use as an outer yard as well as land in the business district for a freight house. The same source is also to provide for the construction of extensive shops at Parsons, Kan., to cost about $1,000,000.

Mr. Rouse calls attention to the fact that in Kansas and Missouri there has been during the past year drastic legislation enlarging the powers of the railroad commissions of those states and placing in their hands the rate making power within the state boundaries. Should the similar agitation which is spreading into Oklahoma result in rate legislation there in the near future, practically the whole territory covered by the Missouri, Kansas & Texas would be subject to restrictive rate control by political bodies. This, Mr. Rouse believes, can hardly fail to prove detrimental to the property, as it amounts to surrendering to the patrons of the road the power to fix the compensation for service rendered. The probable injurious results of these grants of power are much lessened by the business activity which at present prevails; but there is a menace in the situation, especially in view of any discussion of a distribution of the comparatively small surplus which the company now has. As an indication of the general antagonism to railroads throughout this part of the country, the total number of claims filed against the M., K. & T. during the year amounted to 9,069, a large number of which, according to Mr. Rouse, are frivolous and would not be tolerated in more conservative communities.

The record of the road since reorganization is a distinctly gratifying one. With the present policy of steadily investing large amounts of earnings in the improvement of the road continued and the development, as yet only begun, of the southwestern country, the time should soon come when the Missouri, Kansas & Texas shall have greatly increased both in value and operating efficiency.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	3,043	2,884
Freight earnings	$14,134,335	$13,102,910
Passenger earnings	4,935,592	3,802,202
Gross earnings	20,041,095	17,766,595
Maint. way and structures	3,643,201	2,690,226
Maint. of equipment	1,925,195	1,613,969
Conducting transportation	8,114,061	7,521,054
General expenses	885,979	834,222
Operating expenses	14,568,436	12,659,470
Net earnings	5,472,659	5,107,126
Other income	425,181	316,723
Surplus for the year	1,267,191	1,066,369

TRADE CATALOGUES.

Filtration Plants.—The Pittsburg Filter Manufacturing Company has issued four descriptive pamphlets covering municipal and railroad water softening and filtration plants. These are entitled "Municipal Filtration Plants"; "Pure Soft Water for Boilers and Railroad Water Stations"; "Gravity Filters, Pressure Filters and Water Softening Plants," and "A Bacteriological Report of the Municipal Mechanical Filtration Plant at Danville, Va.," by a director of the laboratory of the city water department, giving the results of ten tests of filters installed by the company. The pamphlet on pure soft water gives various photographs of the company's plants, including several railroad water softening plants, with a list of the railroads and cities which use them.

Pneumatic Tools.—The Independent Pneumatic Tool Co., Chicago, sends an illustrated folder descriptive of the "Thor" piston air drills, reversible wood-boring machines, and pneumatic chipping, calking and riveting hammers.

CONTRIBUTIONS

Cast-Iron Car Wheel Specifications and Tests.

Bellevue, Pa., October 2, 1905.

To the Editor of the Railroad Gazette:

In general, specifications are intended to aid the seller to understand definitely the wants of the purchaser and also to enable the latter to know beyond a doubt that he is getting what he has bargained for. The plan adopted by a number of the principal railroads of this country in buying equipment supplies resolves itself into one of systematic penalties against all errors of process and practice so that the tests often stand more as a means of rejection than inspection. Perhaps no product of manufacture has suffered more from such unwise policy than the cast-iron wheel. This repressive policy on the part of some of the railroads has been responsible to a great extent for the inability of a large number of cast-iron car wheels to stand up under the increased capacity cars, and for the desire of the cast-iron car wheel makers to do away with all guarantees as to service. In other words, the railroads have created for themselves a boomerang.

If large shippers should refuse to pay for several train loads of freight because one part of one car of freight was not delivered in good order as agreed, how long could the railroads continue to spend large sums on the development of their equipment and service? Yet this is the trend of the policy adopted by some of the railroads against the cast-iron car wheel makers. If one wheel out of 103 is not just up to the letter of the specifications the inspector is supposed to reject the whole lot and consider them as so much scrap when as a matter of fact and judgment 102 of them would be ideal as to strength and service. This exercise of power defeats its own purpose.

There is talk of increasing the severity of the tests as though the wheels were to be purchased for their ability to stand certain tests instead of given service conditions. This is only another step in the policy of repression. There is a limit to the tests beyond which there will be no benefit. Thousands of wheels that would not meet the letter of many of the specifications now in vogue have stood and are standing the most severe service conditions required. Increasing the severity of the tests, with the consequent increased opportunity for penalties by rejection, will still further retard the natural development of the cast-iron car wheel to keep pace with the increased demands upon it in the way of service, by reducing the profits to a point where improvements in quality of materials and processes will be untenable.

Improvements in the cast-iron car wheel in design, strength and wearing qualities have nearly always kept abreast of the demands along these lines. This will continue to be the case in even greater measure than heretofore, if the railroads will but extend to the manufacturers more co-operation and justice. Looking this question squarely in the face the natural query is, "Who should get up the specifications?" Plainly and honestly, not only those who know a wheel from the shopman's standpoint, or the inspector's reports, or the master mechanic's experience, or the mechanical engineer's theories, but also those who are actually engaged in its manufacture.

The specifications for the purchase and tests of cast-iron car wheels should be drawn up by a board or committee composed of an equal number of railroad representatives and cast-iron car wheel makers. This board, by a two-thirds vote on each proposition, should have absolute authority over every word and line of the specifications for the roads so represented. If the larger railroad systems enter into such an arrangement a uniform practice can be established that will accrue to their mutual benefit. The inspectors should be instructed to accept all that is good and reject only that which is unsafe and bad.

Having chosen specifications that amply safeguard the interests of a railroad without injustice to the manufacturers, the railroads should see to it that the purchasing departments encourage those makers furnishing wheels of the best quality.

In conclusion I will say that a low chilled wheel is not neces-

sarily a strong one nor a high chilled wheel a weak one. Also that a "poor" iron with proper foundry conditions will produce a better wheel than the very best high grade charcoal irons will make with bad foundry practice. J. W. HENDERSON.

Normal Danger vs. Normal Clear.

BY C. H. PLATT.

[Late General Superintendent, New York, New Haven & Hartford; chairman Safety Appliance Committee, American Railway Association; reporter on automatic signals to the International Railway Congress at Washington.]

No one would think of constructing, or dare to construct, a signal mechanism on the normal clear principle. Considerable expense is incurred to add counterweights and to supply the necessary power to lift them every time a clear indication is desired. The practice of going to further expense to hold them in that position about 20 hours out of every 24, giving them every opportunity to stick or freeze in the clear position, is indefensible, if another and safer way has been provided.

Where there are interlocking plants, with signals installed and operated on the normal danger principle, it is very inconsistent to install adjoining signals on the normal clear principle. The practical result often is a starting signal at danger, the first block signal (likely in plain sight) at clear, furnishing engineers a good excuse for overlooking the "starter" and running their trains into danger.

Where switch indicators, or bells, are used to give a danger indication when a train is approaching, the general interlocking principle should certainly govern. If the main line signal is clear, the siding must be blocked. These are conflicting routes, and the signal indication for one should always be the reverse of the other. This principle is strictly observed in the normal danger plan in all cases and at all times, while under the normal clear both the main route and siding indications are normally clear.

Surely there should be good and sufficient reasons for going contrary to principle, disregarding consistency, and ignoring danger for installing signals on the normal clear basis. What are the controlling reasons given by those who advocate that practice? The following includes the important, if not all, of the published reasons in articles on the subject:

a. A false clear indication is as liable to be given under one system as the other.

b. The normal danger system uses more line wire and contact points than the normal clear.

c. The signals on double track roads can be more easily inspected from the rear of the train if the normal clear is used.

d. The fact that there is a larger number of signals installed on the normal clear system shows that many believe in that practice.

e. The normal danger system employs the normal clear circuits, plus additional complications, and is more expensive to install (a repetition in part of "*b*").

f. The cost of operation under the normal danger system is only a trifle less than under the normal clear.

Accepting these as final there is in them nothing to warrant ignoring principle, consistency and danger, as above outlined, but many of these will not stand the test of a close examination.

"*a.* False clear indications as liable under one system as the other." This is not a reason, if true; is it true? Signals stick and freeze, unfortunate, but true. This freezing is not confined to the mechanical parts controlling the semaphore arm; a more fruitful source is the sticking by frost, or otherwise, of the slot arms and clutch magnets, and in such cases signals are nearly always held in their normal positions. There is no time for freezing in the temporary position of two to five minutes at a time. If they freeze in the normal clear position they do all that mechanical arrangement can do to provide the conditions for a rear end collision. Under the most favorable outcome they increase the number of false clear indications.

"*b.* Additional line wire and contact points." This is true to this extent: one line wire between the home and the distant signal, and one clearing relay, if compared with the so-called wireless circuit for the normal clear. If the wire circuit normal clear is used the amount of line wire is the same unless switch indicators or bells are used in conjunction with the block signals, in which case more line wire is required for the normal clear than the normal danger. It is almost universally true that parts are added to any electric or mechanical device to accomplish results not before accomplished, or to give added protection, but no one at this late day will claim that the additions required for the normal danger cannot be safely and regularly operated with the utmost efficiency.

"*c.* More easily inspected from the rear of a train." This refers to the opposite track only, and under conditions of traffic favorable to such so-called "inspections." No up-to-date management would place any reliance upon such a superficial inspection. But calling it an inspection for argument's sake, what can one find if he happens to find anything? Simply a failure to clear. This is on the side of safety. On the other hand, what can one find under exactly the same conditions if signals are installed under the normal danger system? He finds the failure, if any, to protect, and may prevent a rear-end collision.

"*d.* Larger number of signals installed on the normal clear system." This statement is true if time is taken into consideration, but it is not a good reason. It is as true that at one time all signals were installed on the normal clear principle. But the premises are rapidly changing. The normal clear had 20 years without competition before the normal danger was evolved, and it was then brought out to do away with the inherent defects and dangers of the original system; some railroads have changed, others not as yet.

"*e.* Cost of installation greater." Generally speaking, this is true, but the saving in operation and maintenance covers the extra expense in a year or two, and during the lifetime (as a whole) of the signals, the normal danger is less expensive.

"*f.* Cost of operation only a trifle less," is really an argument for the normal danger, and calls for no comment, except to say that the saving is not "trifling," and that no necessary expense is unwarranted, especially to retain an element of danger.

In addition to what has already been said, the normal danger is correct in *theory*. Lines are blocked for the protection of traffic. Theoretically, then, the normal condition of the section should be "blocked," and a signal should only be cleared when a train is approaching, providing the block is clear—not left normally unblocked.

Conditions have arisen when something occurred to endanger trains when the signal showed clear. It is far better in principle and safer to hold the signal at danger until a clear indication is required and can be safely given, than it is to restore it to danger perhaps after the engineer has seen it in the clear position.

The normal danger is more efficient for reasons already stated, and because high resistance magnetic coils are unnecessary. It lessens the dangers of lightning and residual magnetism, and decreases the liability of failure on account of chilled batteries.

While signals are installed principally for controlling trains in one direction, they give valuable information for other purposes if installed on the normal danger principle. Under the normal clear a train may approach at any time without notice by changing the position of the signal; under the normal danger the signal clears, only on the approach of a train, and the clearing relay can be placed at any desired point, so that the engineer can see it clear if so desired, or at the entrance of the block; or in the case of short blocks, at the entrance of the next block in the rear. When installed in this, the usual way, trackmen and bridgemen working in sight of a signal are always informed as to the approach of a train, and can govern their work accordingly to better advantage, and with greater safety to themselves.

On double track, engineers can be informed of the approach or non-approach of a train on the opposite track; can maintain higher speed past stations if no train is approaching, and avoid running between another train and a station if a train is approaching on the opposite track.

Persons using highways or farm crossings in sight of a signal can be governed intelligently as to the use of the crossing.

At commutation stations especially, patrons learn to notice the position of signals, and if clear, indicating a train in the block, hasten their approach to the station, and are ready on the platform to take their train promptly upon its arrival, shortening the average stop to some extent.

Automatic intermediate signals between interlocking points work in harmony with such signals if installed on the normal danger principle, without change in locking circuits, or in operating regulations.

I may have omitted some of the minor points, but the principal reasons in favor of either system are enumerated above.

Recent Bridge Work on the Nickel Plate.

BY ALBERT J. HIMES,
Bridge Engineer, N. Y., C. & St. L.

The New York, Chicago & St. Louis was built in 1882. The bridges of wood and iron erected at that time were unsuited to the present heavy traffic and their reconstruction has been in progress for about six years. It is the fixed policy of the road to pay for all improvements out of current earnings, and this work has therefore not progressed as rapidly as it might have done had the whole amount of money to be expended been available at one time. Up to the present time about 13,000 tons of new work have been erected and at the beginning of this year there yet remained to be built approximately 7,000 tons. Of this amount 1,600 tons were under contract.

Among the structures which have been or are to be replaced are four double-track viaducts, having a total length of 6,099 ft., and eight single-track viaducts, having a total length of 7,996 ft. The depth of the ravines crossed by the viaducts is generally about 100 ft. Fig. 1 shows the old viaduct at Swanville, Pa., which illustrates the style of all the old structures. They were pin-connected, king-post, and Fink trusses of 30 ft. and 60 ft. span supported by trestle towers. The old structures were generally in good condition

and the material of excellent quality. Many of them have been re-erected on the neighboring electric roads and are still doing good service.

But two of the old viaducts remain on the road, one at Painesville, Ohio, which is under contract for renewal, and one over the Cuyahoga Valley in Cleveland, a part of which has just been reconstructed. Fig. 2 shows the new viaduct at Ashtabula which is typical of all the new viaducts. They are composed generally of alternate 30 ft. and 60 ft. deck plate girder spans supported on trestle towers. The bracing of the towers is composed entirely of stiff members with riveted connections.

These viaducts have been erected upon the old masonry without interrupting traffic. This seemed to be a new problem for the bridge companies and their first attempts did not compare very favorably with their later efforts. In one case, a temporary run-around was erected of wood, and in another case a falsework was erected about 90 ft. in length along the track and moved ahead from span to span by taking it down and re-erecting. The latter method was very slow and tedious and also very expensive.

The most satisfactory method, and that which was used at Ashtabula, is to build a ground traveler to envelope the whole structure and move it along on runways placed on the bed of the valley. This method is well illustrated by Figs. 3, 4 and 5, which are reproduced from photographs of the work at Ashtabula. The girder spans were riveted up complete at one end of the viaduct and new ties placed on the span ready for rails. The spans were then run out on flat cars, lifted from the cars by the traveler, and the car run back off the structure. The track was then cut, the old span lowered to the ground and the new span lowered to place. In changing the towers, the new bents were first set up close to the old bents and when ready for the change, after lifting the old tower span from the posts, the old bents were disconnected and moved towards the center of the tower, the new bents placed in position, connected by longitudinal bracing, and the old span lowered to place on the new posts. The ends of the old 60-ft. spans adjacent to the tower were also supported by the traveler during the operation. The maximum time required to place a new tower was three hours, and to place a new span, two hours. It was very seldom that trains were delayed, and never more than two hours, the limit fixed by the contract. The total time of erection, not including the framing and removal of the traveler, was 73 days. There were about 10 trains per day running over the viaduct during working hours.

A novel method of placing the span at the west end of the structure was used, where by reason of the slope of the side of the valley, the traveler could not be moved near enough to the abutment to swing the span directly to place. A gallows frame was used to carry one end of the span, while the other end was held by the traveler.

The removal of the 170-ft. span and the erection of the 75-ft. and 80-ft. plate girder spans over the creek was a somewhat different proposition and required the use of timber towers to carry the 80-ft. span. The latter span came at about the center of the truss span and was erected first without breaking the old trusses. Portions of the steel towers at each end were erected before the span and when it became necessary to break the portals to put in the 75-ft. spans, it did not take long to make the change. When the sway bracing had been removed the old trusses were bolted directly

Fig. 1—Typical Fink Truss Viaduct at Swanville, Pa. Built in1882. Rebuilt, 1904.

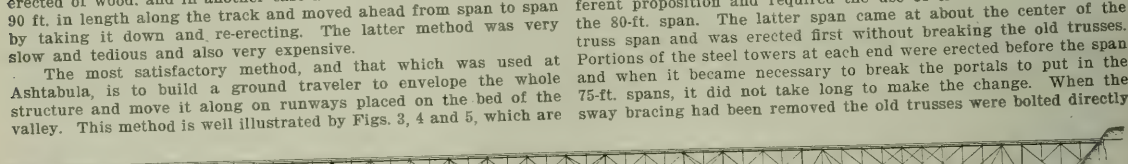


Fig. 2—Elevation of Old Ashtabula Viaduct, New York, Chicago and St. Louis.

to the new girder spans to hold them in position while taking them apart. The old piers were abandoned and will be removed.

The bridge material was manufactured by the King Bridge Co., Cleveland, Ohio, and erected for them by the Pittsburg Construction Co.

There are five drawbridges on the road, three of which have been rebuilt and one is under construction. The Cummings drawbridge over the Grand Calumet River in Chicago is a single-track riveted structure, partially continuous over the center, and has a span of 214 ft. 11 in. center to center of end bearings. The load is transmitted to the drum by means of four loading beams bearing on eight radial girders at a point such that about 12 per cent. of

the weight is carried on the center and 88 per cent. on the rim. The end lifting apparatus consists of a toggle arrangement such that the motion of the bearing surface is vertical. Its corners are beveled, and it operates as a wedge to bring the bridge into perfect line when driven home. The rails are connected by a sleeve rail-lock which makes the rails continuous, and they are connected with the interlocking apparatus in such a way that the rail-locks cannot be drawn until the semaphores have been set at danger. The bridge is operated by a 16 h.p. gasoline motor. The perfection of the operating machinery is shown by the fact that one man can turn the bridge by hand under favorable conditions and three men can release the support at the ends of the bridge. The total weight of the bridge is 261 tons.

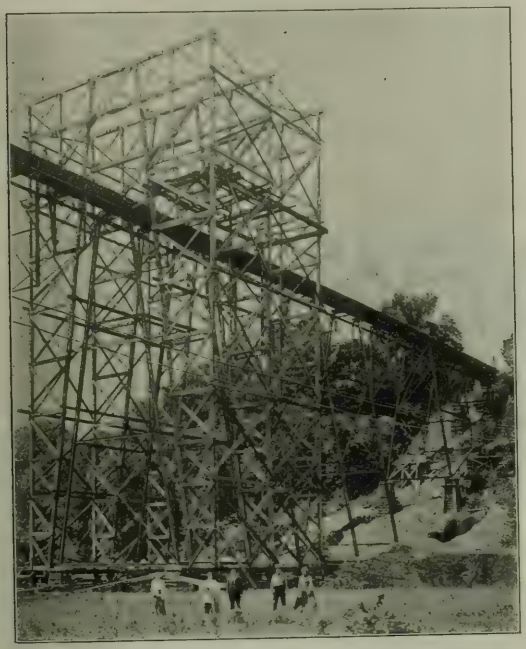


Fig. 3—Traveler Used in Erecting Ashtabula Viaduct.

The Hammond drawbridge is a double-track structure 225 ft. long, used jointly by the Erie R. R. and the N. Y., C. & St. L. Mr. M. R. Strong, Bridge Engineer of the Erie, designed the bridge, and the construction was performed under the direction of the N. Y., C. and St. L.

The Lorain drawbridge is similar in a general way to the Cummings bridge. It is operated by electricity and the load is distributed to 16 points on the drum and to the center. The latter carries 20 per cent. of the weight. The bridge weighs 604 tons and has a span of 341 ft. 4 in. center to center of end bearings. It is shown in Fig. 6.

The new bridges are being designed to carry two 136-ton locomotives, coupled, followed by 4,000 lbs. per lineal foot. The material used has an ultimate strength of between 56,000 and 64,000 lbs. per sq. in. The unit stress is 7,500 $\left(1 + \frac{\text{min}}{\text{max}}\right)$ for tension members, and all rivet holes are reamed except those in the bracing. The railroad company either prepared full detail plans before asking proposals, or else specified that the structure in question should be similar to some structure already built. In the case of the drawbridges above mentioned, the plans were prepared by the railroad company, there being none like them on the road. The mill and shop inspection was handled directly by the railroad company, that method having been found more satisfactory than turning the work over to an inspection bureau. The latter plan was tried first and then abandoned.

Three large viaducts were built by the American Bridge Co., and most of the other work, including all the drawbridges, by the King Bridge Co. The fabrication of the work by both companies was very satisfactory. Rapid and careful erection was performed by the Pittsburg Construction Co., which has sub-contracted for much of the erection from the King Bridge Co.

When by reason of a change in the span length or in the character of the bridge, new masonry has been required, it has been built entirely of concrete. Old masonry, when in bad condition, has been reinforced by concrete jackets having iron rods taken from the old bridges, embedded in the concrete to prevent a pos-

Fig. 5—New Viaduct Over Ashtabula Creek, Showing Traveler.

Fig. 4—Completed Viaduct Showing Girders and Towers.

Fig. 6—New Drawbridge at Lorain, Ohio.

sible separation of the old masonry from the new. Where changes in the height of piers and abutments have been necessary, new concrete copings of liberal thickness have been built and the whole course of concrete firmly tied together with large iron rods.

The most difficult foundations were at Lorain, where the material under the center pier and the west abutment was a soft gravelly clay which required piles. Excavation was made by means of coffer dams to a depth of about 22 ft. below water and then piles were driven in the bottom of the pit as close together as possible. The piles were not cut off but left sticking up into the concrete in an irregular form, thus avoiding the expense of a grillage and making it certain that every pile did its share of the work. It was thought best to carry the concrete down to the depth of 22 ft. in order that dredging in the channel might in no case endanger the foundation for in the case of the center pier, had the piles been unsupported for even a short space between the ground and the masonry, there would have been danger of displacement that might interfere seriously with the operation of the bridge.

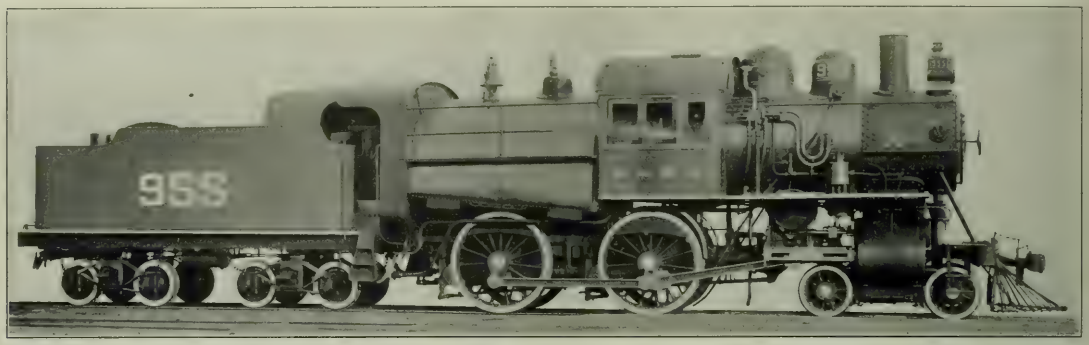
At Cummings and Hammond the foundation was a gravelly clay so hard that no piles were needed. At Cummings the new center pier was built on the location of the old pier, but having a much larger diameter, 30 ft. at top, only the outer shell, about 10 ft. thick, was carried down to the full depth of 22 ft., the center of the pier being filled with concrete right over the old foundation, which was composed of piles and a grillage. The grillage was, of course, first removed and the concrete deposited among the piles so as to secure their full bearing value.

The foundation work was all done by day labor under the direction of the railroad company's engineers. The concrete was made of Portland cement, sand and unscreened limestone in the proportion of one barrel of cement to 10½ cu. ft. of sand and 27 cu. ft. of stone. The concrete was built at an average cost of a little less than $5 per yard exclusive of the freight charges on material hauled over the company's own line.

All of the bridge renewal work on the New York, Chicago & St. Louis is being carried out under the direction of Mr. E. E. Hart, Chief Engineer.

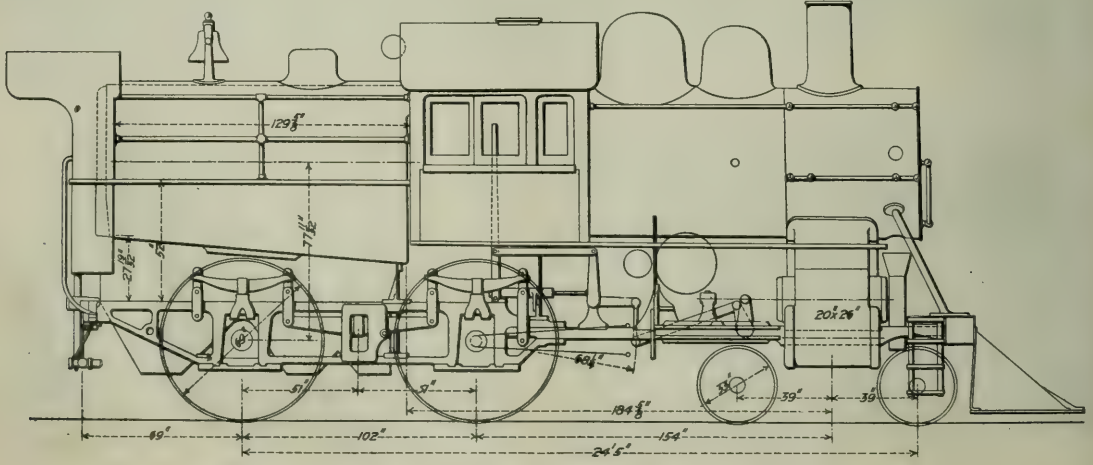
Lackawanna Locomotive with Schenectady Superheater.

The American Locomotive Co. has recently built two eight-wheeled (4-4-0) locomotives for the Delaware, Lackawanna & Western, one of which was fitted with a Schenectady or Cole superheater. The general construction of the superheater pipes and connections is the same as that already illustrated in the *Railroad Gazette* for June 9, 1905, in connection with the Pacific locomotives for the Erie. In this case there are 60 large tubes for the superheater, arranged as shown in the accompanying plan of the tubesheets, where there are 60 2½-in. holes in the back, and 60 $3^1/_{16}$-in. holes in the front tubesheet. It will be seen, too, that they occupy the upper central portion of the nest of tubes having a depth of six horizontal rows and a width of ten vertical rows, which is equivalent to somewhat more than eight horizontal and 15 vertical rows of the ordinary tube. The superheater tubes, moreover, are not staggered, but are set in straight lines, for the sake of securing a more convenient connection at the front end. As the space occupied falls well within the transverse dimensions of the tubesheet, the small tubes rise in four vertical rows on either side outside the superheater tubes, as in the case with the engine noted above. The superheater tubes naturally reduce the heating surface very materially, in this case cutting it down from 1,947.89 to 1,635.56 sq. ft.

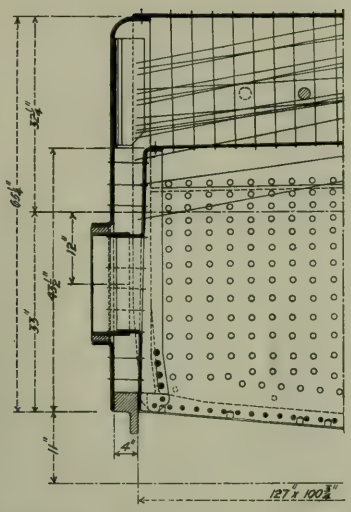


Passenger Locomotive for the D., L. & W. R. R. Fitted with Schenectady Superheater.

The boiler has the broad Wootten type of firebox, in accordance with the standard practice of the road, and this has one very wide door with across inside dimensions of 34¼ in. This was probably done in order to avoid the troubles that are apt to arise when two doors are cut in the back head. The method of cutting the door opening itself is worthy of attention. Instead of flanging the inside sheet out far enough to engage the flange of the outer sheet and rivetting the two together, the inner sheet is turned out only just far enough to rivet to a ring which, in turn, runs out to engage with the outer sheet, a heavy ring being placed between the two for stiffening. Instead of the double rivetting all round the mud ring that is common practice, the sheets have a single rivetting along the sides and ends; double rivetting being used only at the corners where leaking is most liable to occur. In fact, it



Side Elevation of 4-4-0 Locomotive with Schenectady Superheater—D., L. & W. R. R.

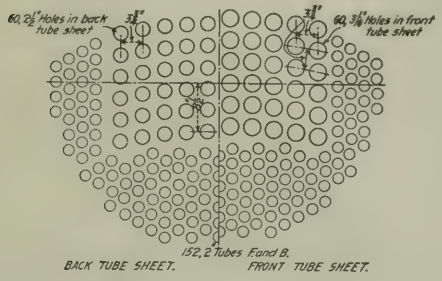


Longitudinal Section of Back End of Fire-Box Showing Door Construction—D., L. & W. Locomotive.

has been shown by long practice that double rivetting at the corners is all that is needed. In this case the shape of the mud ring is particularly well designed in order to accomplish this neatly and effectively. The firebox is carried, at both the front and back, by the buckle plates that have come to be accepted practice. The dome connection is very heavy, having a thickness of 1 in., and the opening is farther stiffened by the use of an inside plate or welt ¾ in. thick. At the firebox there is a shallow combustion chamber, and at the front the shell extends out beyond the tubesheet to take the ring connecting with the smokebox. The back course of the shell is conical with the top horizontal and the bottom sloping down to the throat sheet, thus increasing the depth of the body of water beneath the tubes where it is especially needed.

From the side elevation of the engine it will be seen that the whole of the boiler, with the exception of the smokebox, where it rests upon the saddle, is carried by buckle plates similar to those used under the firebox. Those that come beneath the shell are merely the continuance of an old practice. A noticeable feature in connection with the machinery is the use of the piston valve and the sharp angle of rise of the connection between the link block and the rocker arm. Open eccentric rods are used and the link is brought down to the level of the driving axle, while the upper end of the rocker arm is about 18 in. higher. This requires a sharp angle for the bar, but the advantages of a direct connection and an inside admission for the valve are retained.

The driver brakes are operated by two cylinders placed between the frames on a line with the guides. These cylinders are bolted to the inside of the frames and work on the upper end of a lever that multiplies the pull six to one. To the lower end of the lever a connection leads to an equalizer at the forward driver which distributes the pull to the brake-shoe levers of the two wheels, an arrangement that will be readily understood by reference to the special engraving of the driver brake rigging.

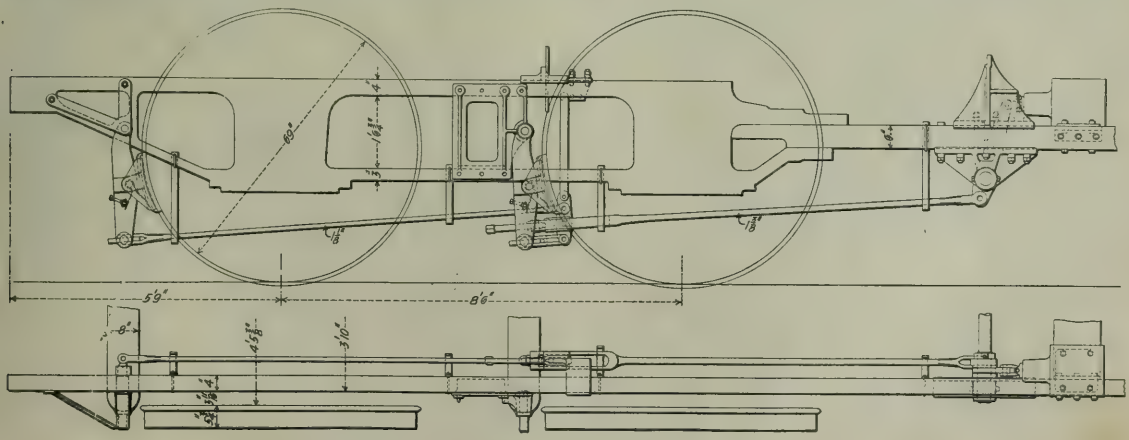


Arrangement of Tubes D., L. & W. Locomotive with Schenectady Superheater.

The following are some of the principal dimensions of these engines:

Cylinder, diameter	20 in.
Cylinder, stroke of piston	26 in.
Wheel base, driving	8 ft. 6 in.
Wheel base, total	24 " 5 "
Weight in working order, without superheater	151,200 lbs.
" in working order, with superheater	153,100 "
" on drivers, without superheater	100,000 "
" on drivers, with superheater	101,000 "
Heating surface without superheater	1,947.89 sq. ft.
" " with superheater	1,635.56 "
" " firebox, without superheater	190.8 "
" " firebox, with superheater	191.54 "
" " total, without superheaters	2,138.69 "
" " total, with superheaters	1,827.10 "
Grate area	87.54 "
Axles, driving journals, diameter	9 in.
" " " length	13 "
" truck, " diameter	6½ "
" " " length	12 "
" tender, " diameter	5 "
" " " length	9 "
Fuel	Fine anthractie
Boiler type	Straight top
Firebox (Wootten) width	100 in.
" length	126 3/16 "
" thickness (crown, side and back sheets)	⅜ in.
Water space	4 "
Crown stays	Radial
Tubes, diameter	2 in.
" diameter, for superheater	3 "
" No. 2-in. diameter, without superheater	280
" " 2-in. " with "	152
" " 3-in. " with "	60
" length	13 ft.
Exhaust pipe, double, diameter	3¼ in.; 3⅜ in.; 3½ in.
Stack, diameter	18 in.
Stack, height above rails	15 ft.
Tender, frame	10-in. steel channel and plates
Tank capaciay, water	5,000 galls.
Tank capacity, fuel	10 tons.
Valve, type	Piston
" travel, 5½ in.; lap, 1 in.; exhaust clearance, 1/16 in.; lead, 1/16 in.	
Wheels, driving, diameter	69 "
" engine truck, diameter	33 "
" tender truck, diameter	33 "
Tractive power	23,710 lbs.

Cast-steel is used for the journal boxes and driving wheel centers, and the engine is equipped with the Westinghouse high-speed brake.



Driver Brake Rigging of 4-4-0 Locomotive—D., L. & W. R. R.

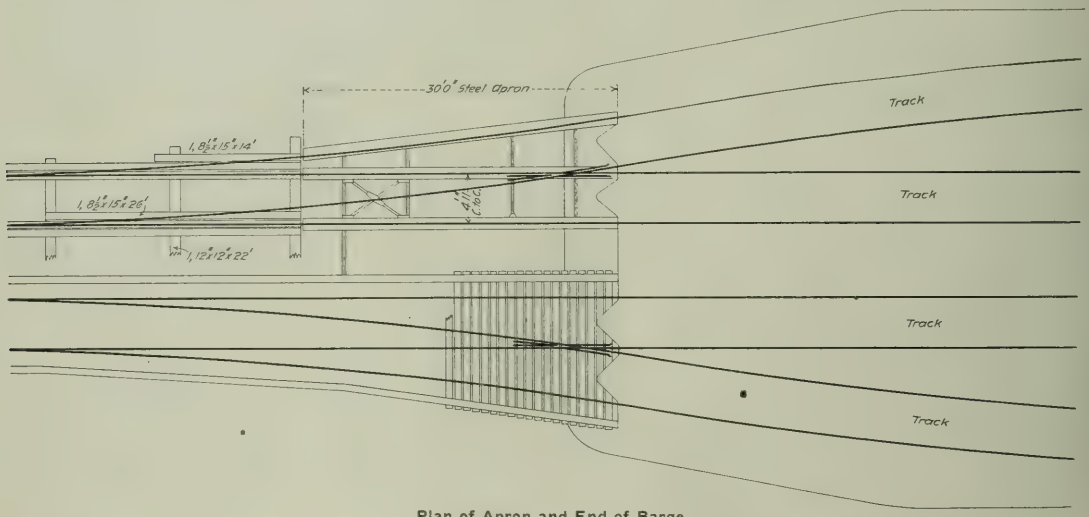
East Ivory Car Ferry of the Missouri Pacific.

With the exception of the Illinois Division, which runs from East St. Louis south to Thebes, Ill., the Missouri Pacific lines are all west of the Mississippi river and have St. Louis as their eastern and northern terminus. The Southern District lines, formerly known as the St. Louis, Iron Mountain & Southern, during the last five years have been gradually extended by new construction and purchase so that there are now what are practically two complete parallel lines from Louisiana north to St. Louis, one running from 50 to 100 miles west of the Mississippi and the other following closely along its banks. The road now known as the Illinois Division was built about three years ago by outside interests and sold to the Missouri Pacific on its completion. It forms the northern link in the new line parallel to the main line of the St. Louis, Iron Mountain & Southern and takes the place of a road on the west bank of the river, a route which had been previously surveyed and considered in connection with this plan for a parallel road into St. Louis. The Illinois line offered much more favorable grades than the route in Missouri, which ran through rough undeveloped country, and at the same time taps the excellent coal fields of southern Illinois as well as offering an outlet for the tremendous corn crops grown in that region. So despite the fact that its utilization as a part of the Missouri Pacific's north and south line involved two crossings of the Mississippi river it presented a more favorable route than the one originally surveyed on the Missouri side. At the south end of the line connection is made with the rest of the system over the Thebes bridge to Gray's Ferry, Mo. At the north end the freight terminals are in East St. Louis and passenger trains run into the St. Louis Terminal Station over the Ead's Bridge. The Terminal Railroad Association terminals in St. Louis and East St. Louis are often badly congested and the charges for transfer across the river are high so that it was thought necessary to provide some other means of transfer for freight operated exclusively by and for the railroad company. Plans were accordingly made soon after the purchase of the Illinois Division for building the necessary inclines and cradles on both sides of the river for a car ferry to operate about six miles below the Eads Bridge at East Ivory, Ill.

The design of a suitable incline and bridge involved difficulties not met with in lake and tidewater ferries. The banks at this point are low and provision must be made for changes in the stage of water of as much as 20 ft. as against 8 ft. or 10 ft. in most tidal waters. The usual form of floating bridge and apron was, of course, out of the question and an incline trestle and moving cradle was substituted. The details of the trestle and cradle are shown in the drawings.

The main line of the Illinois Division is about a mile back from the river bank and a double track embankment was built across the bottoms to the end of the incline, which is approached on a 10-deg. curve. The trestle work begins about 100 ft. out from the high water mark on the bank and extends down into the river on a 4 per cent. and 3.45 per cent. grade for a distance of about 900 ft. It consists of bents of eight piles each spaced 11 ft. 9 in. and 11 ft. center to center surmounted by four rows of stringers carrying the ties and rails. The stringers are dapped over the caps of the bents and the ties are likewise dapped over the stringers, every fourth tie being bolted down to alternate stringers. The guard rails are dapped 1½ in. over the ties and lag screwed to alternate ties to prevent any shifting. Twelve-foot centers are preserved between the tracks. The piles for the outer 380 ft. of the trestle were cut off under water and the trestle framing for about 250 ft. was done under water, sometimes at a depth of from 10 to 15 ft. The work was frequently delayed on account of high water and it was severely damaged twice by the June floods. Before work was begun 27 clusters of six piles each were driven 60 ft. above the trestle on the up-stream side at intervals of 40 ft. and chain fenders were strung between them to prevent damage to the bents or trestle framing from floating driftwood which is carried down by the floods in large quantities. These clusters begin close inshore and extend out 280 ft. beyond the end of the trestle to protect the ferry barges and to form a crude slip. In spite of this protection the cradle has been put out of commission a number of times by drifting logs and debris which had to be removed before the incline could again be used.

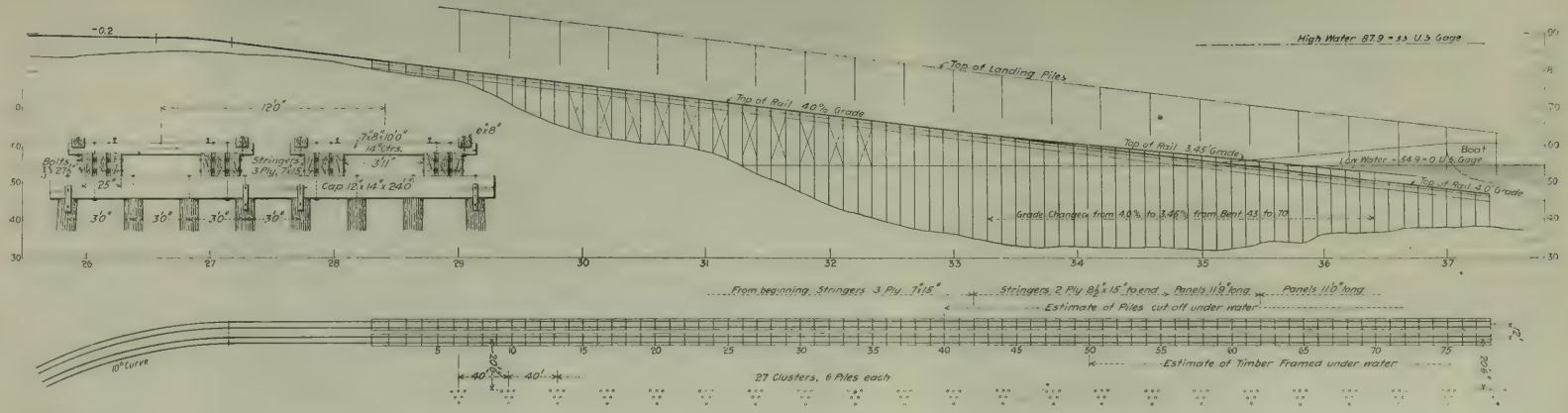
The cradle is 150 ft. long and is framed in two parts, each half carrying one track. The top and bottom stringers are 8½-in. x 15-in. timbers, packed with cribbing made up of 12-in. x 14-in. blocks to give the rail on the cradle a rising grade of 3 per cent. The bottom stringers carry cast journal boxes bolted to their under side in which the axles of the supporting wheels revolve. These wheels are mounted on standard axles with 4½-in. x 8½-in. journals. With the exception of the four pairs of wheels on the inshore end, which are 12 in. and 20 in. in diameter, all of the wheels are 33 in. in diameter. At the inshore end where the depth of the cradle will not allow the use of wheels running in journals, sliding shoes are substituted. A feather rail 12 ft. long leads from the trestle rails to the cradle rails. The plan shows the cross-framing and bracing and the location of the hoisting sheave for moving the cradle up and down on the trestle to accommodate the different stages of water.



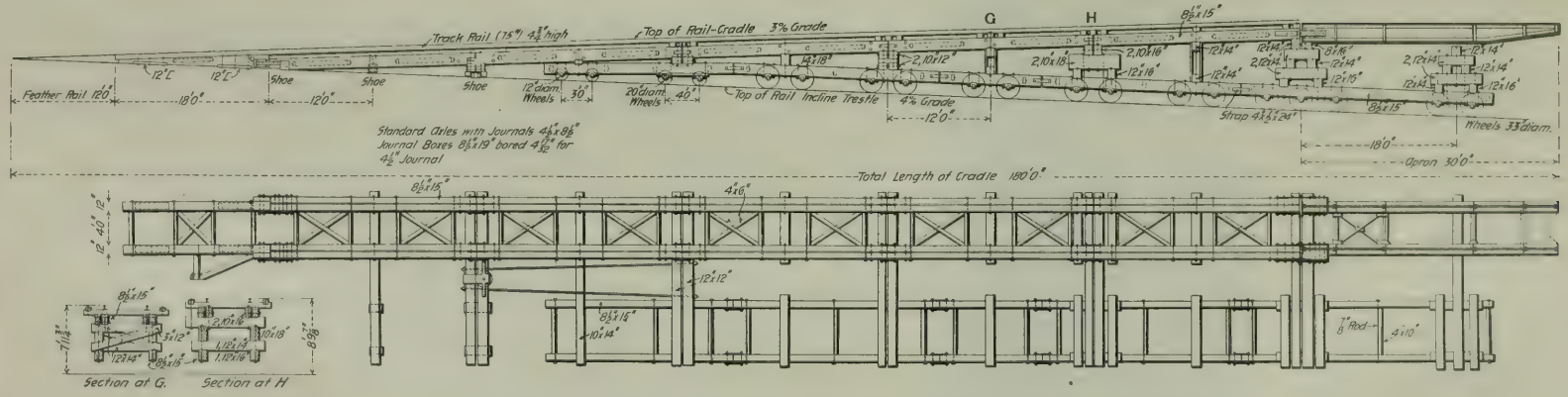
Plan of Apron and End of Barge.

The hinged apron at the end of the cradle is framed of steel with plate girder stringers 24 in. deep and light angle cross-bracing. It is 30 ft. long and is supported at the outer end on a nest of packing blocks built up on an extension of the bottom stringers of the cradle. The form of bow on the car floats is such that the apron is lifted off its outer bearing when the boat is tied up to the cradle and rests on a shelf slightly below the level of the boat deck.

The barges have four tracks 12 ft. center to center, and the necessary frogs and switches are put in on the cradle and apron, leaving the tracks on the barge clear. The frog points are located 4 ft. 6 in. from the end of the apron and a No. 6½ frog is used which places the switch point 62 ft. back on the cradle. Without using very sharp curves on the switches this brings the fouling point on the barge tracks well up toward the bow and increases the capacity about four cars over the old method of locating the switch on the barge. One steamer and one barge are at present in service between the inclines at East Ivory, Ill., and West Ivory, Mo. Most of the coal shipped from the Illinois fields into St. Louis is delivered to the Missouri Pacific tracks on the west bank of the river over this route, and a large part of the southbound shipments over the Illinois Division are ferried over the river at this point.


High Water 87.9 = 13 U.S Gage
Top of Landing Piles
Top of Rail 40% Grade
Top of Rail 3.45% Grade
Low Water - 54.9 = 0 U.S. Gage
Boat
Top of Rail -4.0% Grade
Grade Changes from 4.0% to 3.46% from Bent 43 to 70
Bolts 27"
Stringers 3 Ply 7"x15"
Cap 12"x14"x240"
From beginning, Stringers 3 Ply 7"x15"
Stringers 2 Ply 8½"x15" to end
Panels 11'9" long
Panels 11'0" long
Estimate of Piles cut off under water
Estimate of Timber Framed under water
10° Curve
27 Clusters, 6 Piles each

Plan, Profile and Cross-Section of Trestle Incline for East Ivory Car Ferry, Missouri Pacific.



Details of Movable Cradle of East Ivory Car Ferry, Missouri Pacific.

Experiments With Signal Lenses.

Dr. Charles H. Williams, of Boston, in a paper presented to e Railway Signal Association at its annual meeting at Niagara lls, gives the record of some photometric tests of a signal light rently made by him, and he says that the best results were ob- ined with some lenses, designed by himself, which are convex on e front surface, with a greater curvature at the center than at e periphery, and with a concave surface on the back. This design to be patented.

Dr. Williams started to make his experiments outdoors on the ne of the Boston & Maine Railroad, but the smoke from passing ains so disturbed the conditions that he transferred his work to arblehead, where he had a half-mile view across an arm of the arbor. He took one of Peter Gray's switch lights and had the penings glazed with thin plate glass, so as not to disturb the light when changing the lenses. He screwed the lantern to a small turn- table so as to turn the axis of the lens at will 5, 10, 15 and 20 degrees from the direct line. To measure the small amount of light from a common flame at the distance of half a mile he had to im- provise a photometer by using a "photographic wedge" such as is used in measuring the light of stars. This photographic wedge consists of a glass photographic negative which has been exposed to light in such a way that when developed the density of the film in- creases from the clear end to the dense end, in such proportion that for equal distances on the wedge, measured from the clear end, the density of the film will increase in geometrical progression (1, 2, 4, 8, 16, etc.). If such a film is held between the light to be tested and the eye, the light can be seen through the clear end, and by moving the film toward the denser end a point is found where it entirely cuts off the light. This point will vary according to the intensity of the light, and thus various lights can be com- pared with each other, and with any given standard, by noting the distance from the clear end to the point where the light is cut off.

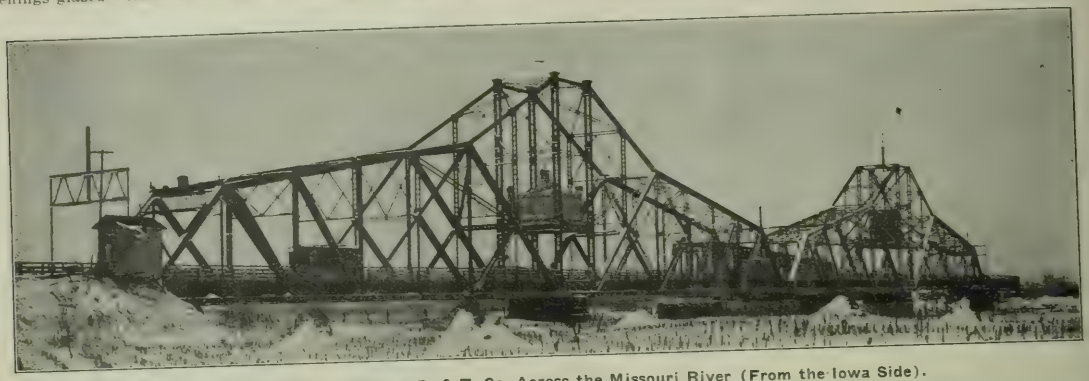
The wedge was mounted so that it could be moved horizontally in front of a tube lined with black velvet. For testing red lights a wedge-shaped cell filled with a green fluid (50 per cent. solution of nickel nitrate) was used instead of the wedge, but this was not enough better than the photographic wedge to warrant its continued use. By the gage on the wedge the comparative value of different lights was measured in centimeters from the clear end of the wedge, the figure in the record showing the point where the light disap- peared. Three corrugated lenses were used and three of the new design mentioned above. With uncolored lenses, placed squarely in front of the observer, the corrugated lenses and the new design differed but little, varying from 6.0 to 6.6 centimeters; but when the lamp was turned 10 degrees to one side, the new lenses showed much better than the corrugated, the latter falling to 3.6 and 3.9, while the others gave 5.5 and 5.7. In other words, for a signal or switch on a curve or in case a light is not carefully fixed in posi- tion, the new lenses are an improvement. They are also easier to keep clean, light is thrown over a wider angle, there is less light lost from reflection from the back surface of the lens, and there are no dark rings. The new design is, however, heavier than common designs, and it stands out farther from the surface of the lantern. Other tests were made with red lights.

Dr. Williams has designed a pocket photometer. It consists substantially of his photographic wedge, with the scale marked on it at one side, and the film protected by glass. The whole is en- closed in a metal case. He estimates that this will not cost more than $2. To use this photometer the wedge is withdrawn from the case to its whole length; it is then held by one hand between the eye and the light to be tested. One finger of the other hand is held against the side of the scale to mark the level at which the light is seen. The wedge is then moved vertically up and down past this finger, until a point is found where the light is cut off. By the aid of a hand lantern the scale is then read off at the point where the finger nail rests against it.

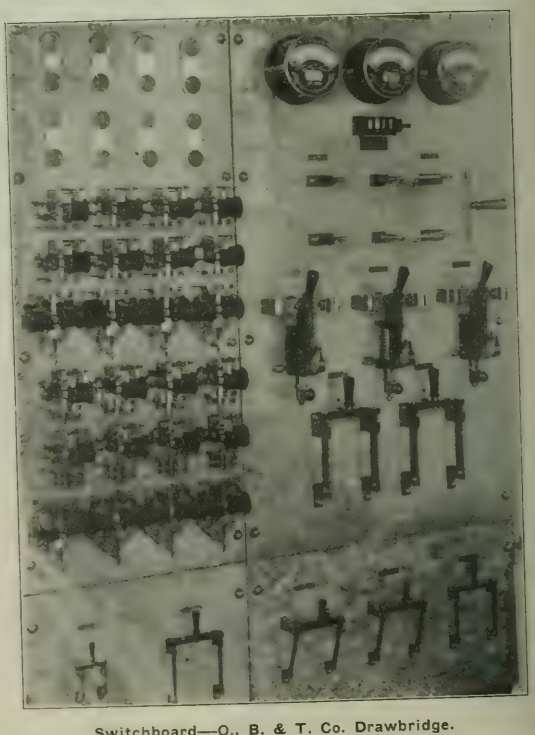
Operating and Controlling Devices of the Omaha B. & T. Co.'s Drawbridge.

The Missouri river bridge of the Omaha Bridge & Terminal Railway Company was described in these columns Feb. 24, 1905. It consists of two 520-ft. draw spans placed tandem, the longest drawbridges in the world. One was built in 1893, and the other was completed in January last.

In arranging for the operating and controlling devices and for the signals guarding the approaches, the idea constantly in mind was to render it impossible for the operator intentionally or by any blunder to perform any of the motions or operations out of its proper order; to permit the operation of the bridge when the sig- nals were clear for trains; or to clear the signals when the bridge was not in condition to permit trains to pass over safely. The motive power is electricity, which is taken from two independent circuits, one on each side of the river. The feeders as well as all



New Bridge of the Omaha B. & T. Co. Across the Missouri River (From the Iowa Side).

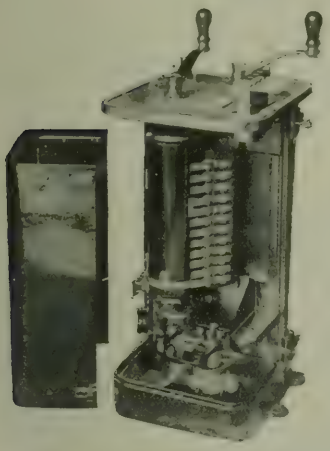


Switchboard—O., B. & T. Co. Drawbridge.

of the signal and indicator wires are brought to the operator's house through overhead spans ending in a swivel pole, at the bottom of which is a set of insulated collector rings for making connections at all points in the rotation of the bridge. The swinging of the draw span is performed by two 40 h.p. street railway type motors mounted directly on the machinery inside of the drum. The end lifts, which are of the wedge type, are moved by two 20 h.p. compound motors—one at each end of the bridge.

The rail locks at each end of the bridge are worked by compressed air, one cylinder being connected to all of the rail locks at one end. The semaphores are operated by primary batteries, the home signals being placed about 500 ft. from each end of the bridge, and the distant signals about 1,000 ft. in advance of the home signals. The railroad line is single track but the bridge is double track, requiring a double-track signal system. All signals are normally at danger, requiring trains to approach the bridge under control.

Top of Controller Box—
O., B. & T. Co.'s Drawbridge.



Controller O., B. & T. Co.'s Drawbridge.

The entire control of the signal system and the bridge is effected through a single controlling stand designed especially for this bridge. The semaphores being normally at danger, no train is permitted to enter the bridge without the signal of its track first being cleared by the operator. The levers controlling the semaphores are mechanically interlocked to make it impossible to allow trains to approach the bridge from opposite directions on the same track.

Taking up the movements in the order of their occurrence, it will be seen in the engraving of the top of the controlling stand, that the left-hand handle, which controls all movements preliminary to the actual swinging of the bridge, is standing at point 1. In this position the signals are under the control of the operator. Moving the handle from point 1 to point 2 breaks the signal circuits, permitting all signals to go to danger; and until this is accomplished it is impossible to move to point 3, the controller drum being locked in position. In position 3 a four-way air valve

Operators' Direction Card—O., B. & T. Co. Drawbridge.

at the bottom of the controller box is opened and the air cylinders for moving the rail locks are set in operation. There are eight of these locks, which are connected up in series by an electric circuit. This circuit is completed only when all eight locks are released; and until the circuit is formed the controller is locked, preventing movement of the handle to the next position. Position 4 starts the 20 h.p. wedge-moving motors. When each motor has made the proper number of revolutions to have withdrawn the wedges, the current is automatically cut off by means of a special stop device and the connections left so that the motor cannot be run any further in that direction but can be reversed readily at the proper time. When the wedges have been withdrawn, the handle can be moved to 5, which unlocks the second controller, moved by the right-hand handle. This latter controller, which governs the bridge-swinging motors, is a General Electric standard series-parallel controller for 40 h.p. motors. The first drum remains locked at point 5 until the bridge is back in normal position. When the rails are exactly in line, electric contacts are formed at the ends of the bridge which release this drum and permit the operator to perform in reverse order the several operations already described. The handle, however, continues to move in the same direction through a complete revolution back to point 1. In engraving of the controller will be noticed a rectangular space near the center of the top of the box. This is for the insertion of the card giving exact instructions to the operator.

In addition to having the controller drum locked until the next movement can be performed safely, each movement is visually indicated by means of red and white lights on the switchboard. These indicating lamps may be seen in the engraving at the top of the board at the left-hand side. There is also placed on the board for the instruction of the operator a card, 3 in. x 6½ in., which is reproduced. Each lamp is marked in accordance with its indication, the markings under the lamps corresponding to those shown on the card.

The operator's house, which occupies an elevated position at the center of the span, is fire-proof, with steel framework, concrete floors and walls of Portland cement plaster on expanded metal laths. It contains the switchboard, controller and an electric compressor. The compressor is the regular street car type with a capacity of 50 cu. ft. of free air per minute. It is entirely automatic in its operation, uniform pressure being maintained at all times in the reservoir.

The entire operating, interlocking and signal system was designed and installed by Geo. P. Nichols & Bro., Chicago, from general specifications prepared by Waddell & Hedrick, designers of the bridge.

Effects of Work and Heat on the Quality of Rivets.

At the July meeting of the Academy of Science (France) Mr. C. Fremont presented a note in which he discussed the quality of rivets used in bridges, structural work and boilers.

In order to properly investigate the subject he took seven specimens of Swedish iron, from those in common use, having a tensile strength of 47,000 lbs. per sq. in. and six pieces of steel whose strengths varied from 50,000 lbs. to 78,000 lbs. per sq. in. Three specimens were taken from each of the seven samples intended for tensile and bending stresses, both static and dynamic. One of these three pieces was tested in its original condition, that is to say, just as it was cut from the bar and without receiving any treatment whatsoever either thermal or mechanical; the second was heated in the forge to the temperature at which rivets are usually driven, that is to say from 1,650 deg. to 2,000 deg. Fahr., but received no mechanical treatment; finally the third specimen was made into a rivet, then driven hot by a machine under a pressure of about 55,000 lbs. and then completely removed so that it could be used like the two preceding specimens for the various tests of tension, bending, etc.

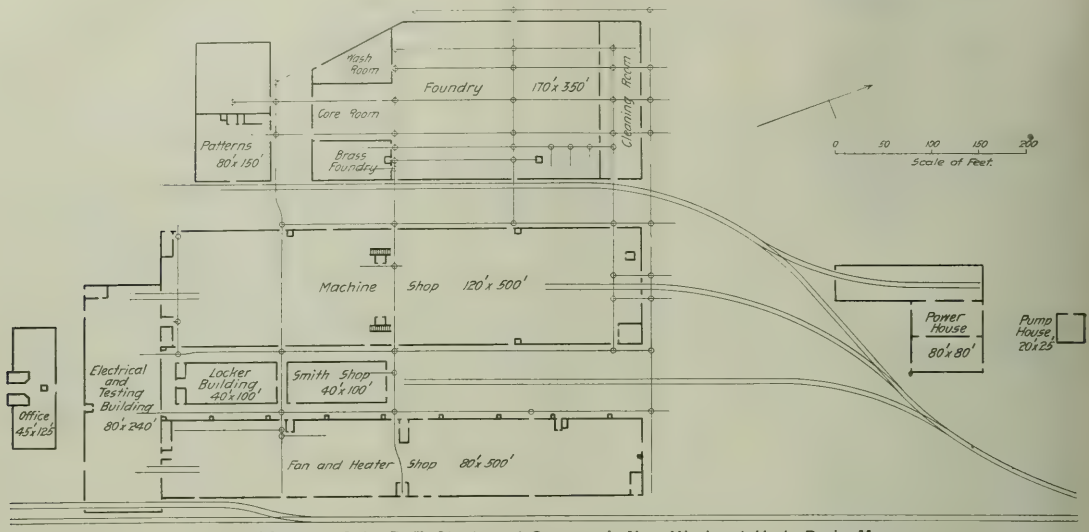
The following table gives the results of these tests, and it may be stated that the metal after having been subjected to mechanical contraction in cooling under tension is visibly improved.

The result of the shock tests upon these bars shows that their brittleness was not increased, so that the increase of tensile strength did not have the effect of temper as might have been supposed.

		Limit of elasticity.	Ultimate strength.	Reduction of area per cent.	Resistance to shock.
Swedish iron	Natural.	23,343	47,678	0.55	24,123
	Heated.	23,343	47,678	0.49	20,961
	Riveted.	36,894	61,585	0.54	25,542
Mild steel (marine q'lity)	Natural.	27,671	50,658	0.65	31,218
	Heated.	23,910	49,665	0.63	36,894
	Riveted.	36,894	61,585	0.66	34,056
Mild steel (structural)	Natural.	32,979	64,565	0.62	85,140
	Heated.	34,056	60,591	0.61	28,380
	Riveted.	49,026	78,471	0.59	14,190
Nickel steel (3%)	Natural.	39,023	62,578	0.63	31,218
	Heated.	31,928	59,798	0.65	26,961
	Riveted.	56,760	81,451	0.62	38,313
Semi-hard steel (marine)	Natural.	34,766	69,531	0.57	85,140
	Heated.	31,928	68,538	0.59	70,950
	Riveted.	56,760	92,235	0.59	11,352
Nickel steel (5%)	Natural.	42,570	70,524	0.66	32,637
	Heated.	44,911	70,524	0.64	31,218
	Riveted.	75,491	103,303	0.64	41,151
Semi-hard steel (German)	Natural.	42,570	77,477	0.64	14,190
	Heated.	41,151	79,464	0.65	14,190
	Riveted.	52,148	90,390	0.61	31,218

The B. F. Sturtevant Company's New Works.

The general layout of the new works of the B. F. Sturtevant Company at Hyde Park, which is about nine miles from Boston, Mass., is shown in the accompanying illustrations. The plant is essentially a commercial one, and therefore a detailed description of it would not be of special interest to railroad men; although the following description of the general layout may be suggestive at least, inasmuch as careful study was given to it, which resulted in a most systematic method of progressively handling the various machine parts from the foundry to the shipping room with a minimum amount of labor. The plant occupies a tract of about 20 acres and the buildings consist of a foundry, 170 ft. x 350 ft.; a pattern shop, 80 ft. x 150 ft.; a machine shop, 120 ft. x 500 ft.; a fan and heater shop, 80 ft. x 500 ft.; a testing shop, 80 ft. x 240 ft.; a smith shop, 40 ft. x 100 ft.; a locker building, 40 ft. x 140 ft.; an office building, 45 ft. x 125 ft., and a power house, 80 ft. x 80 ft.



General Layout of the B. F. Sturtevant Company's New Works at Hyde Park, Mass.

The entire plant is electricly driven and lighted at 220 volts from a central power house containing one 100-k.w. and one 250-k.w. Sturtevant generating set; the power plant engines run condensing and the exhaust steam derived from the engines under test upon the plate in the testing building is utilized for heating; supplementary live steam being admitted to the heating system at reduced pressure as may be required. The waste exhaust is discharged through a Sturtevant exhaust head. The boilers are equipped with Sturtevant fuel economizers for heating the feed water, and with the Jones under-feed system of mechanical stoking.

Steam, electricity and compressed air are transmitted to the individual buildings through a concrete tunnel and a supplementary system of covered trenches. The machine shop is of the gallery

General View of the B. F. Sturtevant Company's New Works at Hyde Park, Mass., Showing Power House in the Foreground.

The floor area totals up to about nine acres, which is slightly more than double that of the company's old plant which was located at Jamaica Plain, and which was destroyed by fire a few years ago. The buildings are somewhat composite in their construction, consisting of steel interior columns and main steel girders, with heavy brick walls, wood timbered floors and plank roofs. The foundry is of one story and the roof is supported by steel trusses; but in the other buildings open timbering with wooden columns in the upper floors is used. The main floors in the machine, fan and erecting shops are of tar concrete, upon which 3-in. hemlock is bedded in liquid pitch and toe-nailed together. The upper floors are carried upon hard-pine beams on 4 ft. centers spanning the spaces between the steel girders which follow a unit system of 20 ft. on centers throughout the buildings. The machine shop gallery floors which are designed for 200 lbs. load per sq. ft. are of 2½-in. plank; other upper floors are 2-in. plank for 200 lbs. load per sq. ft. Maple top flooring is used in all cases and all roofs are of 3-in. plank with tar and gravel top.

type with wings 40 ft. wide, having a central craneway of the same width designed for a crane of 20 tons capacity; making a total width of 120 ft. The lighting, which is remarkably effective, is secured principally by a series of saw-tooth skylights running crosswise of the roof with the glass facing due north. The upper floor of the building is devoted to the electrical department and is provided with individual small traveling cranes. Both standard and narrow gage tracks enter the machine shop at the end farthest from the erecting shop. Generally speaking, large castings and forgings pass in at this end and are transported by the crane, while smaller parts are brought in through numerous side entrances and are handled by hoists or by manual labor. Industrial tracks also cross the building at the center and at both ends. The heavy machine tools are driven by direct connected Sturtevant motors

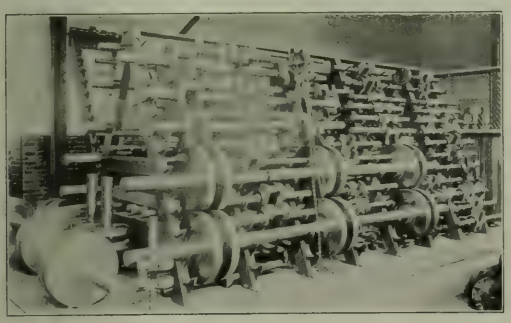
and are arranged in the open craneway and consist in part of two Detrick & Harvey open side planers, one a 60-in. and the other a 72-in.; a 6-ft. and a 7-ft. Baush radial drill; a Beaman & Smith horizontal boring mill with 60-in. swing, and a 48-in. Johnson lathe. Beneath one of the side galleries is a line of planers included in which is a Cincinnati 60 in. x 48 in.; and a group of radial drills and several horizontal boring mills, which are all served by traveling cranes on a continuous runway. Beyond these are the large vertical and planer type milling machines. The smaller tools are driven in groups, by means of 20-h.p. motors suspended overhead. The grinding and polishing room is on the main floor and is equipped with a Sturtevant exhaust fan, hoods and piping.

In the fan shop are installed large shears and brakes for cut-

Circular Overhead Crane with Supported Center, Fitted with a 2-Ton Rand Air Hoist—B. F. Sturtevant Company's New Works.

ting and folding plates up to 120 in. in length and rolls for handling ½-in. plates 120 in. wide. Pneumatic punches, riveters and chippers are also extensively used. All plate iron is stored on edge in diagonal alcoves in the storage shed, which has capacity for nearly a thousand tons. Special attention was given to the testing plant, which has proved most valuable in conducting the rigid tests demanded by the United States Navy Department upon the engines, generatinng sets and engine and motor driven fans which the company has furnished to the government in large numbers.

All of the buildings are heated and ventilated by the Sturtevant system. In the machine shop the hot air pipes are hidden beneath the second floor wall benches and deliver most of the air downward to the first floor. The fan and erecting shops are supplied through an underground duct which delivers the hot air to specially constructed external vertical flues upon one side of the



Special Rack for Storing Crank Shafts—B. F. Sturtevant Company's New Works.

building which in the case of the fan shop are located 40 ft. on centers and discharge the air across the building above head level. The B. F. Sturtevant Company is especially proud of the fact that a large amount of its new equipment was made and installed by its own works. Aside from the motors, engines, heating and ventilating systems, forges, etc., which the company regularly makes, it also designed and constructed its entire industrial equipment, which consists of a complete industrial railroad system, including the platform, coal, charging and dump cars, ladle trucks, truck ladles and turntables. The company also made a large part of its general factory equipment, such as cast-iron bench legs, electric hoists, wash-sinks, shelf-brackets for pattern storage, manhole and catch basin covers and frames, trench cover plates and pipe hangers.

Cost of Stopping Trains, Compared With Cost of Interlocking Signals to Avoid Stops.*

There exists in the minds of most railroad officers the idea that, if the factor of safety is left out, an interlocking plant is a luxury at any place where traffic is not so great that one is required to facilitate the movements so that all may be handled without increasing the track facilities, or where the time to be made by fast trains makes necessary the saving of every minute possible.

It has been my belief, for a long time, that this idea was erroneous and when a Division Master Mechanic made the statement that the temporary removal of a certain interlocking plant had cost his company $1,200 a month for additional coal consumed on account of the additional stop for all trains, the fact was strongly impressed upon me. Inquiries made of various officials as to the cost of stopping an average train brought forth a wide divergence of opinion ranging all the way from five cents to five dollars. An official of a western road says:

"For trains such as Nos. 55 and 56, regularly eight cars between .....and....., and seven between.....and....., and total weight including engine and tender half loaded about 530 tons, the various items of stopping and starting, from and to a speed of 50 miles an hour are estimated as follows:

Coal to stop train (air pump)	30 lbs.
Coal to accelerate train	275 "
Total coal	305 lbs. at $2.15 per ton $0.33
Brake shoe wear and tire wear	.03
Wear of brake and draft riggings and miscellaneous	.06
Total	$0.42

"The cost of brake shoes per stop is estimated from some experiments now being conducted by the laboratory. The cost of tire wear, brake rigging wear, are estimated.

"Tests recently made on trains Nos. 55 and 56, the point at which steam was shut off and the speed were noted and also the point at which the speed at shut-off was attained after starting up. The time in which the train would have covered this distance if no stop had been made, subtracted from the time it actually took, gives the time lost on account of stop, exclusive of time standing at the station. The time lost at various stations, exclusive of time standing at station, was as follows:

	Direction.	Speed at time steam shut off.	Seconds lost on account of stop.
Station A	West.	52 m. p. h.	166
" A	East.	54 "	197
" B	West.	59 "	129
" B	East.	48 "	335
" C	West.	39 "	90
" C	East.	60 "	180
" D	West.	52 "	155
" D	East.	45 "	121
" E	West.	52 "	119
" E	East.	42 "	95

"Thus the time lost in making a stop (exclusive of time standing) on a straight and level track averages about 145 seconds.

"The records of some tests of train No. 56 made in 1901, before the.....interlocking plant was installed, have been gone over and compared with the tests on No. 56 recently made. The tests show that the interlocking plant has saved 85 seconds on the time of this train.

"The cost of stopping and starting a 2,000 ton freight train (80 cars) from and to a speed of 35 miles an hour would not be far from $1.00, itemized as follows:

Coal to stop train (air pump)	50 lbs.
Coal to accelerate train	500 "
Total coal	550 lbs. at $2.15 per ton $0.56
Brake shoe wear	.15
Other items (as classified above)	.29
Total	$1.00

"In both the foregoing calculations, the figures of coal used by the air pumps are based on tests; that required to accelerate the train calculated; and the item of brake shoe wear is estimated from tests now going on; all other items are purely estimates."

Another road gives me the following estimate:

Six-Car Passenger Train; 45 M. P. H.

Coal for starting train and for air pump	$0.28
Cost of wear and tear on brake rigging and shoes	.07
Total	$0.35

1,500-Ton Freight Train; 15 M. P. H.

Cost for starting train and air pump	$0.40
Cost of brake rigging and shoe wear	.16
Total	$0.56

"These amounts do not take into consideration tire wear, possible wheel sliding, wear and tear of draw-bars and other wear and tear on brakes, or liability of injury to freight in cars and possibly breaking in two when stopping or starting. These figures would possibly increase the total five to six cents in the case of a

*A paper by J. A. Peabody, Signal Engineer of the Chicago and North-Western, presented before the Railway Signal Association, at Niagara Falls Oct. 10-12, condensed.

passenger train and 12 to 15 cents in the case of a freight train."

A recent experiment on still another road showed the following results:

"A 24-car freight train of 900 tons was stopped from a speed of 45 miles an hour, and accelerated to a speed of 45 miles an hour after having run over the same distance at the same place. There was a loss of four minutes of time and the additional use of 440 lbs. of coal. The total distance covered in making this test was five miles, and care was taken to have the locomotive fire as near as possible the same at the beginning and end of each trip."

As all these figures were made on separate bases, they cannot be directly compared. I have considered that the figures of the second man's estimate were so conservative that they could not be disputed, and will use the average obtained from them (45 cents in round numbers) in the following illustrations, as the cost of stopping any train; in all of these illustrations it is assumed, unless otherwise noted, that additional men have to be employed to operate the interlocking plant.

The figures used for the cost of installing plants are high, and allowance is made for electric locking, annunciators, etc., as usually installed in modern plants. The charges for maintenance and operation are sufficient for first-class work. The average interlocking plant with proper maintenance will last 20 years, but to be on the safe side, I have only allowed for a life of 15 years. Each actual case should, of course, be taken up as a separate proposition; far better results can usually be shown than are given in these examples, as freight trains are generally more numerous than passenger, and the average saving per train would be increased in proportion.

Example 1.—Entrance to a yard from a double track; crossover, four derails, four high signals, six dwarfs.

Cost of interlocking plant complete	$8,000
Interest on cost at 4 per cent.	$320
Depreciation per year, 7 per cent.	560
Cost of maintenance per year	840
Cost of operation per year	1,440
Total cost per year	$2,800

Saving to be Effected.

Trains per day.	Cost per year for stopping trains.	Total cost interlocking per year, as above.	Net saving per year.	Time required to pay for installation ($8,000) from saving.	Saving —capitalized at 4 per cent.
17	$2,800	$2,800	.....	.....	.....
20	3,285	2,800	$485	16.5 yrs.	$12,125
25	4,105	2,800	1,305	6.13 "	32,625
30	4,930	2,800	2,130	3.8 "	53,250
50	8,210	2,800	5,410	1.48 "	135,250
70	11,495	2,800	8,695	11 mos.	217,378
80	13,140	2,800	10,340	9.3 "	258,500
100	16,425	2,800	16,625	7.0 "	340,625

Example 2.—A single track crossing a single track; four derails, eight high signals.

Cost of interlocking plant complete	$7,000
Interest on cost at 4 per cent.	$280
Depreciation per year, 7 per cent.	490
Cost of maintenance	420
Cost of operation per year	1,440
Total cost per year	$2,630

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Net saving.*	Time required to pay for installation ($10,500) from saving.	Saving —capitalized at 4 per cent.
16	$2,630	.....	.....	.....
20	3,285	$655	10.7 yrs.	$16,375
25	4,105	1,475	4.75 "	36,875
30	4,930	2,300	3.0 "	57,500
40	6,570	3,940	1.8 "	98,500
50	8,210	5,580	1.25 "	139,500
60	9,855	7,225	1.0 "	180,625

*Cost of stopping, minus $2,630.

Example 3.—A single track crossing a double track; six derails, eight high signals, two dwarfs.

Cost of interlocking plant complete	$8,000
Interest on cost at 4 per cent.	$320
Depreciation per year, 7 per cent.	560
Cost of maintenance per year	840
Cost of operation per year	1,440
Total cost per year	$2,800

The saving would be the same as in Example 1.

Example 4.—A single track crossing a double track, including four station switches; total switches, derails and signals, 26.

Cost of interlocking plant complete	$10,500
Interest on cost at 4 per cent.	$420
Depreciation per year, 7 per cent.	735
Cost of maintenance per year	480
Cost of operation	1,440
Total cost per year	$3,075

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Net saving.*	Time required to pay for installation ($7,000) from saving.	Saving —capitalized at 4 per cent.
19	$3,075	.....	.....	.....
25	4,105	$1,030	11.9 yrs.	$25,750
30	4,930	1,855	5.6 "	46,375
40	6,570	3,495	3.0 "	87,375
50	8,210	5,135	2.0 "	128,375

*Cost of stopping, minus $3,075.

Example 6.—Single track drawbridge assuming that men are already employed who can operate the signals; two derails, four signals.

Cost of interlocking plant complete	$6,000
Interest on cost at 4 per cent.	$240
Depreciation per year, 7 per cent.	420
Cost of maintenance per year	420
Cost of operation per year (supplies only)	120
Total cost per year	$1,200

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Net saving.*	Time required to pay for installation ($6,000) from saving.	Saving —capitalized at 4 per cent.
7	$1,200	.....	.....	.....
10	1,640	$440	14.0 yrs.	$11,000
15	2,465	1,265	5.0 "	31,625
20	3,285	2,085	3.0 "	52,125
25	4,105	2,905	2.0 "	72,625
30	4,930	3,730	1.6 "	93,250

*Cost of stopping, minus $1,200.

Mr. Peabody also gives estimates for a double track crossing a double track; for a single track drawbridge assuming that extra men will be required to operate plant; for a double track drawbridge assuming that men are already employed who can operate the plant; and for a double track drawbridge, assuming that extra men will be required to operate the plant.

The Organization of Shop Forces.*

In getting together a force of men sufficient to man a shop capable of turning out 20 to 50 locomotives a month, the first consideration is to pick a man for the head who can be implicitly relied on to carry out the plans you formulate for him, and to have such ideas of his own that he will immediately see where delay or friction occurs and apply a remedy. He must have a firm disposition, be prepared to meet emergencies, have the good will of the foremen and men under him, and be tactful so as to be able to straighten out the many little difficulties that are continually arising. It is far better if he has no relatives or friends working for him as it will save lots of trouble from fancied discrimination. He should not allow work to be done carelessly or improperly; it takes a long time to build up a reputation for thoroughness which can be shattered in a few weeks if work is slighted.

When an engine comes into the shop for repairs, it should be the duty of one or more men to inspect it, and immediately order all of the new material required, and see that it is placed at the machines or benches ready to be worked on when its time comes—don't wait two or three days after the engine arrives, and then find you want something that isn't in stock but ought to be.

In taking down engines each part should be plainly marked so that when wanted again, there will be no difficulty in finding it; the storage of parts that need no repairs is a matter worthy of attention, much material is lost through storing it where it cannot readily be found when wanted.

To get engines or work out of a shop, there should be a classification of repairs, and each piece of work done, or each engine passing through the shops, should have a schedule of time, so that all concerned know when it will be necessary for the various parts to be ready. Don't do things haphazard. Set a time limit and work to it, making such improvement in tools, ways and means of doing work, that all lost motion is taken up.

The head of the shop should have good foremen, all knowing their business thoroughly and being able to handle men with consideration, firmness and fair dealing. These combinations are frequently hard to get, but with a large force of men to pick from, the right kind of men can be found, who, by a little training, will meet the requirements.

A good plan to adopt with your foremen is to hold weekly meetings for, say an hour, and review the work that has been done and that which is ahead of them. Let them tell you how conditions can be improved, what is delaying their work, etc. This getting together is very helpful to the Superintendent of Shops, as he quickly gets in touch with details, and at such times he can say what results he is after and offer encouragement to get them.

The Shop Superintendent who is wise, will lend an ear to suggestions made by his foreman or men when they can show a way by which better results can be obtained; once make light of or ridicule a suggestion from any one, however humble in position, and another will not be offered. The mechanic who tells you that a certain casting has more metal on it than is necessary, is helping you to get results and the least you can do is to listen, and try to remedy the trouble by asking to have the pattern changed.

The organization of shop forces does not end with getting together good foremen and men; it is also necessary to have such a systematic arrangement of accounts and reports that you will not only see that the men are getting the work out promptly, but

*From a paper read at the September meeting of the Western Railway Club, by H. T. Bentley, Assistant Superintendent of Motive Power of the Chicago & North-Western.

can tell at a glance how much is being done and what it is costing; without this knowledge you are not able to perfect the organization to its fullest extent; it also enables you to say when asking for new tools, what can be saved in time and money by their introduction, and to know whether it will be cheaper and better to purchase such things as taps and reamers, or make them in the shops.

The Superintendent of Motive Power who visits his shop frequently and knows all his foremen can get better results and have the men feel more kindly disposed towards him than the one who does all his visiting by long distance telephone; a word of encouragement and a suggestion will often bring out latent ideas that otherwise might have lain dormant. It is natural for most men to like their superiors to come in personal contact with them and see what they are doing and whether advantageously or not; hence, the advisability of the Superintendent of Motive Power or his assistant, making frequent visits to the most important shops and keeping in close touch with the Shop Superintendents and foremen.

A Volunteer Fire Company formed of the men who have been in the service some time and are likely to stay there, should be formed, and a man put at the head who can handle them properly; they should practice at least once in two weeks, familiarizing themselves with fire hydrants, hose, etc. A little encouragement from the officials in charge will keep up enthusiasm, and at a critical time, your volunteer company may be in a position to save you thousands of dollars and keep the shops from burning down and throwing themselves and co-workers out of employment. A watchman system which will necessitate the patrolling of the shops at stated intervals, will often be the means of catching an incipient fire. The checking up of watchmen to know that they are making their rounds at stated intervals is necessary, through the medium of some check clock system.

The organization of forces includes prompt movement of work and tools to the men. What does it profit a Superintendent of Shops if he has a first-class machine and an up-to-date man handling it, if the man has to tie it up several times a day while he goes to get a tool dressed or sharpened, or because the supply of material is not on hand when wanted. A sufficient number of tools properly sharpened and dressed should be available at all times, within easy reach of the mechanic, or better still, have a boy who can keep the men supplied.

A shop telephone system will aid in getting out work and will enable foremen to quickly obtain information from each other, or from the Shop Superintendent and vice versa, and save endless running about which is a waste of time and energy.

The placing of machine tools so that the minimum amount of handling material takes place, will increase the output and save disorder and unnecessary work; where possible a piece of work should travel from foundry, storehouse or blacksmith shop to the various machines and never make a retrograde movement, and when completed, should go direct to its resting place, which should not be around the man or machine finishing it. Always have plenty of unfinished work before your men and remove that which is completed soon as possible.

Labor saving devices can be carried to extremes. Put an air or electric hoist where it will save delay in handling work, but don't put anything up that will cause a man to wait until some one else has finished with it, when, without it, he would have handled the work himself in a quarter of the time, if no power hoist had been available. Pneumatic hammers and drills are indispensable in doing work quickly and should be used wherever possible; but to have 50-ton hoists handling 50-lb. loads, is a waste. Keep your pneumatic tools in first class shape and stop all air leaks.

The Mechanical Engineer, while not directly coming under the head of Organization of Shop Forces, is a potent factor in getting results. A bad feeling exists among foremen when castings or forgings come to their machines improperly designed or with more metal on than is necessary. The frequent breakage of parts that could be readily corrected, is something that the Mechanical Engineer's office is often responsible for, and a man in this position who quickly corrects complaints that are made to him, enables the shop organization to be perfected in a way that few people realize.

The foreman boilermaker who finds that an engine is coming into the shops for a new firebox, does not wait until the engine is actually in the shop before he takes action looking towards the building of a new firebox, so that as soon as the old one is removed, the new one will be ready for application; the same with engines requiring new side or flue sheets.

The blacksmith shop generally is not a place that looks neat and tidy; but orderliness pays there just as much as anywhere else. The turning out of duplicate work by machine, instead of by hand, makes a big reduction in cost, and the foreman blacksmith who can organize his work and men so that he is always in the van instead of the rear, is a valuable addition to the shop organization.

The tank shop, tin shop, paint shop and brass and iron foundries all play their parts in getting results; it is of no avail if the machine and erecting shop have the engines finished on time if they have to lie around two or three days waiting for the tender.

The power plant is an important factor in the smooth running of a shop. Engines too small to carry a load, and boilers that do not furnish enough steam, are a trial and tribulation. Relay engines and boilers cost money but often save shutting up shop when it can least be spared.

Apprentices should be given opportunities to learn their business thoroughly, as we depend upon them to make our future mechanics; if they are looked upon and treated as necessary evils, we may expect indifference and indolence from them; but if treated properly, and shown how to do their work efficiently and quickly, they will, in most cases, turn out desirable men to keep in the shops. Special apprentices, who have graduated from a technical college, are invaluable if made of the right kind of stuff. In a large establishment conditions are often arising where some special information has to be obtained, which necessitates mechanical training, and a certain amount of technical knowledge to properly work up the data. In this field, special apprentices can be used to advantage, and later, when they have completed their term of apprenticeship, if competent, they can be used in higher positions to advantage.

This is the age of Specialists and in hiring men you will find some who are first-rate mechanics in one line and not much good in another. The good all-around mechanic, like the old family physician, is disappearing from our midst and instead, we get the Air-Brake Man, Machine Hand, the Valve Setter, the man who is handy at lining up guides, etc. Find out what your man's forte is and use him at it, wherever possible; in a large shop, this can be done to advantage with a corresponding increase in your output.

Always be on the outlook for promising timber in the shape of young, energetic and progressive men and encourage them, so that when in want of a foreman or master mechanic, you will know where to find one. Many a good man has been lost to the profession through lack of encouragement. Nothing stimulates a man so much as to know that his work is appreciated. Don't have too many rules, bulletins and notices, they take up the men's time reading and discussing them. Only make rules that you know can and should be carried out, and then see that they are lived up to.

The Motive Power Department organization can be nearly put out of business if it is not backed up by the Storekeeping and Accounting Departments. The prompt furnishing of material in sufficient quantities to keep machines going long enough to perform the work economically is a matter that must have attention, otherwise the cost will immediately go up. The setting up of some machines often takes longer than to do the work, if furnished in small amounts, and a direct loss to the company takes place. The furnishing of cost sheets within reasonable time after the work is done is very helpful in detecting increased or decreased cost and applying the remedy if needed, before the matter gets old. In some shops messengers are used to deliver material and they are great time savers when used in connection with a shop telephone system. The ordering of material is done by 'phone to storehouse and deliveries are made from there by boys or men, thus obviating the necessity of high priced mechanics going back and forth doing work that is just as well performed by cheaper labor.

Nothing looks so bad in a shop as material, whether usable or scrap, being allowed to lie around indiscriminately—a man is frequently what his surroundings are; try both methods and you will quickly find that a dirty shop is the most expensive to handle. Have distinctive marks on scrap and usable material, and see that it goes where it belongs when once picked up—it is cheaper than to set it down and pick it up later on.

The following requisites are necessary to get the best results:

A good man at the head of the shop.
Good foremen under him.
The education of foremen and men.
Proper control of men by foremen.
Punctuality.
Orderliness.
System.
Harmony.
Prompt movement of material to and from the various departments.
A good system of handling tools.
The use of templets and jigs wherever possible.
Absolutely fair treatment of foremen and men.

The Damascus-Mecca-Haifa Railroad.

The Hedshas Railroad, the line from Damascus to Mecca, with branches to the Mediterranean and the Red Sea, which the Turks are building primarily for the carriage of pilgrims to and from the Mohammedan holy cities, is making better progress than any purely industrial enterprise in that country, the funds coming very largely from contributions by the faithful and also much of the material, as timber and stone. The work was begun in March, 1902. On Sept. 1, 1904, 285 miles of the main line, from Damascus southward, and 48 miles of the branch from the Mediterranean at Haifa eastward across Palestine to the River Jordan, were open for traffic, and at the same date this year an extension of 56 miles of the main line and of 52 miles of the Haifa branch were completed. The extension of the branch required the heaviest work on the line, rising as it does from 850 ft. below sea-level at the Jordan to 1,210 ft.

above the East Jordan plateau. The present eastern terminus at Deraa was formerly the royal residence of Og, king of Bashan. The Chief Engineer of the railroad is a German, named Meisner, and his corps of engineers includes 17 Turks, 12 Germans, 5 Frenchmen, 5 Italians, 2 Austrians, 1 Belgian and 1 Greek. It is expected that some of the Turks will have become capable of taking entire charge of the work when the vicinity of the holy cities is reached. Infidels would hardly be safe there.

Railroad Shop Tools.

MILLING MACHINES.

(*Continued.*)

The accompanying illustration, Fig. 1, shows a No. 5 horizontal milling machine fitted with two vertical spindles, made by the Niles-Bement-Pond Company, New York. This machine is specially adapted to do a great variety of slab milling work, and carries besides the horizontal spindle, two vertical spindles, which enable

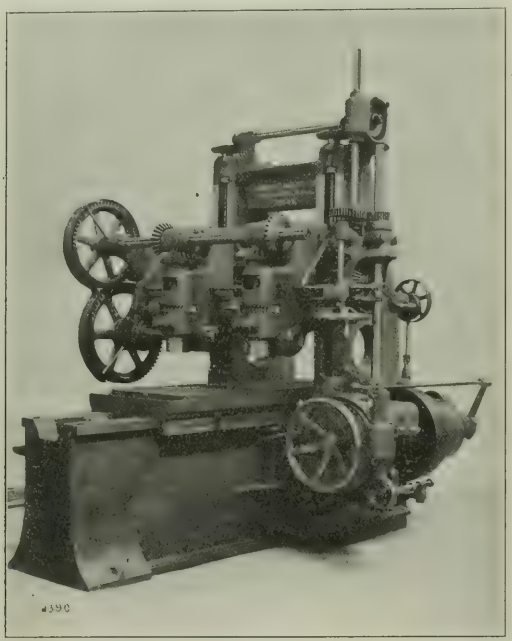


Fig. 1—The Niles-Bement-Pond No. 5 Horizontal Milling Machine.

a variety of irregular work to be finished without the use of expensive form milling cutters. The machine will take 24 in. between the housings. The main bearings for the horizontal spindle are incorporated with the bearings of the vertical spindles. The vertical spindles have an adjustment of 3 in. and the maximum distance from the lower end of spindles to table is 20½ in. The distance from the center of the vertical spindles to the center of the horizontal spindle is 7 in. Fig. 2 shows a No. 6 horizontal milling machine made by the same company. The machine as shown in the illustration is driven by a 25-h.p. Westinghouse motor, with speed variations from 560 to 1,120 r.p.m. These speeds in conjunction with the changes by gearing give a speed range to the spindle of from 8 to 36 r.p.m. The cross-rail is raised and lowered by a 3½-h.p. motor mounted on the top of the housings. This type of machine is particularly applicable for channeling and surfacing the main rods and side rods of locomotives. One of its principal advantages over the planer for this work is that it leaves the rod in one cut with a good finish. In railroad repair shops, this type of milling machine is also used for both facing off the boxes and for cutting the shoe and wedge grooves. For facing driving boxes, a number of boxes are put on the table and finished with one operation. For milling the shoe and wedge grooves, it is usual to place two boxes parallel with each other on the table. The horizontal milling machine is also used for milling the shoes and wedges.

The width between the uprights of the machine shown is 37½ in. The maximum height of the spindle above the table is also 37½ in., and cutters up to 16 in. in diameter can be used. The cross-rail is counterweighted and is arranged so that the bearing of the

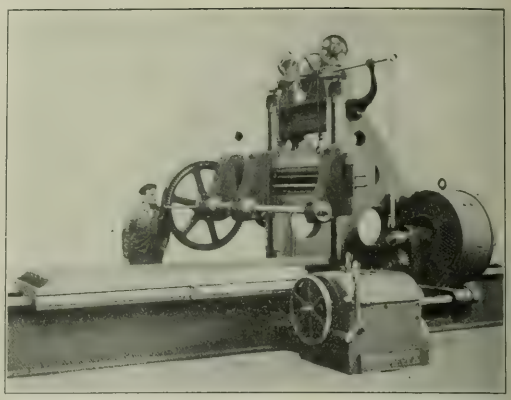


Fig. 2—The Niles-Bement-Pond No. 6 Horizontal Milling Machine.

outer end of the mandrel may be traversed entirely free of the mandrel, thus allowing the easy insertion of different mandrels. The spindle is supported by two bearings, each of which is provided with means for taking up wear. The inner bearings are adjustable along the cross-rail for the different lengths of cutters, and the bearing for the cutter mandrel is also adjustable along the cross-rail. The spindle is placed so as to permit of end or side milling. The table has power feeds in both directions, and quick power traverse as well as rapid and fine hand adjustment. The feeds are positively driven through gearing and are variable throughout a wide range. Adjustable automatic stops are also provided for the table feeds.

Fig. 3 shows a No. 4 plain milling machine made by the Cincinnati Milling Machine Company, Cincinnati, Ohio. This type of milling machine is used for doing such work as was formerly done on shapers and small planers, such as connecting rod brasses, driving box shoes and wedges and similar smaller parts of locomotives. The table of this machine is 64 in. long by 16 in. wide overall, and has a working surface of 52 in. by 16 in. and is provided with three ¾-in. T slots. The full width between the face of the column and the brace is 25¾ in. The feeds are all automatic in either direction. The longitudinal feed is 42 in., the cross feed is 10 in. and the vertical feed is 21 in. The overhanging arm is of solid steel 5 in. in diameter and its under side is 7¾ in. from the center of the spindle. There are two arbor supports supplied with each machine, each of which is provided with a bronze brush. The spindle is of crucible steel $3^{11}/_{16}$ in. in diameter in the front bearing, and has a $^{13}/_{16}$-in. hole through it. It runs in babbitted boxes which are provided with adjustment for wear. The driving

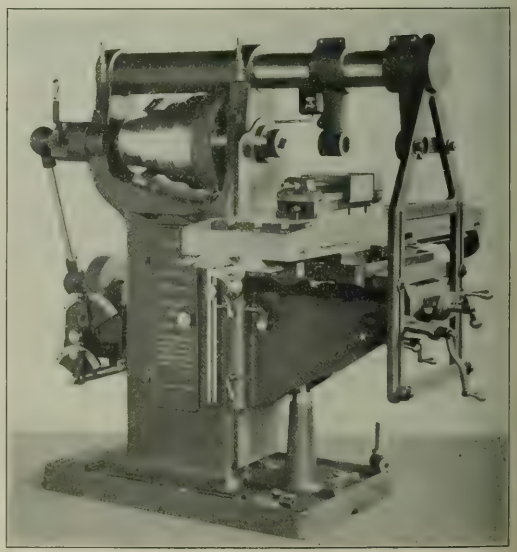


Fig. 3—The Cincinnati No. 4 Plain Milling Machine.

cone has four steps for a 3½-in. belt, ranging in diameter from 8 in. to 14 in. The spindle has 16 speeds ranging from 6½ to 312 r.p.m. The feed is positive and is also provided with 16 changes ranging from .006 in. to .300 in. per revolution of spindle. The floor space required for the machine is 82 in. x 125 in. These dimensions include an allowance for the extreme limits of the table travel. The net weight is about 4,900 lbs. When desired these machines can be fitted with motor drive, in which case the motor is mounted on an extension which is cast on, and forms part of the base of the machine. The drive is then obtained by means of a silent chain connected to a wheel on the clutch shaft which in turn is connected by another silent chain to a wheel on the spindle.

The No. 2 Universal milling machine shown in Fig. 4 is made by the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio. This type of milling machine is practically of the same construction as the plain type of milling machine except that provision is made for swiveling the table and automatically rotating the universal head. They are especially adapted for tool room use, or where there is a large variety of work, as they can perform every

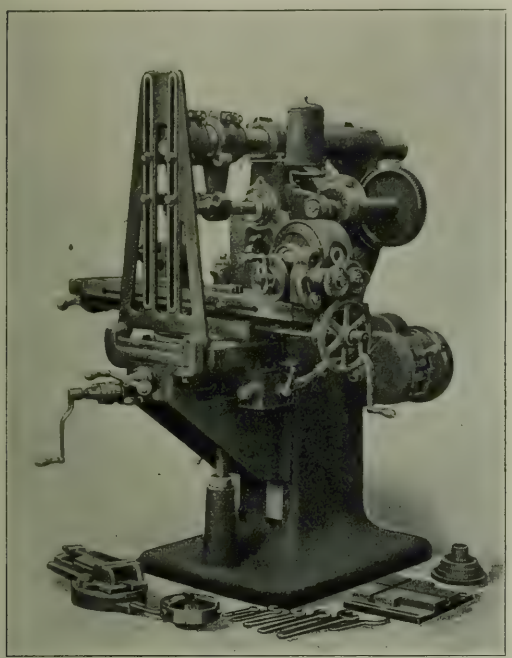


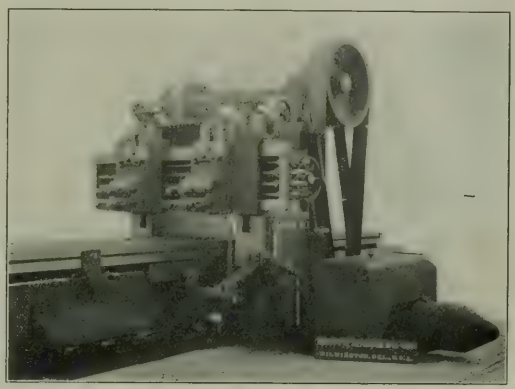
Fig. 4—The R. K. LeBlond No. 2 Universal Milling Machine.

operation of which a plain miller is capable and in addition many other varieties of work such as cutting spirals, notching worm wheels, etc. The machine shown has an automatic transverse feed of 8 in., a vertical movement of 18½ in., and automatic longitudinal movement of 29 in., all of which are graduated to the one-thousandth part of an inch. The table has a working surface of 42 in. by 10 in., and the length over-all, including oil pockets, is 50 in. It can be swiveled to 45 degrees each way for cutting spirals, and is provided with three T slots for holding work. There are 15 changes of feed, for every spindle speed, ranging from .006 in. to .143 in. The spindle is back geared and can be readily adjusted to compensate for wear. Its front bearing is 3 in. in diameter. The cone has three steps, the largest being 11 in. in diameter. The overhanging arm is of solid steel and is fitted with two supports. At its extreme position it is 22 in. from the end of the spindle. The spiral head swings 10 in. and takes 23 in. between centers. The spindle can be set 10 deg. below the horizontal each way and can be turned completely over from one side to the other. The tail stock is fitted with a vertical adjustment above and below the center for use in taper work. An index plate is furnished with each machine, which will divide all numbers up to 50, all even numbers to 100, and most uneven numbers to 360. Spirals from one turn in 1½ in. to one turn in 137 in. can be cut on this machine. The countershaft has double friction pulleys 12 in. in diameter and should run at 185 and 250 r.p.m. With a three-step cone 12 spindle speeds ranging from 18 to 500 r.p.m. can be procured. The net weight of this machine is about 2,710 lbs.

(To be continued.)

The Betts Extra Heavy Frog and Switch Planer.

The accompanying illustration shows a 36-in. frog and switch planer, made by the Betts Machine Company, Wilmington, Del. This machine planes 37 in. wide and 18 in. high, and any desired length. It is built very massive to successfully carry its great power, which is transmitted through friction clutches from a 6-in. driving belt to the all-steel driving gears. The cross-rail is unusually deep and separate feed rods and screws are provided for each operation. The feed adjustment is at the end of the cross-rail, convenient for the operator, and is operated from a positive feed box which only uses power at the instant of feeding. The cross-rail only has 18 in. of travel, but it is provided with power movement so that the workman cannot have any possible excuse for working with extended tools. The table travels on "V" tracks, which are gibbed at the center to prevent lifting under heavy cutting. The driving mechanism can be arranged for the machine to stand parallel with or at right angles to the line shaft. The feeds are positive, operating the tools at any angle. The cross-rail is of box girder form with deep arches back, and when desired can be made of sufficient length, when using two saddles, to permit of one head planing the entire width between uprights. The uprights are of double plate construction thus insuring rigidity for side cutting. The side heads can be furnished with independent power feeds in either direction. An arrangement is provided by means of which the workman can throw out the clutch pilot mechanism and operate



The Betts Frog and Switch Planer.

the clutches direct. The countershaft is carried on the uprights and runs in ring-oiling, self-adjusting bearings. It is belt driven from a 15-h.p., type S, Westinghouse motor, 220 volts d.c., which is placed on the floor back of the machine.

Four of these machines have just been furnished to the Lorain Steel Co., Johnstown, Pa.

Single-Phase Electric Traction.*

The direct current interurban railway has its limitations. If a region be sparsely settled the available traffic will not show a profit on the cost of circuits and rotary converter sub-stations. There is a material reduction in the investment and operating expense incident to the single-phase railway that will enable it to be built and operated with a profit in cases where the traffic would not support a rotary converter system. In heavy service the direct current has not made much headway, being handicapped by the heavy cost of sub-stations and of conductors. Heavy and relatively infrequent trains are the hardest loads for sub-stations. For example, if sub-stations be eight miles apart each will supply eight miles of track. A train running 40 miles an hour will receive current from a given sub-station for 12 minutes. In order that a sub-station may be continuously supplying current to trains in one direction they must have a headway of 12 minutes. If they be an hour apart the current from each sub-station is used but one-fifth of the time. Trains in two directions will double the sub-station output, but as the peak load is considerable when two trains pass near a sub-station the load factor is extremely low. Therefore as the aggregate capacity of the sub-stations must be large in proportion to the actual power taken by the cars, it follows that the sub-stations will involve a relatively large expense if they are equipped with expensive rotary converters and require constant attendance, whereas the cost will be relatively small if they require simply lowering transformers having an efficiency very much higher than

*Extracts from a paper by Charles W. Scott, read at the convention of the American Street Railway Association, Philadelphia, September, 1905.

the rotary converter sub-station and not requiring attendance. The reduction in the sub-station is therefore of especial value when the service is infrequent. Moreover the single-phase equipment by reducing the size of conductors frequently enables the sub-stations to be more widely separated. This possibility in the reduction in the number of sub-stations and in the aggregate capacity of sub-station equipment, as well as the elimination of rotary converters with their energy losses and their attendants makes practicable the operation of long distance roads which could be operated by direct current only at an excessive cost.

The single-phase system therefore decreases the cost of installation and operation for the kind of interurban service which has been successfully developed by the direct current, and it extends the field of commercial operation to include, on the one hand, rural roads with relatively light traffic, and on the other, a heavy, infrequent, multiple unit or locomotive service for passengers or for freight approximating steam railroad conditions.

If the single-phase road is to be an extension of an existing road it may be desirable to run the single-phase cars over the tracks which have a direct current trolley wire. While single-phase cars can be arranged to operate from a direct current trolley wire, it handicaps in some measure the single-phase equipment. The addition of resistance to the car equipment, extra switches, etc., for enabling the change to be made in the current supply is obviously objectionable. It is best, therefore, to keep single-phase equipments free from operation on direct current if it be practicable to do so. When it is found necessary for them to operate from an existing direct current trolley wire, the motors are connected two in series for 500 volts, and if there be four motors the two pairs may be connected first in series and then in parallel as in ordinary series-parallel control. The transformer is cut out, and the control apparatus and motors operate in substantially the same way as those on an ordinary car.

The single-phase railway which shows the most extensive operation as measured in car miles is the Indianapolis & Cincinnati Traction Company. Operation was begun over a short length of track January 1, and on April 1 37 miles were covered. Since July 1 a regular schedule has been maintained over 41 miles, 37 miles of which is under alternating current trolley and the remaining four miles is under direct current trolley in Indianapolis. The company has 10 cars, each equipped with four 75-h.p. motors. A maximum speed of 60 to 65 miles per hour is secured and the cars are not only the heaviest but they operate upon the fastest schedule of any of the numerous suburban roads radiating from Indianapolis. Some defects have developed in the equipment, which, however, have been incidental in character, and not in those new features where trouble might reasonably have been anticipated. It was found that the natural ventilation under the car was insufficient for the transformer and a ventilating motor was added. A weak point developed in the armature insulation when the cars, which had been running for some time by alternating current, were first run regularly over the direct current lines into Indianapolis. One feature of the new condition was the opening of the circuit with four motors in series, the motors having laminated fields which give greater field discharge than solid poles. The remedy was obviously the strengthening of the insulation. This brings out the interesting fact that operation on alternating current at 3,300 volts with an intervening transformer is less severe upon the motor than operation on direct current at 500 volts. Experience showed wherein the control apparatus, suitable for both alternating and direct current could be simplified and the apparatus reduced in quantity. The result is a control system which is relatively simple and compact, although suitable for operation interchangeably between alternating current and direct current.

The best verdict upon the working of the single-phase system on this road at Indianapolis has been given by the operating company. It is found in the contracts which have been placed for extending the present line a distance of 16 miles; also in extending the single-phase operation to the Shelbyville line; both to the 29 miles which have been operated by direct current and for a 20-mile extension. The length of track is therefore to be increased from about 40 to 100 miles; the number of cars will be double the present number and all equipments will be similar. It is significant that a company which has been operating two substantially similar suburban lines, one by single-phase current and the other by direct current, should see fit to throw out the direct current and substitute single-phase alternating current. It may be noted that this course was taken, although the reverse was easily possible, as provision was made in the original contract for the single-phase apparatus by which it would be exchanged for direct current equipments if its operation proved unsatisfactory.

Other single-phase roads which are operating Westinghouse equipments show a variety of conditions, some having exceptionally sharp curves and steep grades. On the road between Derry and Latrobe, in Pennsylvania, 30-ton cars are started on a 10 per cent. grade. The cars have platform controllers and are equipped with four 50-h.p. motors. In some cases the initial operation has been handicapped on account of incompleteness, or through the use of temporary apparatus either in the power house or on the car. In its fundamental elements, however, the operation is proving perfectly satisfactory.

The extension to long distances will soon be shown in the carrying out of the contract which has been closed by the Spokane & Inland Railway Company for 150 miles of railroad running south from Spokane, Washington. The equipment will consist of 15 motor passenger cars each with four 100-h.p. motors, six motor freight cars, each with four 150-h.p. motors and six 40-ton freight locomotives which may be in pairs for heavy trains.

The most notable recent event in electric traction is the purchase of Westinghouse single-phase locomotives by the New York, New Haven & Hartford. The passenger trains on this road which enter Grand Central Station in New York run over the tracks of the New York Central for about 12 miles. As steam locomotives cannot enter the new terminal station and as the New York Central is equipping its track for direct current it is imperative that the New Haven trains be handled over 12 miles by direct current power. Instead of changing from electric to steam locomotives for all local and through trains at the end of 12 miles it was decided to extend the electrification and to do it, not by extending the direct current, but by changing to alternating current. The single-phase locomotives will be designed so that they may operate interchangeably from direct current or from single-phase alternating current.

Picked Up on the Road.

BY GULF.

Apropos of the present discussion on cheap wheels and poor material; it was a good many years ago, just following the time when all men believed and acted on the principle that a cast-wheel could only be made of high grade charcoal iron, that a man walked into the office of a well-known master car builder. Now this car builder had wide reputation as an outspoken individual and one who believed in good goods as an economical proposition. Perhaps the man did not know this; at any rate he offered the master car builder wheels for about three dollars a piece less than he had been paying. The M. C. B. was on his feet like a flash: "You infernal scoundrel," he said; "you know as well as I do that you can't make a decent or a safe wheel for that price, and here you come thinking that you can tempt me to risk my trains and the lives of their crews and passengers just to make a better temporary showing to the management. Get out of here and don't you ever come back with an insult like that. You ought to be in state prison and if anything ever happens I'll do my best to put you there." I sometimes wonder if a little more of the same spirit would not be a blessing to the railroad.

The external and internal appearance of the high car-window has features to be highly commended, but if we consider the passenger who wishes to open the window they are not all that can be desired. The size is such that they can only be opened about 10½ inches, and this leaves the lower rail within a disagreeable range of the eye, so that the passenger neither looks above nor below it. If the window cannot be raised to a height of at least 21 in. it would be just as well to limit the rise to about 6 in. This would keep the rail below the level of the eye and still admit a considerable quantity of air for ventilating and cooling.

Since the memory of man engineers have advocated the sand-blasting and thorough cleaning of metal work previous to cleaning. It is a curious coincidence that in spite of this universal agreement as to what should be done it rarely happens that that same thing is done. In the painting of bridges and elevated structures the sand blast is seldom used, but the scraper in the hands of an ignorant workman takes its place—a workman who not only has no conception of the importance of his work but whom it would be impossible to convince of it. So the loose rust and scale and dirt is scraped off and the paint applied on a surface that will go on serenely rusting beneath the covering. These things came to mind when seeing just such a piece of work on a gilt edged trunk line, where things are supposedly done just right, a supposition that outsiders are not disposed to acknowledge as correct. Since in this particular instance there was the best chance in the world to use the sand blast and it could have been done at a minimum expense, the question naturally arises as to why it was not done.

Following the example of that illustrious gossip Sairy Gamp, I usually refrain from naming names, but sometimes I am sorely tempted to do so, especially when my own comfort is concerned. The case in point is that of a tunnel which I pass through morning and evening. In the evening after the cars have been exposed to the sun all day, the combination of heat and tunnel air causes so much discomfort that it is greatly dreaded. To close the deck ventilators before the train starts would create intolerable condi-

tions. So, just as the train enters the tunnel a brakeman starts down from the front car to close these ventilators. He goes down closing one side, back on the other and then scurries to the rear of the car to take the next one. Thus he walks the length of each car three times before the last ventilator is closed. We are well into the tunnel, with smoke and gas pouring in before the work is done. It occurs to the lay mind, to whom all things seem simple, that it would be a good idea to use deck ventilators so connected that they can be closed from one end of the car by the movement of a single lever. The device is in use elsewhere but perhaps it costs more.

It came somewhat as a surprise, that statement, at the topical discussion on water legs at the Master Mechanics' Convention, in which it was urged that the inner sheet of the firebox be kept vertical or given a slight outward slope so that the steam as it was generated would rise along the surface of the sheet, while with an inward slope the steam would rise through the water space and impede circulation. This is undoubtedly true, but the question arises whether it is not better to have the inward slope with the increasing water space towards the top, and therefore increased opportunity for circulation than to force the water away from the sheet, cover it with steam only, reduce the steam production and subject the plates to the danger of overheating. Current practice favors the inwardly sloping sheet, as will be seen by an examination of the boilers illustrated during the past few months in the *Railroad Gazette*.

It is interesting to note how, after more than half a century of independent and almost antagonistic practice the railroads of America and Europe are gradually approaching a resemblance. It does come somewhat as a surprise, however, to find that the bar frame for the American locomotive has actually gained a foothold, and it will be interesting to watch developments and see whether it can hold its own or not. The plate frame has had such absolute sway in the past that it almost takes one's breath away to think of it. Of course, they have been tried before, but somehow they have had a bad reputation, and it is only recently, apparently, that they have been tried in a manner that seems to promise permanency in the practice.

Speaking of European practice, those who have admired the beauty and fineness of finish on French and German engines have often thought it comparable in point of usefulness and economy with the putting of a crocus finish on a crowbar. And now comes the claim that all this fine work is paid for by the saving of time in the erecting shop. It will probably take more than the mere assertion to convince an American builder of the truth of such a statement, and we shall probably continue in our old ways for the time being. To the casual observer it would appear that the probable reason for the differences in practice in this regard is that abroad the engineer of rolling stock has a comparatively free hand to follow all the niceties of his scientific and artistic inclinations in the designing and building of his engines; while here he is being constantly crowded down to the necessity of shaving expenses and cost to the uttermost farthing.

The American types of heavy cars and engines are gradually gaining a recognition abroad, one of the latest examples being a steel car of 40 tons capacity for the Paris, Lyons & Mediterranean. The peculiar feature about this car lies in its exemplification of the old saying that Frenchmen are very saving of materials and lavish in labor, while the American is lavish in material and saving of labor. The car in question shows that the utmost care has been taken to so distribute the material of the sills that it is disposed in the best possible manner to sustain the stresses to which it will be subjected. But the amount of work involved in its construction would drive an American builder crazy. It is curious to note how these little things indicate the economic conditions of the two countries, and it makes one shudder for the welfare of home industries to think what foreign competition would mean if its labor were utilized as efficiently and economically as our own.

The *Four Track News* of August is rapturous over the fast New York-Chicago schedules. It says: "A reckless run of a few miles is of no real value. It is the trains that make the run from New York to Chicago and Chicago to New York and sustain a schedule, be it 18, 23 or 28 hours, that enter into the calculations of men. It is the leaving and arriving times that count, not the possible cannon ball flight of a mile or two somewhere along the route. The economic train is the one that, through all ordinary conditions, 'gets in' on time every day in the week." Well, this is encouraging. In season and out of season, I have preached the gospel that the business man would rather travel on a slow schedule and "get in" on time, than on a fast one and arrive an hour late, and now comes this support from a source so unexpected. When will a management appear with the courage to raise the schedule times so that all trains can "get in" on time, "through all ordinary conditions." Some roads need such a management most woefully. I recently had occasion to watch the performances of a Chicago-New York train for two weeks. Its nearest approach to arrival on time was a half hour late. From that it extended to three hours. I would like to paraphrase the statement of the *Four Track News* and say: It is not the especially coddled high-speed train that raises a road in the estimation of men and counts; but the everyday "ordinary" express, used by the great majority, which, by a punctual arrival on time in rain or shine enables the traveler to make positive engagements, earns a reputation for its road and causes the patrons to speak well of its performance.

There is no doubt of the good done and doing by the railroad branches of the Young Men's Christian Association, and there is just as little doubt that there is ample room for the widening of this good influence in little things. Cleanliness and godliness, according to the old proverb, are near of kin, but the relationship seems to have been lost to sight in many of the houses that are supposed to be models of all that is attractive. It is especially in the restaurants that this is noticeable. If these concessions are rented, it should be with the distinct understanding that the kitchen and dining room shall be subject to the same rigid inspection that once obtained in the canteen of an army post. There is no reason why, because a low price is charged for meals, the surroundings should not be immaculate in their cleanliness, or why a man who is compelled to eat in his working clothes should not like to have his surroundings clean. These remarks are apropos of a few meals taken in the building at a busy point on a great trunk line, whose dining rooms could have given points to an eating house in the slums. So bad was it that the men kept away from it except when force of circumstances drove them to it. There was nothing the matter but dirt, but there was plenty of that. It was just a case that called for the interference of the man higher up who could do no better than go in and have a "reg'lar clearin' up time."

To the altruistic philosopher whose experience in practical life has been limited, the Jim Crow car naturally seems an abomination; but to the every day man it is, to use a popular expression, "all right." All through the south it meets with the hearty approval of every white man, and West Virginia alone holds out for the common car. Not but that the Jim Crow arrangement is heartily endorsed and desired, but political interests forbid and the people look with envy on their favored neighbors. Hence, to the knock-about man, the present northern agitation for legislation to abolish the race distinction in cars seems like kicking against the bricks of a firmly established and well-founded public opinion.

The first intimation which comes to the hungry traveler, via the Lackawanna, of the provisions which have been made (and gathered) for his comfort is the appearance of a waiter properly attired in white coat and apron carrying under his arm a lot of large pasteboard signs, one of which he hangs up on a nail at the forward end of the car. It bears the following: "Meals now being served in dining car attached to this train. Order what you want. Pay for what you order." Lest the passenger has been sleeping, reading, or admiring the view during this performance the waiter soon returns, announces the meal in the usual way and also hands to each passenger a copy of the day's menu neatly printed on a sheet of paper. In the dining car, food and service are of the best; electric fans insure the free circulation of air, but if this is not sufficient the diner on a warm day will find a fan of the old-fashioned type convenient at hand. For the latter, however, it appears that he is indebted not so much to the dining car superintendent's solicitude for his comfort as to the enterprise of the makers of a certain preparation for the cure of headaches, indigestion and—car sickness! In a little brass pocket attached to the woodwork by each table a lead pencil for writing out the order is to be found.

Foreign Railroad Notes.

A valuable hunting dog, which ran loose, by his owner, on reaching a German railroad crossing where the gates were closed, dashed under or over the gate, was run over and was left no longer useful for hunting, but for nothing except perhaps sausage. The owner sued; he claimed that the railroad should have made the gate dog-tight. But the court said it was the owner's own fault. He should have led the dog when approaching a crossing.

On assuming charge of the Italian State Railroads July 1, General Manager Bianchi issued a general order addressed to all employees in which he announced that the country expected a reduction in the cost of operation, permitting lower rates, greatly needed for the development of the national industries; that he would require much of his subordinates, but would do his best to secure proper reward for efficient service; promotions would go to those who show industry and capacity. He would exercise severe disci-

pline towards all who fail to contribute towards the economy, safety and punctuality of the public service.

The greatest railroad shipping station in Germany is Duisburg-Ruhrort, the Pittsburg of the Rhine. In 1903 this place, or these places (they have been united into one municipality recently) received and shipped 22,900,000 tons of freight by rail and 18,500,000 by water. Hamburg had a freight business of 25,600,000 tons by water, but only 4,000,000 by rail; Berlin, 10,600,000 by rail and 8,250,000 by water.

Italian newspapers having reported that the Simplon Tunnel would be opened May 1 next, simultaneously with the Milan Railroad Exhibition, the Swiss who are building the tunnel say that the present state of the works warrants them in saying that trains will pass through before the end of this year, and probably by Dec. 1.

Concrete-Steel Signal Battery Vaults.

Concrete, strengthened with steel, is an ideal material for signal battery vaults because of its waterproof, non-corrosive and indestructible character. The illustrations given herewith show several designs of such vaults. Fig. 1 is a vault 4 ft. 6 in. in diameter inside and weighing about 2,700 lbs. The drawing also shows the lining employed, where one is desired. It is made of creosoted matched lumber with a metallic, hermetically sealed sheathing attached to the outer surfaces—top, sides and bottom—to which the material composing the vault firmly adheres.

Fig. 2 is a turret type, adapted for placing deep in the earth below the frost line. The neck or turret is built and shipped separately from the vault. It is cemented to its seat by a material specially prepared to make a strong, tight joint. The standard size for these vaults is 6 ft. diameter by 6½ ft. high inside, and the turret is 3 ft. x 3 ft. inside. This type has a shoe-rim to give strength and protection at the bottom and provide a safe means of lifting. The vault weighs 4,700 lbs. and the neck 1,300 lbs.

Fig. 3 is a multi-sectional design which requires no hoisting apparatus for handling. A duo-sectional design is made for use in places where water in the excavation cannot be wholly pumped out and where a derrick for heavy lifts is not available. Another design for extremely cold climates has the lining stopped off some little distance below the vault top, with an inner cover at the top of the lining. The space above this inner cover can be used for storage purposes.

A demonstration of the strength of these vaults was made by filling a number of 6-ft. x 6½-ft. turret-type vaults having shoe-rims, each weighing 5,000 lbs., with water while on a car, transporting them to the place where they were to be used and lifting them off the car into their permanent positions. Each weighed about 15,000 lbs., but the 2-in. walls, floor, etc., of the vaults withstood the stress without apparent injury. The hooks in the shoe-rim, not being designed for such heavy loading, straightened out. The smaller sizes of the vaults are handled from a yoke inside, which engages them under the shoulders.

Three cylindrical types of vaults are made, the rest being elliptical in plan. The latter can be made with the major axis varying from 4½ to 15 ft. The elliptical vaults have advantages over the cylindrical type, it being possible to transport more of them of equal storage capacity on a car; also, they may be placed between two closely adjacent tracks, a position which might be impossible with a cylindrical vault of equal capacity.

These "Hydrolithic" concrete-steel vaults are made by the E. J. Winslow Company, Chicago.

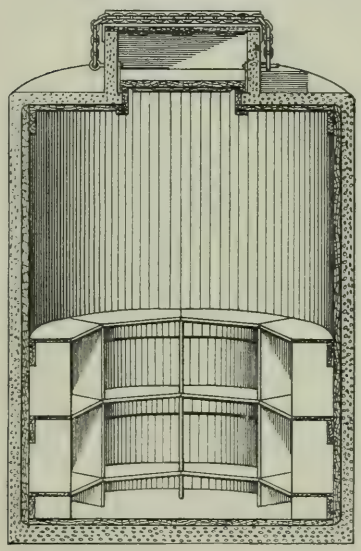


Fig. 1.

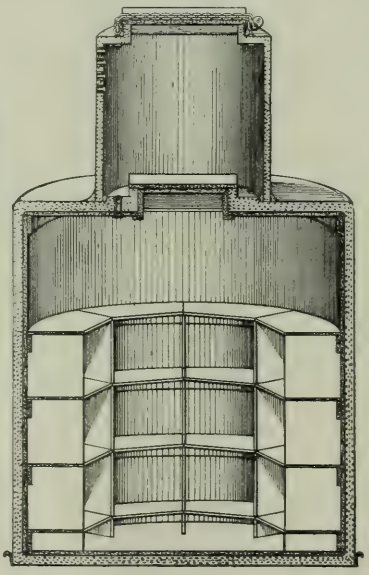


Fig. 2.

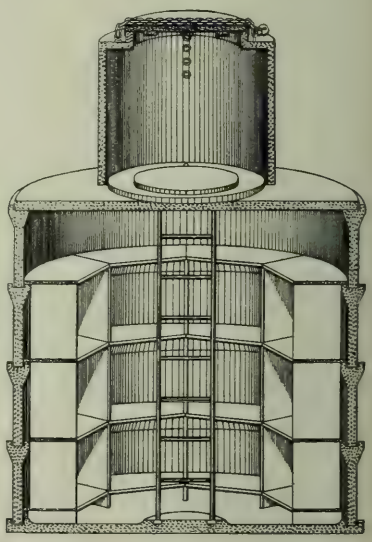


Fig. 3.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.

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The new Westinghouse quick-service triple valve is as important an advance in the art of freight-train braking as was the high-speed brake in passenger service. This is shown by the results of the August train tests made at West Seneca, N. Y., which are printed in this issue. These tests proved four things: That the quick-service triples will stop a 50-car train in 35 per cent. less distance than the standard triple valves when both are set with a full service application; that a light application made with a reduction of 5 lbs. in the train-pipe pressure will stop a 50-car train equipped with quick-service brakes in substantially the same distance as the standard triple valves when set with full service application with a reduction of 20 lbs. in the train pipe pressure; that it is possible to release brakes at low speeds when the train is equipped with these improved valves with greatly reduced draft-gear stresses; and that the new form of valve works in entire harmony with the standard triples. The good results due to their use are in proportion to the number of improved valves in the train. The underlying principles which make possible these results are as follows: By reason of the perfect and rapid equalization of pressure in all of the brake cylinders from the first car to the last, every brake in the train does its full share of the work of retardation. This action is as rapid as the emergency action. The ability to make a heavy service application on a 5-lb. reduction in the train pipe is due to the progressive wave motion of the air pressure throughout the train pipe. The initial reduction at the engineer's brake valve actuates the triple on the first car which in turn reduces the pressure in the train pipe behind it by admitting some of the train pipe pressure into the brake cylinder to do useful work. This successive reduction is rapid and continuous, and is as effective on long trains as on short ones. The retarding feature which has been introduced permits the release on the rear cars first, advantage being taken of the friction in the train pipe which reduces the pressure in almost direct proportion to the distance from the main reservoir supply. With the new valve a slightly reduced pressure gives a quicker release than the full reservoir pressure, hence the rear cars may be released before the forward cars, thus keeping the slack bunched and preventing jerking and break-in-twos. The value of the new valve is not that it adds much additional safety, for the emergency feature remains as before, but it improves operating conditions with long trains where the standard air-brake apparatus has often proved troublesome and unreliable. The Safety Appliance Act requires more brakes on trains. The new triple valve makes it possible to comply with the law safely and economically.

The Baltimore & Ohio is said to have notified the Lake Shore that it will not load any more cars with coal for points on the Lake Shore until that company returns about 1,000 cars belonging to the B. & O. It is further said that these 1,000 cars have been held by the Lake Shore for more than 30 days. It is unnecessary to investigate the truth of these statements in order to discuss a condition which is not uncommon. Some little additional significance attaches to this incident because Mr. Arthur Hale is not only General Superintendent of Transportation of the Baltimore & Ohio but is also Chairman of the American Railway Association's Car Service Committee, and, therefore, in his function as an executive he is applying in practice his own precepts as a committeeman in reforming abuses in car service. Here is an incident, one of many, where the coal shippers and coal receivers are at war with the railroads in a time of threatened car famine for the purpose of getting and holding for their own convenience as many cars as possible. The interests of the public, the users of the coal, are not identical with those of the shippers and receivers of the coal. These traders are at war with each other and with the railroad. When dealers in one region, foreseeing a shortage, order and hold cars beyond their storage capacity and until it is convenient to unload them, they interfere seriously with the interests of other consignees. It is the business and the direct interest of the railroad to prevent such abuses. A government bureau which could be called upon in these emergencies to abandon for a moment a consideration of the complaints of the Cincinnati Shippers' and Receivers' Association that rates from Richmond to Atlanta are too low in comparison with the rates from Cincinnati to Atlanta, or the complaints of the California fruit growers that the Florida business is being unduly nursed—such a bureau would be, indeed, a comfort to Mr. Hale under these circumstances, provided they were all wise and capable of considering the interest of the consumers as well as that of the traders. Until he gets such help from the government, however, he will probably need to continue to perform the functions of a transportation officer.

On another page we give a Frenchman's conclusions drawn from a study of American locomotive practice. The opinions expressed will be found to show a clear perception of the underlying

principles which have caused American and European locomotive designers to develop their art along diverging lines. The American designer is usually a manufacturer. The competition under which he works makes it necessary to produce a locomotive which shall be simple in design so that it can be economically built and easily maintained. In the construction solidity must be obtained; and the designer must bear in mind Wellington's maxim that, "An engineer is a man who can do for one dollar what any fool can do for two." When built the locomotive must be capable of giving hard service under a superintendent of motive power who has no personal interest in proving that the locomotive is of a type and design entirely suited to the service. Consequently the American locomotive must stand or fall on its own merits. There is consequently an effective evolution constantly going forward and selection plays a larger part in locomotive development than is possible in Europe, where the locomotives are for the most part designed by the railroad officials. Under these circumstances personal ideas are fostered and there is always a temptation to introduce new designs rather than to make use of devices which have become commonplace by general use. From many European sources criticisms of American locomotives have been heard, and it is therefore refreshing to hear an appreciation from a non-American source. The low price at which American locomotives can be built has been attributed to inferiority of design and materials. The truth is, as Mr. Oudet points out, that cheapness of production is obtained by simplicity of construction.

WHAT SHOULD DIRECTORS DIRECT?

Of late years, whenever a defalcation or wrong doing by the executive officers is brought to light, it has been common for the public to revile the board, and the word pictures of the newspapers show us a collection of successful but senile gentlemen, who have made money in yeast or leather or corsets or hams, who doze in their chairs while the President sells the company's securities in an attempt to corner something, or the Cashier rifles the safe to play the races. This picture is true of some small proportion of the 3,500 steam and electric railroad corporations, the 18,800 banking and trust companies, the 1,700 insurance companies, and of the uncounted thousands of very large and very small corporations which may be generally classed as industrials; but is there enough of it to justify a general overhauling and readjustment of directors' duties? The function of the director in an American corporation differs radically from that in other countries, with perhaps only one feature in common, namely, that some are apt to be chosen for the value which their names or reputations are supposed to add to the dignity or credit of the corporation. Our common idea of the duty of a board is that it shall control and direct the policy of the company and consider and pass on all undertakings of sufficient importance to in any way affect the company's financial credit or standing in the community. The occasion for the present general interest in the subject is the development of the carelessness of the directors of the Equitable Life Assurance Society and the shocking incapacity of the president of the Mutual Life Insurance Company. The text is the following misleading paragraph from the testimony of Mr. Jacob H. Schiff, a recent director in the Equitable:

> "The system of directorship in great corporations of the City of New York is such that a director has practically no power. He is considered, in many instances, and I may say in most instances, as a negligible quantity by the executive officers of the company; he is asked for advice when it suits the executive officers, and if, under the prevailing system, an executive officer wishes to do wrong or wishes to conceal anything from his directors or commit irregularities, such as have been disclosed here, the director is entirely powerless; he can be used only in an advisory capacity and can judge of only such things as are submitted to him."

This, which has been quoted generally by the daily newspapers, is unduly alarming to the investing public. Mr. Schiff is no longer young. He is a director in 16 companies, and senior partner in the firm of Kuhn, Loeb & Co., over whose immense financial transactions he undoubtedly keeps close watch. He had no investment in the Equitable, not even an insurance policy, so that we may assume that he was wanted in the board primarily for the appearance of stability which his name lent to it. It is also fair to assume that he accepted believing that he would be called on for advice and was competent for such advice in the company's large financial transactions.

But we believe that this is not all that the American investing public are led, by custom, to expect from a director. It is at least quite near the truth that we expect from directors, who commonly appoint the officers, a considerable degree of watchfulness of those officers and a close inspection of the results of their work—the details of the expenses which they incur and of the income which they get for the company. This, in addition to a direction of the general policy and scrutiny of the finances and credit, is about all that we, American fashion, expect from the directors—that by them the officers are "judged out of the things which are written in the books, according to their works."

The duty of the British railway director goes much further. To quote from the same authority: He is one "that fashioneth the hearts of them all, that considereth all their works." He is a salaried man, usually, really an officer. The committees of the board, assigned to each department, haunt the department offices, ask questions and call for special reports. "Where is your authority for having this office repapered?" "Why did you put in a concrete wall?" "How much did you pay for that asbestos lagging?" "What is this 'ton mile' that the Americans keep? We don't seem to have any of them." The British manager likes to answer this last question, but, on the whole, the British officer is bored by this minute directing. It has its value, it is often suggestive, but it consumes time.

Some American railroad officers are expressing fear that the late developments of laxity may inspire their own conscientious directors to interfere in technical matters. The chief engineer does not like to have his detailed plans criticised and changed by directors after they have authorized him to spend a certain sum of money to accomplish a specific purpose. He thinks he knows better than they know how to design an engineering structure to serve the end which they desire—and he is surely right.

The good results of the insurance companies investigation are already apparent in wakening the consciences of directors, but we hope it will be to the end of greater watchfulness of the results of officers' work and greater care in choosing, promoting and discharging those officers, rather than interference with them. Judge Gary, who is conscientious, has lately said to his fellow directors in the United States Steel Corporation:

> "We have no right to neglect our duties as directors, and I for one intend to give more attention to the affairs of this company in the future than I have in the past."

The converse of this confession by Judge Gary is that men of position who lend their names without fully performing their duties as directors do a great wrong. Their highest duty and most serious responsibility is in appointing officers, in promoting from the inside so far as possible, in making or reforming the organization so that it will work efficiently and without friction, in watching intelligently the results of the officers' work and infusing enthusiasm and loyalty. This is a fine function for sages, and fortunate is the corporation which has such a board of experienced men.

Deficient and incompetent men in such a board will be tempted to go farther and in the wrong direction, to criticise in detail the mechanical and civil engineering structures and operating methods of their own chosen men, trained and expert in technical departments. We have never happened to know of an instance where such interference does any good. The time of earnest, busy, officers is apt to be consumed in argument and kindergarten instruction, without a corresponding benefit to the company.

A MATTER OF STANDARDIZATION.

Is trouble brewing, or what will be the result of the apparent determination of the New York, New Haven & Hartford to haul its suburban trains as well as its express trains to the new Grand Central Terminal, in New York, with alternating-current locomotives? This involves two variations from the New York Central's methods on the same tracks, namely, locomotives instead of motor cars for suburban trains, and locomotives designed primarily for a. c. instead of d. c. operation. It was announced in these columns three weeks ago that the New Haven Company has ordered for this service 15 78-ton locomotives, with alternating-current series motors, adapted for use with an overhead trolley system, but capable of using the direct current taken from a third rail. Between Woodlawn and Grand Central Station the New Haven trains come into the city over the New York Central tracks, where the direct current is to be used. In an article on single-phase electric traction, published in these columns last week, the engineer of the Westinghouse Electric & Mfg. Co., Mr. C. W. Scott, concludes: "It is best, therefore, to keep single-phase equipments free from operation on direct current if it be practicable to do so." It is uneconomical, it is possible but not certain of uniform good results. The answer to it might be something like this:

(1) This proposed use of alternating current equipment in direct current territory will require more energy when running at slow speeds than similar equipment of the d. c. type, thus placing a load on the transmission system and sub-stations of the New

York Central not originally contemplated, and also largely increasing the cost of operation.

(2) The state of the art is such that the practical use of a. c. equipment will require many months for a proper development of untried devices, which will delay the installation of the New Haven equipment beyond the fall of 1906, when the New York Central expects to change from steam to electricity in its electric zone. The public expects the New York Central to keep its promise of an early discontinuance of steam locomotives through the Park avenue tunnel.

The New Haven Company is the New York Central's tenant, under a lease and agreement made in 1848. The New Haven Company has running rights over the New York Central line from Woodlawn to Grand Central Station, but must do its own hauling. It has always heretofore used the method of hauling adopted by its landlord. As long as the Central stopped its locomotives at Thirty-second street and hauled its passenger cars by horse power to City Hall, the New Haven did the same. Electric traction was not contemplated in 1848, and when nearly three years ago the New York Central, in response to public sentiment, accepted the act of legislature authorizing it to change its power, it appointed an "Electric Traction Commission" composed of men who had earned the respect of the whole country. After years of study this commission decided to use the direct current and the third rail, but expressly disclaimed any intention "to pass upon the relative merits of alternating current or direct current railroad operation as a general proposition." It simply decided that the local conditions precluded the use of the alternating current. Since this conclusion was arrived at, the commission has controlled every detail of the work—the electrification on the main line and the Harlem division, and the enlarged Grand Central Terminal with its surface tracks for trains hauled by electric locomotives, and its sub-surface tracks for a suburban service of multiple-unit train operation so as to obviate reverse movements and the switching incident to locomotive operation.

There are loops in the sub-surface part of the terminal, but they are not designed for locomotive operation and are not suited for it. Nevertheless the New Haven Company now proposes, under its agreement for running rights and authority to haul its own trains in its own way, to use 78-ton electric locomotives to bring its suburban trains to this terminal.

There may arise, therefore, a nice question of law, or, rather, a difficult judicial interpretation of a contract made 57 years ago, and its application to a state of things not then conceived of. What was the spirit of that contract? Since the combined forces of public opinion and the authorities of the state and city of New York have compelled the New York Central to desist from using steam power in the Park avenue tunnel, can the New Haven enforce its agreement and use steam locomotives in the city? Granted that the New Haven cannot do this, because locomotive smoke has been declared to be a nuisance, has the New Haven a right to abate the smoke nuisance by substituting mule power, and compel the Central to pave its tracks so as to make it comfortable for its mules? If it is answered that this would be unlawful because it would be inimical to public convenience, economy and despatch, it is apparent that the same objection holds good, in a less degree, to the New Haven's a. c. motors which will overload the transmission system and sub-stations of the New York Central. Locomotives for suburban trains in the sub-surface track would be more troublesome than mules.

There is a double-track loop, with which all tracks are connected. This design permits of operation as a stub-end terminal (the motor-driven train reversing direction and running back on its own incoming track), or running around the loop. The locomotive-hauled train has no alternative, and the further objection to it is that the loop is 135 ft. radius, and therefore impracticable for a 10 or 12 car locomotive-hauled train.

Another lamentable feature of a failure of the two companies to agree and standardize their stock in this electric zone is that it will prevent a pooling of equipment for common use. This provision for a highly probable economy and convenience to the public has been by both companies considered desirable.

If the New York Central, or its Electric Traction Commission, has been autocratic; if it has failed to invite and urge the New Haven officers to consult in all matters which affected them; or if it has omitted to invite them to have representatives in the Commission, the New Haven might by so much (very little) feel justified in avoiding, as a matter of personal feeling, an economical standardization; but we have no reason to believe that there was such a cause or such an undignified result. In any event, we earnestly hope that the success of this, the greatest undertaking of its kind, may not be imperilled by a failure to agree on standards for electric suburban cars and for the use of electric power.

It is not intended in this discussion to disparage the use of the single-phase alternating-current series motors, and the overhead trolley system for heavy traction. Its economy is unquestioned and its future use is certain, so far as we can see, at least for single and double track lines. But when an expert commission, quite unbiased, has after years of study decided that local conditions preclude its use in the New York Central terminal, the New York, New Haven & Hartford can well afford to deliberate before seriously interfering with the success of this monumental reconstruction for the public convenience.

Railroad Gross Earnings in August.

Gross earnings in August reflect the continued condition of the general prosperity of the country which was evident in the figures for July earnings. The increases in August over the figures for the corresponding period of 1904 mean much more than the July increases did, because in July, 1904, the great majority of roads reported decreases as compared with 1903, while in August, 1904, business conditions were recovering from the July depression and the majority of roads showed increases over 1903.

Of the Trunk lines, eight roads show gross earnings of $40,337,408, an increase over the figures for August, 1904, of $3,478,749; 9 per cent. Conditions have been especially favorable for these roads; the total receipts of grain, flour and corn meal at New York during this month aggregated 10,115,599 bushels, as against a corresponding movement in 1904 of 8,706,240 bushels, and the increases in similar receipts at Philadelphia were in about the same proportion. In the Southern group, the gross earnings of nine roads are $17,841,425, an increase of $554,052; 3 per cent. The full force of the yellow fever embargo at New Orleans was felt during August, and the ensuing reduction of traffic also affected roads which did not reach New Orleans but handled traffic originating there. The Coal roads show the largest percentage of increase of any group. Nine roads report gross earnings of $15,349,502, an increase of $1,970,093; 15 per cent. The coal and coke traffic originating on the Pennsylvania lines east, during the five weeks ending September 2, amounted to 4,363,756 tons, as compared with 3,677,589 tons in 1904. Of the Granger lines, six roads show gross earnings of $12,663,949, an increase of $1,157,543; 10 per cent. The receipts of live stock at the important cities in the region covered by these roads were only slightly greater than last year, but the grain movement was much greater; receipts of grain at Chicago being nearly 3,000,000 bushels (about 10 per cent.) greater than in 1904. In the Southwestern group, the gross earnings of six roads amounted to $18,884,043, an increase of $1,155,369; 7 per cent. These roads were still suffering in August, 1904, from the effects of the beef strike. The Transcontinental roads, like the Trunk lines, show the effects of the general prosperity in their increased amount of through traffic, much of it being merchandise which would not be bought in hard times. Of this group, five roads report gross earnings of $25,398,687, an increase of $2,658,960; 12 per cent.

The more noticeable increases and decreases in the earnings of individual roads can be explained by the conditions which affect the groups of which they are a part. All the roads which last year had great increases in passenger traffic on account of the St. Louis Fair of course show the effects of the lack of that traffic this year.

The accompanying table shows the gross earnings for August, 1905, and the increase over the figures for August, 1904, of 46 roads:

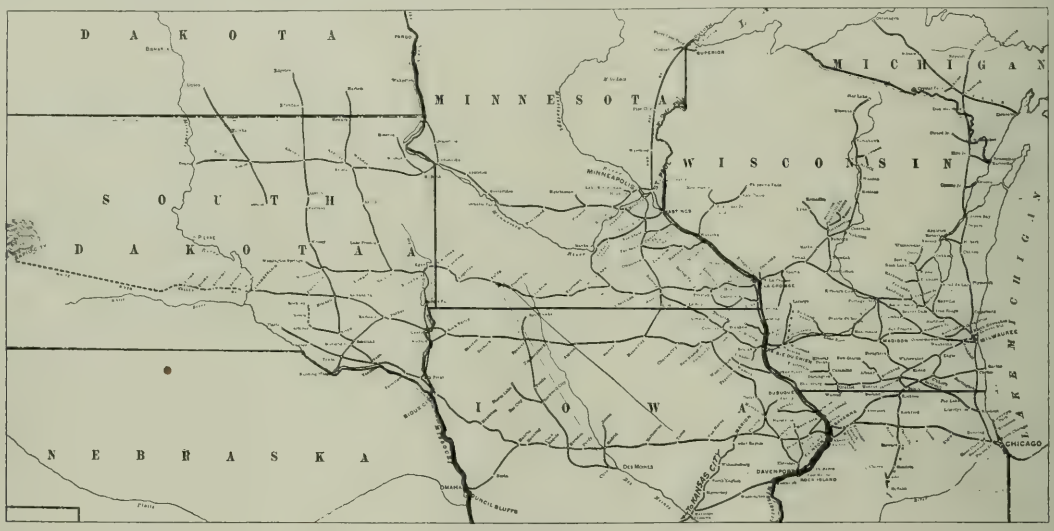
	August, 1905.	Increase over August, 1904.
Atchison, Topeka & Santa Fe	$5,967,032	$522,698
Atlantic Coast Line	1,612,763	158,757
Baltimore & Ohio	6,398,087	527,735
Buffalo, Rochester & Pittsburg	806,567	71,351
Canadian Pacific	4,796,734	322,496
Central of Georgia	827,820	101,828
Central of New Jersey	2,248,388	268,813
Chesapeake & Ohio	1,967,281	147,500
Chicago & Alton	1,056,300	*136,764
Chicago Great Western	714,364	89,169
Chicago, Milwaukee & St. Paul	4,467,405	262,351
Chicago, Rock Island & Pacific	4,481,592	584,778
Chicago, St. Paul, Minn. & Omaha	1,028,980	51,278
Cin., New Orleans & Tex. Pac.	665,467	39,281
Clev., Cin., Chic. & St. Louis	2,158,266	32,168
Colorado & Southern	596,492	105,743
Denver & Rio Grande	1,690,261	265,284
Erie	4,406,759	302,880
Grand Trunk	2,647,130	75,175
Great Northern	3,972,540	334,649
Hocking Valley	575,791	*33,682
Illinois Central	4,015,835	*198,373
Lehigh Valley	2,836,938	425,721
Louisville & Nashville	3,402,605	180,236
Mexican Central	2,294,684	204,788
Mexican International	511,637	*38,834
Minn., St. Paul & Sault Ste. Marie	916,308	306,731
Missouri, Kansas & Texas	1,722,633	191,811

Missouri Pacific-Iron Mountain....	$3,734,000	*$173,000
Nashville, Chattanooga & St. Louis	872,772	*15,989
National R. R. of Mexico.....	539,196	66,167
New York Central & Hudson River	8,146,196	824,926
New York, Ontario & Western....	782,954	80,384
New York, Susquehanna & Western	245,699	34,189
Norfolk & Western	2,394,003	437,794
Northern Pacific	4,905,644	532,470
Pennsylvania Lines East of Pittsb'g	11,967,490	1,667,600
Philadelphia & Reading	3,492,781	538,023
Pitts., Cin., Chic., & St. Louis	2,361,778	277,348
St. Louis & San Francisco	3,352,474	140,040
St. Louis South-Western	718,875	4,737
Southern	4,258,555	216,983
Southern Pacific	8,591,941	832,565
Union Pacific	5,758,737	946,647
Wabash	2,251,702	*229,083
Yazoo & Mississippi Valley	461,055	*120,491
Total	$133,820,530	$11,206,888

*Decrease.

Chicago, Milwaukee & St. Paul.

The St. Paul, with an operated mileage of 6,900 miles, covers the territory west and north of Chicago, including lines to Minneapolis, St. Paul, Duluth, the Michigan peninsula, Kansas City, Omaha, Evarts, S. Dak., and Fargo, N. Dak. Through northern Illinois, Iowa, southern Minnesota, Wisconsin and the eastern part of South Dakota its lines spread widely. One of the farthest western points now reached by the St. Paul is Chamberlain, S. Dak., 682 miles from Chicago. The construction of a line from Chamberlain, 75 miles west to Rapid City, now under way, has led to some very definite rumors of a further extension, when this is finished, between the Union Pacific and the Northern Pacific, to the coast. Belief in the ultimate purpose of the St. Paul management to reach the coast over its own rails has been strengthened by the fact that the road has not, it is believed, been getting its share of through traffic (its average haul on a mileage of 6,912 miles decreased from 185 miles in 1904 to 175 miles last year), and by the fact that there is unissued in the treasury $25,000,000 common stock which would provide funds for the extension. The large stretches of undeveloped territory between Rapid City and the coast, which could not fail, profited by railroad development, to eventually furnish a large local traffic, give a further argument for the extension.



Chicago, Milwaukee & St. Paul.

Aside from its possible aspirations for a coast connection, the St. Paul is prosperous in its present territory. Gross earnings last year nearly reached the fifty million mark, being $49,884,114 against $48,330,335 in the preceding year, an increase of $1,553,779. The fact that earnings for 1904 increased $667,597 over 1903 shows how large last year's increase really was. The striking fact about the year's operation is not only the large increase in gross but the large proportion of this increase saved for net earnings, which increased $1,136,328 over 1904, being $17,590,073 in 1905 and $16,453,745 in 1904.

Last year the company's statement was severely criticised because of the very large reduction in maintenance of way expenses and the serious increase in the expense of conducting transportation. Maintenance of way cost, in 1904, $5,128,248, against $7,347,048 in 1903, a decrease of $2,218,800 in one year in expenditure on the line. In the same time, conducting transportation increased $1,767,547; from $16,829,795 in 1903 to $18,597,342 in 1902. This would make a bad showing for any road and in consequence the results last year, though apparently satisfactory, were in the expense account largely disappointing. Furthermore gross earnings were not increasing at the rate which might have been expected, so that the underlying condition was doubly unsatisfactory. During the past year these unfavorable factors have to some extent been overcome. The large increase in gross earnings has already been noted. Maintenance of way, though over $2,000,000 less than in 1903, increased $280,378, to $5,336,626. This is at the rate of $773 per mile of road against $751 in 1904 and $1,099 in 1903. Conducting transportation, though still nearly $1,500,000 more than the 1903 figure, also decreased $316,884. The large increase in gross business makes the showing in this account better than the figures seem. Yet, although gross earnings show a remarkably satisfactory increase, expenses do not appear to be yet in hand and the bad results in 1904 have been only partially, and that but a small part, overcome.

The saving in conducting transportation is more than explained by a decrease of $379,292 in fuel for locomotives, brought about, no doubt, by the completion of the company's line into the Illinois coal fields. With this exception, conducting transportation cost the company a great deal. Station service increased $49,111; advertising $33,110; outside agencies $32,249; rents for tracks and terminals $44,676, and loss and damage ($479,437) $143,488. In 1904 conducting transportation was 38 per cent. of gross earnings against 33 per cent. in 1901. With the large increase in gross and the small decrease in this expense account, this relation was reduced to 37 per cent. last year. Following the showing made in 1904, these figures can hardly be regarded as satisfactory, and it is probable that a still greater effort will be made during the current year to get expenses on a more satisfactory basis.

Maintenance of equipment during recent years seems to have been fairly well, though not liberally, taken care of. A satisfactory fact is that it has been increasing year by year. Repairs and renewals cost $1,538 per locomotive last year against $1,493 per locomotive in 1904 and $1,232 per locomotive in 1903. Per passenger car there was spent $592 in 1905, $531 in 1904, and $544 in 1903, and per freight car $42 in 1905, $38 in 1904, and $36 in 1903.

While current maintenance charges are not as liberal as might perhaps be expected, the company's policy in regard to improvements is highly conservative. During the year there was expended from the renewal and improvement fund $6,704,127, leaving a balance of $3,966,106 in this fund at the end of the year. In 1904 there was $5,914,372 spent from this fund for betterments. Independently of the fund there has been spent out of current cash, but charged to capital account as "earnings and other income expended for additions and improvements to property," since 1902, $18,222,631 and in the past year $2,867,699. This is a remarkable record for improvement expenditures which could be matched by few other roads. It would seem natural that the effect of these very liberal outlays on expenses should soon be more clearly shown.

The company maintains its own insurance department and has evidently during the past year changed its attitude in regard to some of the larger risks, influenced no doubt by the severe losses of the Illinois Central in the New Orleans fire, which amounted to within $600,000 of the total reserves against loss in that company's insurance department. An item of $45,355 expended

by the St. Paul as re-insurance from March 16 and 18, 1905, for one year, suggests that the larger risks were at that time re-insured with regular fire insurance companies.

Traffic statistics show that there was a decrease of 209,638 tons of wheat and 143,927 tons of miscellaneous forest products, and increases of 314,482 tons of corn, 91,791 tons of oats, 942,674 tons of iron and other ores, 182,422 tons of stone and sand, 146,349 tons of lumber, lath and shingles, and 179,392 tons of iron and steel, in the tonnage carried during the year. Wheat furnished 5 per cent. of the total tonnage and products of agriculture 23 per cent. Products of mines furnished 28 per cent. against 24 per cent. in 1904. There were 2,473,150 tons of bituminous coal carried, an increase of 93,402 tons over 1904. The train load increased from 246 tons to 264 tons; or, including company freight, from 280 tons to 296 tons. The rate received per ton mile was 0.881 cent against 0.891 cent in 1904, and per passenger mile 2.243 cents against 2.305 cents in 1904. The average number of miles each passenger was carried was 44 miles.

With its 6,912 miles of track, the Chicago, Milwaukee & St. Paul secures less than 500 miles haul on through freight via either Minnesota Transfer or the Omaha or Kansas City gateways, for it is not likely that the Great Northern, Northern Pacific or the Minneapolis, St. Paul & Sault Ste. Marie turns freight over to it west of Minneapolis for a longer haul. This will probably be the determining factor in deciding upon an extension to the Pacific coast. Why the Chicago, Milwaukee & St. Paul is any more compelled than the Chicago & North-Western to make such an extension is not at first sight clear, but an examination of Chicago & North-Western returns shows that not only does that company serve its own territory more completely and more profitably, but hints at the fact that through affiliations of ownership or for other reasons it is able in general to obtain a considerably better share of through traffic.

The principal statistics of operation follow:

	1905.	1904.	1903.
Mileage worked	6,912	6,906	6,683
Freight earnings	$35,968,946	$35,081,759	$34,797,045
Passenger earnings	10,126,958	9,661,633	9,542,201
Gross earnings	49,884,114	48,333,335	47,662,758
Maint. way and structures	5,336,626	5,128,249	7,347,048
Maint. of equipment	5,181,586	4,651,783	3,893,834
Conducting transportation	18,280,458	18,597,343	16,829,796
General expenses	1,243,079	1,190,907	952,309
Operating expenses	32,294,041	31,876,590	31,598,174
Net earnings	17,590,073	16,453,745	16,064,563
Gross income	50,114,912	48,646,766	48,172,768
Net income	11,858,825	10,718,400	10,473,259
Surplus after dividends	4,371,114	3,277,169	3,072,033

NEW PUBLICATIONS.

Mechanics of Materials (Tenth Edition). By Mansfield Merriman, Professor of Civil Engineering, Lehigh University. New York: John Wiley & Sons, 1905. Cloth, 6 in. x 9 in.; 507 pages; 183 figures. Price, $5.

In presenting the tenth edition of this work the author states that while his main purpose in re-editing and enlarging it has been to keep it abreast with modern progress, he has at the same time attempted to present the subject more clearly and logically than before, in order both to advance the interests of sound engineering education and to promote sound engineering practice. The same general treatment of the subject is followed, in a similar manner, as in the past editions, although various topics have been treated more at length than before and the sub-divisions are somewhat different. There are 19 chapters and these are devoted to the following subjects: Elastic and Ultimate Strength, Elastic and Ultimate Deformation, Materials of Engineering, Cases of Simple Stress, General Theory of Beams, Simple and Cantilever Beams, Overhanging and Fixed Beams, Continuous Beams, Columns or Struts, Torsion of Shafts, Apparent Combined Stresses, Compound Columns and Beams, Resiliance and Work, Impact and Fatigue, True Internal Stresses, Guns and Thick Cylinders, Rollers, Plates and Shears; Miscellaneous Discussions, and Mathematical Theory of Elasticity. To encourage students to think for themselves and to illustrate the practical use of the formulas and methods which are given in the text, a number of examples are given after each article. Among some of the new topics introduced are those of economic sections for beams, moving loads on beams, constrained beams with supports on different levels, the torsion of rectangular bars, reinforced-concrete beams, plates under concentrated loads, internal friction, rules for testing materials, and elastic-electric analogies. A number of good practical tables, such as the working unit-stresses for buildings, which are abstracted from the Building Code of the City of New York, are also given.

Design and Construction of Metallic Bridges. By William H. Burr and Myron S. Falk. New York: John Wiley & Sons. 1905. Cloth, 532 pages, and 4 plates. Price, $5.

Burr's "Stresses in Bridge and Roof Trusses, Arched Ribs and Suspension Bridges" has long been a standard text-book on the analytical methods of computing the stresses in framed structures. After having passed through nine editions and revisions it makes its appearance under this new title completely rewritten and enlarged in scope. American bridge design has advanced rapidly during the last few years and many of the old types and methods of computation have become obsolete. The types of structures considered in this new work represent only those which have survived the test of time, and the methods of design are those in general use among the more advanced bridge engineers. Less space than usual in a book of this kind has been devoted to the complete solution of a number of different types of bridges, more attention being paid to the special problems involved in the design of all types such as wind load, effect of centrifugal force, full treatment of moving loads and similar problems which come up every day in practical bridge design, but which are too frequently dismissed in most text-books with only passing mention. The design of swing bridges has been very fully treated, more than 120 pages being devoted to this one class of structures. Other chapters deal with the history of bridge building, design of plate girders, trusses with parallel chords, trusses with chords not parallel, influence lines, theory of least work, wind stresses in roofs and braced piers and details of bridge construction. The book shows evidences of having been hurried through the printer's hands as there are a number of minor typographical errors in the text and the printing is hardly up to the publisher's standard.

TRADE CATALOGUES.

Hoisting Machinery.—The Brown Hoisting Machinery Company, Cleveland, Ohio, sends its 1905 "Brownhoist" catalogue. It measures 9 in. x 12 in. and is handsomely bound in cloth and contains upwards of 200 pages. Descriptions and illustrations are given of the latest machines of the "Brown" type for unloading coal or iron ore from boats and delivering it either into railroad cars or on stock piles, and vice versa, and for the hoisting and conveying of general merchandise at docks, steel works and blast furnaces; also for the handling of material during the construction of ships at ship yards. It also illustrates and describes the Brown furnace hoist and stock distributor for the charging of blast furnaces, besides many other equipments for the handling of material in the yards of steel works, structural shops, etc. The "Brownhoist" suspended pocket is also illustrated, this construction being used in connection with the charging larries in many of the largest steel works.

Locks and Hardware.—The Yale & Towne Mfg. Co., New York, sends its catalogue No. 18, which contains over 200 pages, 6 in. by 9 in. It is neatly bound in green board covers, with red cloth back and gold lettering. It lists and prices only goods most commonly called for, and is intended for a book of ready reference for both large and small buyers. In addition to cataloguing padlocks, night latches, builders' hardware, door checks, chain blocks, etc., it contains a comprehensive glossary of technical terms and articles of interest on the mechanism and care of locks, lock picking, master-keyed locks, etc. Almost every article mentioned in the volume is shown by illustrations and is explained by descriptive text indicating its action, its use and its relative grade.

Car Heating and Lighting.—The Gold Car Heating & Lighting Company, New York, is distributing a large new catalogue of its car heating and lighting apparatus. The devices shown embody many improvements in design and construction and are the latest types made by this company. They include direct and hot water systems of car heating, storage heating system for compartment passenger cars and refrigerator cars, and a complete line of electric heaters. All the parts shown are identified with list numbers so that the catalogue may be used for ordering new or duplicate parts.

Electric Batteries.—The Gordon Battery Co., New York, sends an illustrated catalogue and price-list descriptive of its electric batteries, cells and spark coils. Special attention is called to the improved Gordon batteries, in which a perforated cylinder containing the copper element is provided. This improvement will be especially appreciated by users of primary batteries as, when renewing the same, the necessity of handling the parts which were immersed in the solution is entirely obviated.

General Supplies.—Joseph T. Ryerson & Son, Chicago, sends its October issue of "Ryerson's Monthly Journal and Stock List." It contains several short articles, including "The Setting and Care of Air Compressors" and "The Economical Arrangement of Machinery," as well as the usual number of convenient tables of weights, etc., of various shapes of rolled steel sections and plates.

Automatic Couplers and Draft Rigging.—The W. T. Van Dorn Co., Chicago, sends an illustrated catalogue of the Van Dorn Automatic Couplers and radial draw bars. Full detailed descriptions of the above devices, including working drawings, are given. Illustrations are also shown of an eight-car train of steel motor cars on the New York Subway, which are equipped with the Van Dorn drawbar.

CONTRIBUTIONS

A New Track Book.

Montreux (Switzerland), Oct. 6, 1905.
Pension Grammont.

To the Editor of the Railroad Gazette:

After reading the Etude sur les Déformations des Voies de Chemins de Fer et les moyens d'y remédier par M. G. Cuënot, Ingénieur en Chef des Ponts et Chausseés, attaché au controle de la Compagnie P. L. M. (Eng. Bertéa, Imprimeur Editeur, Bourg (din) France), I think close attention of American maintenance of way engineers who understand the French language ought to be called to this book, which appears to me to be the most interesting and instructive work published up to date. MAX BARSCHALL.

A Runner's Ideas on Signaling.

To the Editor of the Railroad Gazette:

Noting the article on Forms of Signals in your issue of September 29, and in the following issue comments on it by a "President," a "Vice-President" and others, I should like to say something from the viewpoint of the locomotive engineer. The article says:

"In view of the facts that railroad signals are now intended to tell so many different things, some logical variations in their form will soon be quite necessary, or the engineman's memory will be overtaxed. . . . Signal indications may be enumerated as follows:

1. Switch signals.
2. Draw signals.
3. Automatic signals.
4. Unusual route signals.
5. Train order signals.

He might have mentioned more. The different kinds of things the signals tell and the names of the different signals are mere terms by which fine distinctions of little moment to the engineman are made. The engineman knows little of technical names and differences and cares less; yet without effort he can describe his signals to the satisfaction of his immediate superiors.

I cannot see any practical difference between signals such as "interlocking," "distant switch," "manual block," "automatic block," "draw," "train order," "flag stop," and a goodly number of others that could be mentioned; but, since running over as many as four different Superintendents' division, the great lack of uniformity in the application of our present few and simple forms is apparent.

Accidents are rarely due to engineman's innocently misinterpreting signals, but frequently are due to his negligently misinterpreting, guessing, wittingly assuming, anticipating them for little or no reason or for making time. And you may always expect this weakness to crop out in the best of enginemen some time or other; the best protection against it is uniform application of signals placed as far apart as practicable and possessing few forms. Signals will necessarily become so close together that enginemen will have no time to reason as to their significances other than those of "Stop," "Go," "Go permissively," "Go, home signals are cleared up to the one in advance of the next distant signal." No expense should be spared to reduce rather than increase these terms. If the permissive signal were abandoned then our present forms would be ideal, as the distant signal could then take the form of the permissive and thus avoid the use of a special form of blade. If there is a fourth light practical then it should be given to the permissive so that its night indication will be different from the distant signal.

Outlying switches can be and should be protected as interlockings are and considered as unattended, with switches left straight and signals pulled. Manual block stations should be so well manned and signalled as to command as much confidence on part of enginemen as if they were interlocked; and can be considered interlockings with or without switches.

Automatic blocks are more than interlocked, provided the outlying switches are properly connected or mechanically or electrically controlled, and may be considered manual block stations. When the signals show "Stop" one may consider the attendant disabled.

Drawbridges should be treated as nothing more than derails at interlockings.

If it is thought that trains stopping at interlocking or block station signals cannot be safely and promptly communicated with as to train orders then do the thing right by placing the usual form of signals for each track in front of the cabin so that the operator may conveniently deliver orders. The engineer need not consider the signal in any other light than others.

Why cannot "flag stop" signals be located and operated much in the manner of block signals and so require no special form? A signal is a signal no matter what its size.

No matter what special marks or forms signals are given, the fact remains that to move safely and make time the engineman must know the locations of his signals so well that he is anticipating the sight of them. If he is so well acquainted with his road as to anticipate the sight of his signals then the special marks and forms have long since become useless to him.

When practicable, an engineman should never pass a "Stop" signal without an order; if this rule were enforced there would be little excuse for specially marking "automatics" anywhere. As it is, there is little use for these markers except where they are mixed up with signals controlled by an operator. There is no objection to day markers; unnecessary lights at night are always sources of danger. But whatever marks or forms signals may be given, they should be applied so that to the engineman the signals primarily mean either "Stop," "Go," "Go permissively," "Go, you have *go* signals up to the signal in advance of the next distant," or "Go, but there is now a stop signal between you and the next distant signal." An engineman satisfied that the operation of signals is surrounded with all the safeguards of the signal art can be depended on to regulate his speed according to these signal indications as well as in conformity to those many other features upon which speed depends, such as grades, curves, road crossings, bridges, stations, water troughs, schedule, condition of engine, make up of train, cattle or school children on track, condition of track, weather conditions, etc.; and particularly in accordance with the distance the signals are apart. In view of signals being only 30 seconds apart and every tenth signal a three-armed interlocking one, do you not think it would be better to refrain from giving the engineman occasion to study new frills until the present forms are uniformly adapted and universally understood? Then, it is my firm conviction, you will find the present forms amply sufficient.

If, on top of all this, speed signaling is to be mixed up with route signaling, the chances are that no present-day runner will, unpensioned, live to see the day of uniform signaling. Why not make the best of what we have rather than chase after a will-o'-the-wisp cure-all? A LOCOMOTIVE ENGINEER.

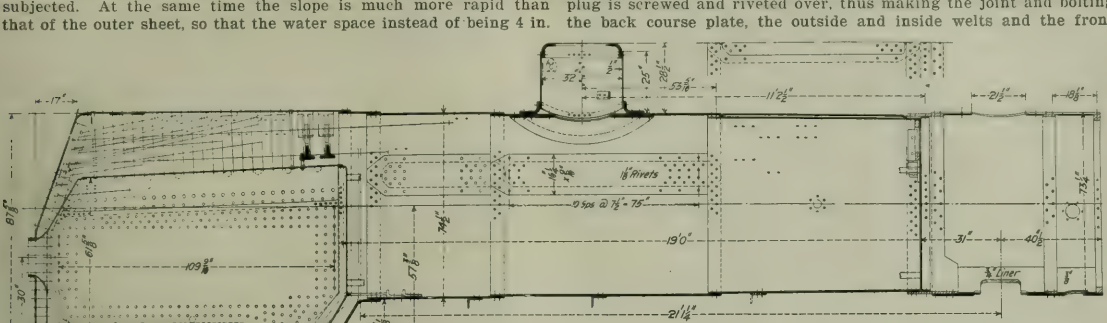
Prairie Type Engine for the Chicago, Burlington & Quincy.

A few months ago the American Locomotive Co. delivered a number of prairie (2-6-2) locomotives to the Chicago, Burlington & Quincy that possess certain features of interest. In the first place, six of the fifty that were ordered were intended for burning lignite and therefore required a modification of the tube arrangement. The boiler used on the bituminous coal burning engines is shown in the longitudinal section. It contains 301 tubes 2¼ in. diameter and 19 ft. long over the tubesheets. They are arranged in the usual manner, with a pitch of 3 in. The boiler for burning lignite has but 198 tubes of 2¼ in. diameter and in addition thereto has 24 of 5 in. outside diameter, that are swaged down to 4 in. and screwed into the back tubesheet, and expanded at the

Prairie (2-6-2) Type Locomotive for the Chicago, Burlington & Quincy.

full diameter into the front sheet. These 24 tubes take the place of 103 small ones in the bituminous coal burning engines, and are located at the center and top as shown in the cross-section of the boiler. These large tubes are required in order to secure the proper condition of combustion of the light burning lignite.

The back head is also somewhat peculiar in its construction. It slopes down to the top of the firebox from which point it is vertical. The inner sheet is flanged out to form the door but instead of the short, sharp bend usually employed it sweeps out on a radius of 11 in. thus avoiding the stresses to which it would ordinarily be subjected. At the same time the slope is much more rapid than that of the outer sheet, so that the water space instead of being 4 in.

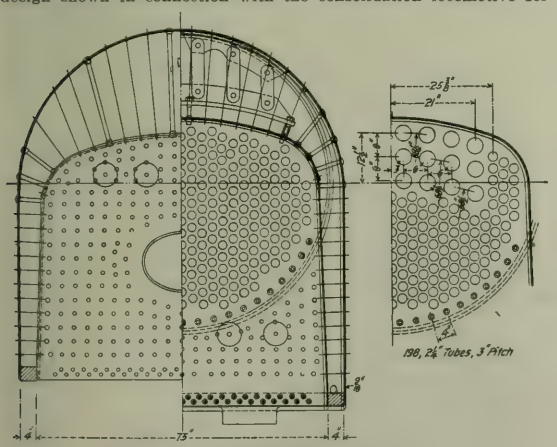


Longitudinal Section of Boiler—C., B. & Q. Prairie Type Locomotive.

wide, as it is below the door, widens out to 9 in. at the crown, thus greatly improving the circulation.

The grate is 108 in. long and is flat for 78 in. from the back and drops 7¾ in. in the remaining distance. The frames are in three sections, being bolted together just back of the cylinders and between the third pair of drivers and the trailing wheels. The equalization of the weights on the drivers varies, the load of the rear being normally greater than on the main pair. It will be seen from the illustration that the weights on the two rear pair of drivers and the trailing truck are equalized by bars with arms of unequal lengths. In this way about 22 per cent. more weight is carried by the rear pair than the main, while the truck carries 25 per cent. less than the latter. The forward drivers and the truck are equalized in the same manner as in consolidation and mogul engines. The back end of the equalizer over the trailing axle box is carried by a short elliptic spring instead of the helical spring that has found a place at the back end of American locomotive frames for so many years.

The support of the boilers on the frames follows the general design shown in connection with the consolidation locomotive for



Sections Through Boiler and Firebox.

the New York Central & Hudson River R.R. illustrated in the *Railroad Gazette* for June 9, with a slight modification. In that case the whole weight of the firebox was carried by two plates bolted to lugs on the bottom of the mud ring and which, by buckling, compensate for the varying dimensions of the shell due to expansion. In the boiler on the engine under consideration this buckle-plate is attached to the back end only, while the front of the firebox is carried by two feet bolted to the lugs of the mud ring and resting on a bracket extending across between the frames. The movement to and fro at this point takes place by sliding as in the case of the expansion plates that were used on the old narrow firebox locomotives.

In this boiler there is also embodied a method of making a butt lap welt on the horizontal seams with which some may not be familiar. It is shown in section and plan at the top of the front course in the longitudinal section of the boiler. In order to avoid the necessity of drawing down the metal and scarfing so as to carry the welt beneath the sheets the outside welt is made to butt against the next larger course plate back, and in the center, a ⅞-in. plug is screwed and riveted over, thus making the joint and bolting the back course plate, the outside and inside welts and the front course plate firmly together. It is one of the unnoticed details of the boiler practice that has been adopted for the purpose of adding to the efficiency of the work and at the same time saving expense.

In the arrangement of the stays for the side sheets of the firebox the diameter is ⅞ in. spaced about 3 7-16 in. apart, except at the ends. Here the row of stays next the back head have a diameter of 1 in. The same size is used in the lower front corner next the mud ring and up the sides next the tube sheet commencing on a line with the bottom of the shell.

In regard to the other details on the engine, the front and rear trucks are the ordinary two-wheeled radial truck and the standard outside bearing truck of the railroad company respectively. All of the journal boxes are of cast-steel as are the centers of the wheels themselves.

The tender frame is also of the standard C., B. & Q. construction, using 12-in. channels for sills. The brakes are the Westinghouse, with a 9½-in. pump, with the American type for the drivers, and having a reservoir of 60,000 cu. in. capacity.

The general dimensions of the engines are as follows:

Cylinder, diameter	22 in.
Piston stroke	28 in.
Tractive power	35,053 lbs.
Wheel base, driving wheel	13 ft. 4½ in.
" " total	30 " 8½ "
" " total engine and tender	62 " 2¾ "
Weight on drivers	154,000 lbs.
" total of engine	212,500 "
" total of engine and tender	366,500 "
Heating surface, tubes (bituminous coal)	3,343 sq. ft.
" " tubes (lignite)	2,940 "
" " firebox	170.9 "
" " total (bituminous coal)	3,513.9 "
" " total (lignite)	3,110.9 "
Grate area	54 "
Axle, driving journals	9½ in. diam., 12 in. long.
" engine truck journals	6 " " 10 " "
" trailing truck journals	8 " " 12 " "
" tender journals	5½ " " 10 " "
Boiler, type	Radial stay; Straight top
Boiler, outside diameter, first ring	70 in.
Firebox, length	109 "
" width	78 "
" thickness crown sheet	⅜-in.
" " tube sheet	½-in.
" " sides and back	⅜-in.
" Water space, front	4½ in.
" water spaces, sides and back	4 "
Crown sheet support	Radial stays with two rows of sling stays at the front
Steam pressure	210 lbs.
Tubes, material	Iron
" number	301 and 198
" diameter	2¼ in. and 5 in.
" length	19 ft.
Grates, type	Rocking
Smokestack, diameter	19½ in.
Smokestack, height above rail	15 ft.
Tank, type	Water Bottom
" capacity, water	6,000 gals.
" capacity, coal	16 tons
Valves, type	Piston
" travel	5¾ in.
" steam lap	1⅛ "
" exhaust lap	1⅛-in.
Wheels, diameter of driving	69 in.
" " truck	37¼ "
" " trailing	42½ "
" " tender	33 "
Ratio of total weight of engine to weight on drivers	1 to .724
Ratio of heating surface in sq. ft. to cylinder volume in cu. ft.	351 to 1
Tractive weight in lbs. to heating surface in sq. ft.	43.82 to 1
Tractive weight to tractive effort	4.39 to 1

Tests of the Westinghouse Improved Quick-Service Triple Valves.

During the fifteen years that have elapsed since the quick-action automatic air-brake came into general use on freight trains, the average weight on drivers of locomotives has increased from 100,000 lbs. to 200,000 lbs. and their drawbar pull from 25,000 lbs. to 50,000 lbs. Within the same period the average freight car capacity has increased from 40,000 lbs. to 100,000 lbs., and while in 1888, 50 cars in a train was considered a maximum, now 80 cars is common and 100 cars is by no means rare. Reference to these figures is not needed to emphasize the statement that brake apparatus which met all requirements 15 or 20 years ago is now satisfactory only in inverse proportion to the increased demands made upon it. So far as draft gear is concerned the proposition is self-evident. The tests made by the Westinghouse Air-Brake Company with a special train on the tracks of the Lake Shore & Michigan Central at West Seneca, N. Y., August 23, 1905, served to demonstrate how much more adequate modern brake apparatus and friction draft gear is to withstand the severe service conditions of train operation today than the old apparatus which has for so long served its purpose well.

The train used in making the tests consisted of 50 steel underframe gondolas with wood bodies of the Baltimore & Ohio type, having a capacity of 100,000 lbs. and a light weight of 45,000 lbs. They were equipped with standard 10-in. freight cylinders having standard triple valves (H-49) and also improved quick-service triple valves (H-49-B) arranged with a cut-in and cut-out device for competitive tests. The other special Westinghouse devices included friction draft-gear, automatic air coupler, American automatic slack adjuster and high and low-pressure retaining valves.

The locomotive used was a consolidation (2-8-0) type, Pennsylvania class H6a; cylinders, 22 in. x 28 in.; diameter of drivers, 56 in.; boiler pressure, 205 lbs.; weight on drivers, 173,000 lbs.; tractive force about 40,000 lbs.; main-reservoir pressure, 90 lbs.; brake-pipe pressure, 70 lbs.; main-reservoir capacity, 66,000 cu. in. Engine equipped with the same special devices as the cars and also with the Westinghouse improved engine equipment, possessing the combined straight-air and automatic, together with the distributing valve features.

The new quick-service triple valve with which the cars were equipped is an improved form of the old standard quick-action triple valve designed to quicken the service application of the brakes on long trains so as to obtain such application on the rear cars of an 80 or 100-car train in approximately the same length of time as was formerly accomplished by the standard valve on a 20 or 30-car train. With the improved valve on long trains a 5-lb. reduction is equal in efficiency to a 20-lb. reduction in the train pipe pressure with the old type of valve, thereby making it possible to apply a greater number of brakes in the train with these valves than was possible with the old valves. With the new triple valve the quick-service application gives approximately an equal cylinder pressure on all cars regardless of the length of the train. Hence it enables making shorter stops and tends to decrease the number of slid wheels by avoiding the increased retardation produced by the excessive pressure produced in the cars at the head of the train when using the standard triple valves. In the new valve a retarding feature has been provided which puts the movement of the train much more fully under the control of the engineman, enabling him to release the brakes on the rear cars of a long train first if desired, thereby permitting the slack to run in and avoiding the jerking and lurching of the train from the rear which often results in break-in-twos. Or, if desired, on account of different road conditions, release can be made from the first car towards the rear, keeping the train stretched. If the conditions are favorable for simultaneous releasing, this can also be accomplished by proper manipulation of the engineer's valve. The necessary modifications in the new valve to accomplish these ends can be made to the present standard valve using the same triple-valve shell, casing and all connections.

The essential improvements in the engine equipment consist of an appliance that enables the engineman to more uniformly control the brakes on long trains and also provides a straight-air or automatic feature for the independent locomotive and tender-brake operation which works in unison with the automatic train brakes, if desired, or gives an independent, graduated straight-air action by a simple movement of the engineer's brake-valve. By the function of what is known as the distributing valve, the pressure in the cylinder of the locomotive and tender brake is automatically maintained. In other words, when once applied, with the new apparatus, the pressure is constant so long as pressure exists in the main reservoir and can only be released by the manipulation of the handle of the engineer's brake valve. By the use of the new apparatus, a more rapid recharging of the brake-pipe can be accomplished with either the new or old type of triple valve, lessening the time required for recharging the brakes.

NOTE.—In all tests the dynamometer car was the twenty-sixth in the train.

The following is a condensed log of the air-brake tests:

Test No. 1.

Standard (old style) triple valves. Speed, 20 miles per hour. Reduction, 20 lbs.
Brake-pipe reduction, 20 lbs.
Speed, 21½ miles per hour.
Length of stop, 557 ft. 9 in.
Length of stop reduced to 22 m. p. h., 584 ft. 0 in.
Duration of stop, 25 seconds.

NOTE.—Runs 1 and 2, covering Test 1, were not counted owing to the improper action of the equalizing piston in the brake valve.

Test No. 1-1.

Repeat Test No. 1, with 5-lb. reduction.
Brake-pipe reduction, 5 lbs.
Speed, 22¼ m. p. h.
Length of stop, 1,312 ft. 10 in. (See note.)
Length of stop reduced to 22 m. p. h., 1,283 ft. 6 in.
Duration of stop, 57 seconds.

NOTE.—In announcing the tests at the time they were made, it was announced that this was 1,613 ft. 10 in. The record given above is the correct one.

Test No. 2.

Quick-service (improved) triple valve. Speed, 20 miles per hour. (Same as Test No. 1.) Reduction, 5 lbs.
Brake-pipe reduction, 5½ lbs.
Speed, 22¼ m. p. h.
Length of stop, 456 ft. 2 in.
Length of stop reduced to 22 m. p. h., 446 ft.
Duration of stop, 20.2 seconds.

Purpose of Tests Nos. 1 and 2 is to show that practically the same length of stop is obtained with a 5-lb. reduction with new triple valves as with a 20-lb. reduction with old triples, thereby making it possible to operate positively a train with a much larger number of brakes in operation, when equipped with new valves, than can be done successfully with old-style valves, which fact has been demonstrated with 100-car train test—the brakes working throughout with new style valves.

Test No. 3.

Quick-service (improved) triples. Speed, 20 miles per hour. (Same as Test No. 1.) Reduction, 17 lbs. (equalization).
Brake-pipe reduction, 17 lbs.
Speed, 22 m. p. h.
Length of stop, 382 ft.
Length of stop reduced to 22 m. p. h., 382 ft.
Duration of stop, 16.4 seconds.

Note that equalization with the new triples requires only 17 lbs. reduction, while old triples require 20. Test No. 3, when compared with No. 1, will show lengths of stop obtainable by the two different types of triples when the brake cylinder and auxiliary pressures are equalized.

Test No. 4.

Standard (old style), triples. Speed, 20 miles per hour. Reduction, 10 lbs.
Brake-pipe reduction, 10 lbs.
Speed in m. p. h., 22¼.
Length of stop, 774 ft. 6 in.
Length of stop reduced to 22 m. p. h., 757 ft. 3 in.
Duration of stop, 33.6 seconds.

Test No. 5.

Triples arranged, 25 standard (old style), 25 quick-service (improved), alternating in groups of 5. Speed, 20 miles per hour. Reduction, 10 lbs.
Brake-pipe reduction, 10 lbs.
Speed, in m. p. h., 22¾.
Length of stop, 538 ft. 0 in.
Length of stop reduced to speed of 22 m. p. h., 503 ft.
Duration of stop, 23.2 seconds.

Tests Nos. 4 and 5 will show, (1) that both triples work in harmony, (2) that shorter stops are obtained practically in proportion to the number of new triple valves introduced.

Test No. 6.

Twenty-five standard (old style) triples ahead, and 25 quick-service (improved) triples behind. Speed, 20 miles per hour. Reduction, 20 lbs.
Brake-pipe reduction, 20 lbs.
Speed in m. p. h., 21¾.
Length of stop, 569 ft. 5 in.
Length of stop reduced to speed of 22 m. p. h., 491 ft. 0 in.
Duration of stop, 20 seconds.
The maximum drawbar tension during this test was, 18,000 lbs.

This test probably represents worst possible combination of old and new triples, proving that the jerk due to the latter being in the rear is but slight.

Test No. 7.

Standard (old style) triples. Speed, 30 miles per hour. Reduction, 20 lbs. Brakes released at slow speed and full head of steam at once applied to keep train in motion.
Maximum drawbar pull due to release and use of steam was 169,000 lbs. This test resulted in breaking the knuckle on the rear of the nineteenth car.
Brake-pipe reduction, 20 lbs.
Speed in miles per hour, 30.9.
Release made at 12½ miles per hour.

Test No. 8.

Quick-service (improved) triples. Speed, 30 miles per hour. Reduction, 5 lbs. Brakes released at slow speed, as in Test No. 7.
Maximum drawbar pull due to release of the brakes and use of steam, 34,000 lbs.
No damage whatever resulted in the train.
Brake-pipe reduction, 5 lbs.
Speed, 31½ miles per hour.
Release made at 15 miles per hour.

The purpose of Tests Nos. 7 and 8 is to show that the releasing at slow speed, which causes so many break-in-twos with the standard apparatus, is practically rendered harmless with the improved type of triple valve. The retardation of train with a reduction of 5 lbs. is greater than obtained with a 20-lb. reduction using the standard valves. This is shown to be so by the Triple Valve Tests; see results of Tests 1 and 1a, also by accompanying curve.

With the improved triple valves, the action of valves in retarding the release will stall the train and prevent damage, even when

steam is used, if an attempt is made to release when the speed of the train is very low.

Test No. 9.

Standard (old style) triples. Speed, 30 miles per hour. Reduction, 10 lbs. Brakes released at slow speed and steam applied to keep train in motion.
Maximum drawbar pull, due to the release of the brakes and to the use of steam, 42,000 lbs.
Steam used 15 seconds after release.
Speed, 32 miles per hour.
Brake pipe reduction, 10 lbs.
Train was kept in motion by use of steam.
Brakes released at 15½ miles per hour.
Minimum speed, 6½ miles per hour.

Test No. 10.

Test No. 9 was repeated with quick-service (improved) triples.
The maximum drawbar pull, due to the release of the brakes and to the use of steam, 45,000 lbs.
Steam used 7 seconds after release.
Speed in miles per hour, 33.
Brake-pipe reduction, 10 lbs.
Brakes released at 16.1 miles per hour.
Minimum speed, 4 miles per hour.
Train kept in motion by use of steam.

The 20-lb. reduction with the old and the 5-lbs. with the new valves was made to see the comparative results that would be obtained with reductions that would give, as nearly as possible, the same comparative stop. The 10-lb. reduction shows the greatest reduction that could be made with the new valves, with this train, and at a speed of no faster than 33 miles per hour, followed by a release at a speed as low as 10 m.p.h. With a heavier reduction the train would have been brought to rest before it could have been possible to have accomplished a release.

Purpose of Tests Nos. 9 and 10 same as that of Nos. 7 and 8: To show effect produced by making a release and using steam at slow speed; also to demonstrate, with equal reductions, a much shorter stop than can be made with new valves.

Owing to greater retardation, release with improved valves must be at higher speeds than with old valves to keep train in motion. See Tests 9 and 10.

How to Define Cost.*

This committee has compiled a large amount of data, which in a large measure deals with the question of accounting. The committee is of the opinion that the Association should not attempt to establish or even outline an accounting system to cover the charges incidental to the expense of signaling, but submits the following data as a basis for making changes for the construction, operation and maintenance of interlocking plants:

Construction:

All materials required to make installation complete in every detail.
All labor.
Freight.
Train service.
Expense of making plans and specifications.
First equipment of all utensils and supplies.
Tower building.
Oil and supply building.
Power house.
All machinery and equipment necessary on account of use of power system.
Expense of building permits or other permits issued by public authorities.
Expense of inspection by State authorities.
Supervision.

Operation:

All wages paid levermen.
All wages paid lampmen.
All wages paid train directors.
All wages paid engineers or firemen.
Fuel.
Oil.
Waste and all other supplies used for the operation of plant.
Expense of power or light bought from outside concerns.
Expense of telephone service or other means of communication required for operation of plant.
Stationery used on plant.
Water service.
Fire alarm service or other protection against fire.
Freight on supplies.
10 per cent. on supplies to cover cost of handling.

Maintenance:

All labor used in keeping plant in a proper state of repair.
All material used to replace worn out or broken parts (not including materials or labor required to repair damage occasioned by derailments or kindred causes).
All tools needed by regular workmen employed on plant.
Fuel and light needed by maintenance force.
10 per cent. for maintenance labor to cover cost of supervision.

The committee has not made any allowance for interest on the investment, taxes, depreciation or other fixed charges, as each company, of necessity, will take care of these matters in accordance with the records of the accounting departments. The committee, however, is of the opinion that the depreciation is equivalent to 5 per cent. per annum. This is on the basis of first-class construction. Where less permanent standards are followed it frequently happens that the depreciation will amount to over 10 per cent. or 15 per cent. per annum.

During the past year a considerable amount of discussion has taken place in regard to what shall constitute proper charges at interlocking plants owned jointly by two or more railroads. A great many railroads have agreed to accept bills on the basis of 10 per cent., to be added to the cost of materials and maintenance labor, to cover the expense of supervision, this arrangement being effected by the General Managers' Association [of Chicago].

*Report of Committee No. 6, Charles Dunham, chairman, presented to the Railway Signal Association at its annual meeting at Niagara Falls, October 10-12.

A Study of American Locomotives.*

BY M. J. OUDET.

A mistake which is frequently made in endeavoring to explain the low price at which the American manufacturers build locomotives is to conclude that the engines are built by the hundred from designs which are absolutly invariable. Nothing could be farther from the truth. The largest order ever received by the Baldwin Locomotive Works for locomotives to be built from the same design did not cover more than 80 engines, and an examination of the catalogues of the Baldwin, Schenectady and Pittsburg locomotive works will show a very large variety of types. During the past ten years the American railroads have been continually increasing the power of their engines, and in point of view of dimensions a single railroad will have as many varieties as are to be found in France. A still greater distance separates the Americans from the uniformity of types and parts found on some of the English roads, such as the London & North-Western and the Lancashire & Yorkshire.

The American locomotive builders have, however, an advantage still greater than the adoption of invariable types and dimensions, and that is the uniformity of the general design of the locomotives and the simplicity of design of the various parts.

An American locomotive may have two pairs of driving wheels 78 in. in diameter with a four-wheel front truck, or it may be a consolidation with four pairs of driving wheels 56 in. in diameter and a two-wheel truck. However the arrangement may vary, the general design remains the same, and in all cases the cylinders are placed in the front and serve as a support for the boiler. They are also always of the same general design unless the engine is a four-cylinder compound or has piston valves. The number of frame crossties will vary, but the crossties are always of the same two types; ribbed cast-iron or steel plates in front of the cylinders and at the back of the engine, and bar-iron ties to maintain the proper spacing of the frames. The valve motion is always placed between the frames, and it, as well as the reverse lever, is always of the same type. The throttle is always of the balanced poppet type, and the steam pipes are always placed inside the smoke-box and connected to the cylinders in the same manner. The boilers may vary considerably in form, but the same uniformity of design is to be found in numerous details. In regard to the simplicity of design of the parts, there is no exaggeration in saying that the valve motion of any American machine costs only half as much as that of a Continental locomotive with outside cylinders. The cost of the running boards is one-quarter that of ours. The truck frame with its boxes and spring rigging can be built at a very much lower cost than the similar parts of our engines.

It would be easy to multiply examples, but the main fact is already clear The high power of their tools and the large amount of work done by the American machinist are important factors in the rapid and economical construction of the American locomotives, but a very considerable part is also played by the simplicity of design both of the locomotive as a whole and of its various details.

The American locomotive builders derive great benefit from this general uniformity of design. A few patterns of eccentrics and eccentric straps, of reverse shafts, of boxes, and three or four trucks of various sizes serve for the construction of a large number of locomotives which differ from each other in the number of wheels and in general dimensions.

In this connection I quote a single instance. During my visit to the Canadian Pacific shops at Montreal the engineer, Mr. Atkinson, called my attention to the fact that the drawings of a Vauclain compound which had been tested on July 4th had been commenced on May 1st. In the drafting room in these shops there are three designers. This extremely rapid construction and design could not have been equaled in France, where, on account of the designs and general arrangements which are used, it would be necessary to go over the entire design, from the cylinder pattern to the arrangement of the brake rigging and ash pan.

It is easy to see the reasons which have led the American builders to this uniformity of design and which have led away from it in Europe. In the first place stands the wide experience acquired by such works as Baldwins, Schenectady, Brooks, which are constantly in touch with their clients both in the production of new designs and in following up the service of the locomotives they build. In the hands of the managers of these establishments the locomotive undergoes a species of evolution, and becomes the product of a natural selection which only perpetuates those arrangements and designs which experience has shown to be best.

The American engineer is at the same time a merchant who is on the lookout for the article which sells best and who discards all useless complications and everything which does not pay. In

*Translated from the *Revue Mecanique*, February, 1902.

Europe, on the other hand, the locomotive has been developed by engineers who are often more occupied in developing their personal ideas than in looking around them to find those arrangements which have been shown by experience to be best and simplest.

The poor condition of much of the American track, particularly in the early days, led to the adoption of two arrangements: The truck to facilitate the passage of sharp curves, and the equalization of the springs to enable the engine to adapt itself to the inequalities of a badly ballasted track. The bar frame appears to have come originally from England and has been retained on account of the desirable simplicity attainable by its use.

The reasons which have led to the adoption of the simplicity so often referred to are equally easily recognized. In the first place the competition between the builders leads them to avoid any part which is complicated and therefore expensive. Then the proximity of the drawing room to the shop which forces the draftsman, who has himself often worked in the shops, to take into consideration the difficulty of constructing any piece and the part it is to play in the locomotive. Consequently the form of a part is chosen not merely so as to join conveniently two arcs of a circle, and the question of what shape a part is to have is not separated from the question of how it is to be made. Then the scarcity and inferiority of the hand work, especially of forge work, makes it necessary to avoid all complicated forgings and to use as far as possible rolled shapes.

Further, it must be acknowledged that the design of the American locomotive shows in many places a more just idea of the role which the parts have to play in the locomotive, both as regards the general design and as regards manufacture. For example, the purpose of the running board is to give easy access to the safety valves, whistle, and sand box, and to enable a man to get around the locomotive. The Americans take this view and build it as they would a platform in a shop. A series of brackets carry boards or a sheet iron plate. Although meant for the same purpose on the European locomotives, it often fails to fill it, for the designer places it where it will best please the eye. The running board is fused with the rest of the locomotive; it is supported on the guide yoke, is depressed at the front, and in the end is a very expensive construction.

The same thing holds for the cab. The American thinks of it as a shelter for the crew, and will put the same cab on a dozen different engines, while in Europe the cab design is swayed by the same considerations as hold for the running boards. On the European locomotive the fact that the parts are intended for a locomotive causes them all to be treated as regards design and finish as parts of a steam engine, while the parts of an American locomotive are treated appropriately to their service.

Terminal Improvements of the New York Central & Hudson River in New York.*

It has been said by an eminent engineer of the old school that no railroad should erect other than temporary structures, as permanency in design retards progress. This would seem to be wise economic counsel, but on the contrary the sound policy of modern railroad management causes to be spent each year enormous sums in rebuilding structures, which at their inception were the best that could be built, but have become inadequate. The population of a municipality increases gradually. Improvements must be made periodically, and it is only a question of time when they become "out of date."

In 1860 the New York & Harlem passenger station was located at the corner of Fourth avenue and Twenty-seventh street, on the present site of the Madison Square Garden. In 1871 the first train left the Grand Central Station, newly completed. In 1899 the Grand Central Station was rebuilt. Thus in the comparatively short period of 45 years three terminals have been built, and now again the facilities are "out of date."

For several years prior to 1903 serious consideration had been given to the adoption of electricity to replace the steam locomotive as a means of motive power through Park avenue tunnel, and in July, 1903, the Legislature passed an enactment authorizing the New York Central to enter into an agreement with the City of New York relative to the enlargement and depression of the Grand Central yard. The same act called for the completion of the change of motive power, south of the Harlem river through the Park avenue tunnel, in five years after the passage of the law.

After further careful consideration of the subject, the railroad company deemed it inadvisable to change from steam to electric operation just north of the Harlem river, about five miles from the Grand Central Station, as required by law, and for many reasons decided to extend the zone of electric operation to the limits of the immediate suburban territory. The terminals will be located at a point just south of Croton on the Hudson division, 34 miles from Grand Central Station, and at North White Plains on the Harlem division, 24 miles from Grand Central Station.

In considering the change of power from steam to electricity over this considerable territory of some 58 miles of main line, two classes of improvements were considered; those closely involved with the change of power and made necessary thereby, and those which might consistently be carried on at the same time for the convenience of the public and for increasing and improving the traffic facilities of the railroad, but which were in no way made necessary by the adoption of electric power. Many of the improvements proposed, in the way of eliminating grade crossings outside the limits of the city, depend on the concerted action of the state and municipal authorities for the carrying out of the work under the elimination law of 1897. With this support promised, however, the railroad company is prepared to carry out improvements throughout the entire zone of electrification which will amount to the practical rebuilding of the road within these limits.

Excavation of First Section of New Grand Central Yard.

The extent of these improvements, for which plans have already largely been perfected, are in outline briefly as follows:

1. The depression and enlargement of the main tracks and yard of the terminal proper from Forty-second street to Fifty-seventh street.
2. The erection of a new Grand Central Station on the site of the present structure.
3. The construction of the "Marble Hill cut-off" and the "Spuyten Duyvil rectification" near Kings Bridge.
4. The depression of the Port Morris branch with the elimination of all the grade crossings thereon.
5. The elimination of all grade crossings and making of special station improvements within the zone of electrification.
6. The four-tracking of the Hudson and Harlem divisions.
7. The electrification of all lines within the limits of the proposed improvements.

ENLARGEMENT AND DEPRESSION OF THE GRAND CENTRAL YARD.

The plans finally adopted as mutually advantageous to the City of New York and to the railroad company and its patrons.

*By G. R. Wadsworth, late with the New York Central.

Birdseye View of the Present Grand Central Yard.

Excavation in Park Avenue, Looking North.

and those on which the work is now progressing, were approved by the Board of Estimate and Apportionment of New York City in July, 1903. A revised set of plans, calling for some minor changes, but in the main similar to the original set, was submitted to the board in December, 1904, and have recently been approved.

All cross streets between Forty-fifth street and Fifty-sixth street inclusive will be restored. From Fiftieth street north the streets will cross the tracks substantially at the present grade of Park avenue, and south of Fiftieth street, grades not exceeding 4 per cent. will be employed. These cross streets will be intersected by Park avenue as it will be extended for its full width of 140 ft. from Forty-ninth street to Forty-fifth street. Thus about 4,500 ft. of city streets will be restored to normal public use, connecting the residential sections east and west of Park avenue, augmenting fire protection and giving a general appreciative tendency to all real estate in the neighborhood. The streets will be carried over the tracks on steel viaducts, with concrete steel floors, and asphalt street and sidewalk paving. The viaducts will be provided with heavily ornate railings and with electroliers at corners and at suitable intervals between.

The street bridging is of the deck type except where the requirements of column spacing forced the adoption of through girders or trusses, as in Park avenue between Fifty-sixth and Fifty-seventh streets, where the steel work will be cased in concrete of an ornamental design to harmonize closely in architectural features with the surrounding residences. Provision has been made to carry water and gas pipes and electric duct lines through the floors of the new viaducts. All of the streets will be restored between Madison and Lexington avenues from Forty-fifth to Fifty-sixth streets, the railroad company retaining for its use merely the sub-surface rights in the streets.

To carry out this plan of street restoration, which is an important feature of the improvement in benefits accruing directly to the city, necessitated the depression of the present main and yard tracks which south of Fiftieth street are practically on a grade with Lexington avenue. The track depression begins at Fifty-seventh street, at the foot of the grade from Park avenue tunnel to the present yard, and extends to Forty-second street, for the full width of the new yard, the present grade being lowered from 15 to 20 ft. Underneath this new main yard, in a further depression of about 21 ft. extending from Forty-third to Fifty-third streets, is located the new suburban station and yard. From Forty-third street the suburban yard will extend for the full width of about 300 ft. between Vanderbilt avenue and Depew place, north to Forty-ninth street, where the yard will begin to converge to meet the established width of Park avenue at Fiftieth street. This depression of the present track grades between Forty-second and Fifty-seventh streets forms a complete barrier to the natural drainage system of the section and consequent changes to the existing sewers, as well as new sewers to drain the depression were necessary. The existing sewers were intercepted in Madison avenue south of Fiftieth street and carried around through Forty-second street. North of Fiftieth street, sewers were intercepted in West Park avenue and led into the main trunk sewer in Fifty-fourth street which was depressed to meet the requirements of the new track grade. A new Second avenue to provide for draining the depressed yard. To drain the lower levels without the use of pumps a 6-ft. private sewer is to be built to empty into the East river. This will pass under all existing sub-surface structures now in the ground. Changes of a similar nature were necessary in gas and water pipes, temporary lines being put in service in many instances until the permanent lines could be laid in new locations, across the street bridges. Changes in sewers, water and gas pipes have already been largely completed. Pipe galleries will be provided in the walls of the depressions, for the disposition of the necessary pipe lines for railroad uses, and incorporated in the walls are also the ducts for the electric power transmission cables.

Bridging in Park Avenue at 56th Street.

The enlarged yard provides for the occupation of Park avenue for its full width of 140 ft. between building lines south of Fifty-sixth street to the northerly limits of the yard proper at Fiftieth street. The existing four main tracks through the tunnel will diverge from Fifty-seventh street to ten tracks at Fifty-sixth street, the six center tracks leading to the upper yard, and two tracks on either side beginning at Fifty-third street, descending at grades slightly in excess of 2 per cent. to the level of the suburban yard at Fiftieth street. Between Fiftieth and Fifty-seventh streets the street surface of Park avenue will be restored to conditions similar to those north of Fifty-seventh street, there being a driveway on either side with openings over the tracks between the driveways. South of Fiftieth street the plan of the new yard covers an area of about 13 city blocks between Madison and Lexington avenues north of Forty-second street, an increase of six blocks over present conditions.

One of the foremost requirements in the design of the new terminal was the adaptation of the yard for the complete handling of terminal traffic. Under existing conditions, on account of the limited space of the present yard, all through trains and periodically local trains have to be hauled north through the tunnel about five miles to Mott Haven yard, for turning, cleaning, restocking, minor repairs, etc. At Mott Haven cars have to be switched into the proper order for outbound trains and again brought through the tunnel to the Grand Central Station, thus making ten miles of light mileagle. Under new conditions all these operations will be done at the Grand Central yard.

Ample provision will be made for storing and cleaning all classes of equipment, each assigned to its own group of tracks, so

Excavation in Park Avenue, Looking South.

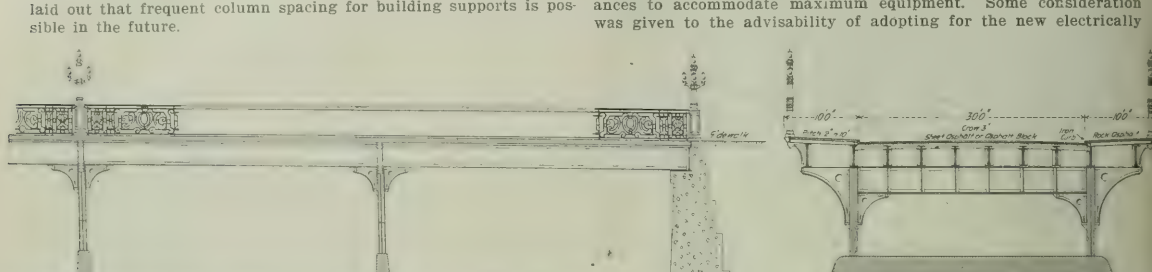
as to be readily available for the proper making up of trains in the classified order. Eighty-foot turntables are provided for the turning of private and observation cars, mail and express cars. Separate tracks are provided for the American and Adams Express Companies, as well as for the United States mail service, and special provisions in the way of elevators are made for the quick and easy transfer of express and mail matter from wagons or from cars of the New York City Railway Company to the express and mail platforms.

The yard will be equipped throughout with steam, air, Pintsch gas and water, with cocks at convenient intervals. Ample provision for the artificial lighting of the yard by electricity will be made, for although the greater part of the yard will be open, it is the plan of the railroad company to hold the air rights of the yard property abutting on the streets available for rental purposes for office or public buildings. To this end the yard tracks are so laid out that frequent column spacing for building supports is possible in the future.

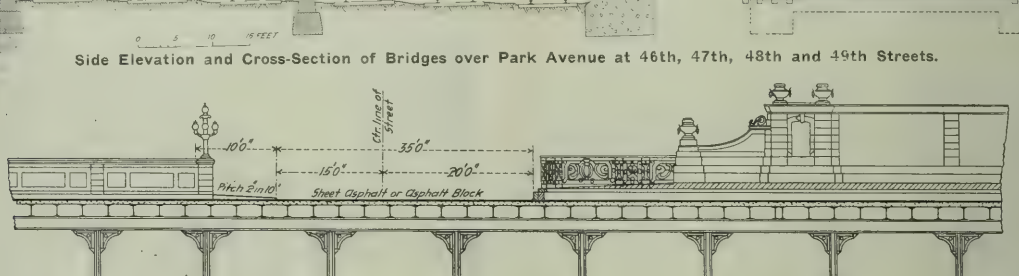
for loading and unloading. The through platform tracks are separated into two groups. Each group has a loop track at the south end, and under normal conditions, with right-hand operation, trains for the easterly pocket will pass round the loop before discharging, while trains for the westerly pocket will discharge and load before passing round the loop.

Double-end storage pockets are also provided on either side, north of the platforms, with clearances for maximum equipment, as well as a stub pocket between the running tracks extending north to Fifty-second street. As the ladder-tracks from the north end of the two side storage pockets cut the main running tracks leading from the upper level to the suburban yard near the foot of the incline, these pockets will be easily available for the storage of through equipments from the upper yard.

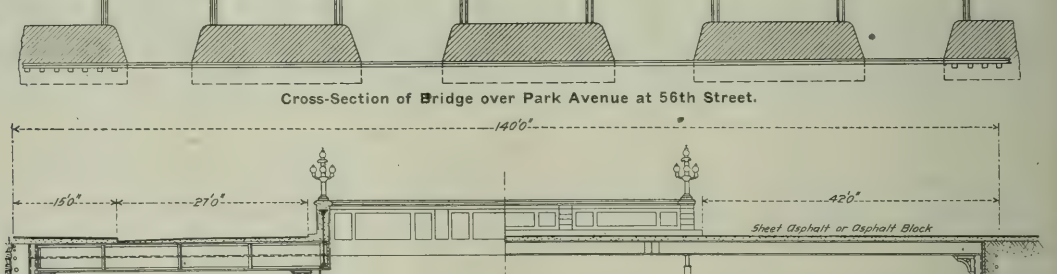
The suburban yard, except the double track loop, as well as the through yard is designed on standard New York Central clearances to accommodate maximum equipment. Some consideration was given to the advisability of adopting for the new electrically



Side Elevation and Cross-Section of Bridges over Park Avenue at 46th, 47th, 48th and 49th Streets.



Cross-Section of Bridge over Park Avenue at 56th Street.



Part Elevation and Longitudinal Section of Bridges over Park Avenue from 50th to 55th Streets.

All main track switches and signals will be operated by compressed air or electricity. The main track switches and controlling signals in the upper level or express train yard will be operated from one central tower. The suburban station will have its own tower for the complete control of all switches and signals on that level. Switches and signals will be interlocked with the towers, and the separate towers with each other so as to control a complete train movement.

The salient features of the design of the new terminal is the complete separation of the through and the suburban traffic. The suburban yard is complete in itself, with platform and storage tracks, switching leads, etc. The design of the suburban yard tracks, it is believed, will prove peculiarly efficient for the uninterrupted handling of trains on one minute headway, allowing two minutes

operated suburban equipment, a type of car similar to the new subway cars, with a view to the interchange of equipment at the Grand Central Station. The connection planned between the loop track in the suburban station and the subway tracks in Park avenue would permit trains from suburban points along the road to continue via the subway to points below Grand Central Station to the Battery and Brooklyn. This operating feature was considered inadvisable, however, on account of the rather different classes of service the two companies have to perform, the subway car not being as well adapted to the comfort of passengers for the longer trip of upwards of 30 miles to the suburban terminal, as the somewhat larger New York Central suburban car which is too large for subway clearances. This connection will, however, greatly facilitate the handling of express and mail matter from points in lower Man-

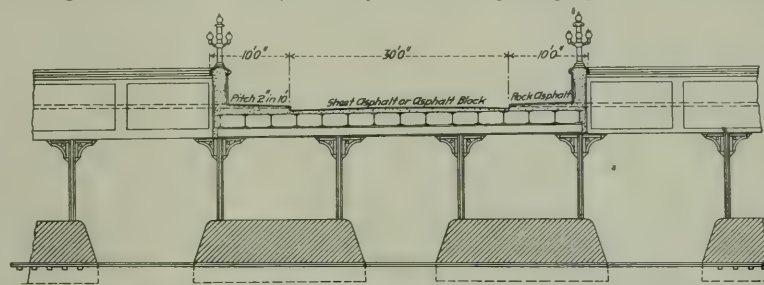
hattan via the Subway to the suburban station, whence it can quickly be transferred to through express trains, and vice versa.

The one feature of paramount importance in connection with the rebuilding of the Grand Central Terminal is the uninterrupted maintenance of the existing enormous traffic, which is increasing at the rate of between 5 and 10 per cent. annually. The work was laid out at its conception with this end in view, that the upwards of 1,000 regular daily train movements might be carried out on schedule, with safety and despatch.

The work is to be completed in sections, the first section to be completed and put in operation before the second is started. The first section now nearing completion includes parts of Park avenue and the six blocks on the west side of Lexington avenue between Forty-fourth and Fiftieth streets. Not the least important feature in connection with the work is the provision of temporary facilities for the convenience of passengers, and to meet operating requirements. Numerous changes of a temporary nature in the existing yard facilities were necessary at the beginning of the work.

It is the purpose of the company to utilize the lower floor of the Grand Central Palace for a waiting room to be used in connection with the operation of the first section. This floor is now given up to Station H of the New York post office. To provide temporary facilities for the post office, the company is erecting on the block between Madison and Vanderbilt avenues, Forty-third and Forty-fourth streets, a three-story temporary building, the lower floor of which will be used for post office requirements, and the upper floors for temporary offices of the company. This arrangement will prevail during the operation of the completed first section along Lexington avenue.

The north half of the new post office building, which is to occupy the two blocks between Lexington avenue and Depew place from Forty-third to Forty-fifth streets, will be built during the operation of section one, and upon completion of this half the post office will again be transferred from the temporary building on Madison avenue to its new home. The waiting room, up to this time on the lower floor of the Grand Central Palace, will then be moved to the temporary building on Madison avenue, to the lower floor formerly occupied by the post office, and the Palace will then be torn down and the remaining or south half of the new post office completed. The upper floors of the new post office building will then be temporarily available for all the offices of the railroad company, which will remove from the present Grand Central Station, leaving this structure vacant for removal and the beginning of the new station.



Cross-Sections of Bridges over Park Avenue at 50th, 51st, 52d, 53d, 54th and 55th Streets.

In connection with these temporary changes suitable passageways between the waiting room and the train platforms will be provided for the convenience of the passengers. Baggage and carriage facilities are also arranged, so that the business of a great railroad may be carried on uninterruptedly. The entire problem is one of particular nicety in engineering requirements, and is, in fact, the building of a terminal under a terminal.

The grading and masonry for the depression and enlargement of the main tracks and yard is being carried out by the O'Rourke Engineering & Construction Company, of New York City. The American Bridge Company, of New York, and the McClintic-Marshall Construction Company, of Pittsburg, are the contractors for the manufacture and delivery of the structural steel.

Use of Oil Fuel in Russia.

How serious for Russia is the interruption of the supply of petroleum from the Baku wells by the recent fires and riots may be judged from the fact that in 1902 (the last year reported) more than one-third of the fuel for all the locomotives of Russia came from these wells, and all that for the steamboats on the Caspian and the Volga, and a considerable part of that of the Russian steamers on the Black Sea. In 1902, out of a total of 14,326 locomotives in Russia, 5,181 used petroleum as fuel. Aside from the difficulty of obtaining all at once coal or wood enough to replace this oil, there is the further difficulty of using it in fireboxes fitted only for burning oil. And this difficulty comes just at the time when the moving of grain to market makes the greatest demand on all transportation facilities—greater than ever this year, because a large amount of last year's crop is still at the stations waiting to be forwarded. The relative value of petroleum and the different kinds of coal is calculated yearly. In 1902, 1 lb. of petroleum was reported to be equal to 1.44 lbs. of Welsh coal, and to 1.57 lbs. of the Donez coal most used in Russia. The other Russian coals are inferior. The coals used on the Siberian Railroad were especially so, 1 lb. of petroleum having the value of 1.95 lbs. of Ural coal, and of 4.17 lbs. of Ussuri coal, mined near Vladivostok.

Storage Batteries in Signal Work.*

The storage battery will stand more abuse and recover more rapidly than any other source of power; but the electrolyte must be kept at its proper density and free from impurities and short circuits. Most impurities come from the water. Iron, chloride, and other things, injure the plates. As the presence of these often escapes notice for a long time, the water should always be distilled and the electrolytes should be regularly analyzed.

For storage batteries at interlockings one of the most difficult things to determine is when the battery requires charging. A storage battery, when worked as required by an interlocking plant, can be discharged much lower than if the discharge was continuous, and for that reason it is not easy to tell when the battery is discharged to a safe point. The only sure way is to have an adjustable resistance so connected that the maintainer can discharge the battery at its normal rate for a period of five minutes and note when voltage drops to a pre-determined point. In order to have this limit high enough to allow for a slight variation I would limit the voltage to which the battery would be allowed to drop at the end of the five minute discharge to 100 volts; but in some cases this limit might have to be higher to insure the proper working of the plant.

One of the chief troubles is sulphating of the positive plates. Sulphating may be caused by allowing the battery to stand when over discharged, by electrolyte being too strong or too hot, or by short circuits between plates. I have been unable to learn the cost of a battery for interlockers because they have not been in service long enough to determine the average life; and there is but little information concerning storage batteries used for automatic signals.

On automatic installations there is a great difference in the duties of the different sets of cells, which, taken together, may be considered as forming one battery when being charged, and as divided into from 10 to 20 separate batteries when discharging. For instance, there may be batteries operating signals near yards which are on the same charging circuit with batteries which operate signals on the main line where no switching is done. It is evident that the battery in the first case may do many times as much work as the other batteries in the same charging circuit. There may be cases where four tracks run into two so arranged that the batteries supplying power for the four-track signals may have to be on the same charging circuit with those supplying power for the two track signals. In such a case, if the batteries on the two-track signals are being too heavily overcharged, either the batteries for the two-track signals must be cut out every other charge, or two sets of batteries be supplied for the four track signals.

Where a signal system is so laid out that there are both single and double locations the question arises will the batteries at the single location stand without injury twice as much charge as they are discharged.

These questions are yet to be fully answered for it requires a number of years to determine the life of a storage battery. On track circuits a constant current through the relay coils is desired and there can be no doubt that the storage battery with its almost constant voltage will give this current satisfactorily unless track conditions are exceptionally bad.

Railway Signal Association.

The ninth annual meeting of this association was held at Niagara Falls, N. Y., last week, beginning on Tuesday, President J. C. Mock in the chair. This association now has 532 members, 82 members having been admitted at this meeting, and 215 members were present, though not all of them remained throughout the six sessions. There were present 40 or 50 persons interested in signaling but not members of the association. Most of the sessions were well attended, making this the largest and one of the most important conventions ever held by the association. President Mock, in his opening address, spoke of the constantly increasing importance

*Abstract of a paper read by Edward L. Adams, Chief Signal Inspector of the Lake Shore & Michigan Southern, presented at the annual meeting of the Railway Signal Association, at Niagara Falls, Oct. 10-12.

of the association and of the vital problems in railroading connected with the signal engineer's work, which must be settled in the near future; and the settlement of which rests as a duty on this association.

The association voted to authorize the publication of a volume of about 500 pages containing the abridged proceedings of the association from its organization.

The first discussion was that on the report of Committee No. 6, which had been instructed to report on the classification of items for calculating the cost of construction, operation and maintenance. The substance of this report is printed in another column. The association voted to expunge the fifth item under the head of construction—expense of making plans and specifications—holding that this properly should be charged to the general expenses of the signal engineer's office. The last item under the head of construction—supervision—was changed to read "special supervision," the prevailing opinion being that most supervision should be a general expense. Under operation the fourth item was made to read "all wages paid engineers or firemen of power plants," and the next one was made to read "fuel and light." Under maintenance the last item was changed to read "10 per cent. to be added to the cost of labor for use of tools and supervision and handling; and 10 per cent. to cost of materials, for inspection and accounting." The following new item was added: Cost to the signal department of work done within interlocking limits in consequence of laying new rails and reballasting track.

In the discussion of this report it was stated that two large roads west of Chicago have agreed not to make charges to each other for damage to interlocking by derailments at crossings and junctions unless the amount is $100 or over, experience having shown that the cost of investigating and deciding who is at fault often turns out to be greater than the amount of damage.

Committee No. 2; Circuits for Manual Block Signals. The committee on this subject, of which Mr. C. H. Morrison (Erie) is Chairman, made a report which is in the nature of a supplement to one made last year. It consists mainly of a brief history of manual block signaling, references to descriptions of lock and block apparatus, and descriptions, consisting of one or two paragraphs each, of the telegraph block system, the staff system and the controlled manual. The committee closes with a brief statement of requisites of installation and adjuncts. Locks by which control of the signal may be had by the operator at each end of the block are set down as adjuncts to the telegraph block system; and the use of track circuits the full length of the block is classed as an adjunct to the controlled manual system. With the staff system a home signal, interlocked with the staff machine, is one of the requisites, and the adjuncts are: (1) Permissive attachments; (2) staff catcher for locomotive; (3) cranes for holding and receiving staff; (4) divided staffs; (5) pusher staff. Electric locks on all switches in main track that are not interlocked are classed as adjuncts to all manual controlled systems. The committee recommends that manual block signals be always controlled, the extent of this control to be arranged according to the conditions.

This recommendation, after some desultory discussion, was approved. Nothing less vague than this would have been accepted, as there was a strong sentiment that "control" does not mean much unless the signals have all the approved locking and safety devices, including a track circuit the whole length of the block section.

After this the meeting spent several hours in discussing the report of Committee No. 8—that on Standard specifications for mechanical interlocking. That part of the report under discussion consisted of paragraphs 60 to 130; but no useful result was accomplished. Many members expressed their individual views, but this developed marked differences on many points, and the assemblage was too large to properly handle such a matter. A number of paragraphs were referred back to the committee, so that the final revision of the report will vary in many paragraphs from that which was printed previous to the meeting.

This committee submitted a diagram (to be used in place of the table which was printed on page 70 of last year's Proceedings) for use in determining the differences in the lengths of rods, cranks and compensators to provide for differences in temperatures. This diagram is accompanied by a list of the districts into which the United States Weather Bureau has divided the country, and the "normal" temperature of each district is given. The diagram has four temperatures as bases; namely, 40 deg., 50 deg., 60 deg. and 70 deg. For example, at Duluth 40 is to be used as the base in making calculations; at Columbus, Ohio, 50; at Nashville, Tenn., 60, and at New Orleans 70.

On Wednesday morning the meeting took up the report of Committee No. 5, A. G. Shaver (U. P.), Chairman, that on Organization of the signal department. The main conclusions of this report are given in the next six paragraphs.

The Signal Engineer, or other Chief Signal Officer, everywhere has charge of signal construction; on 17 roads (replying to the committee's inquiry) he has charge of construction and maintenance; but on only six roads has he direct supervision over construction, maintenance and operation.

On 15 roads the signal department is apparently a departmental organization, at least in so far as construction and maintenance are concerned, while on the remaining 13 roads the organization is evidently purely divisional. Of late years the tendency on many roads has been toward a divisional rather than a departmental organization. Some roads, recognizing the importance of signaling, have retained the departmental organization for that branch of the service, although they have changed to the divisional organization in every other respect. Others have made the change to the divisional organization complete, giving the chief signal officer supervision over construction but either nominal or no powers over maintenance and operation.

As to the efficiency of the two organizations, it would be interesting to compare, if it were permissible, the signaling on two roads, one where the chief signal officer has entire supervision over construction, maintenance and operation and the other where he has charge of construction, but only nominal supervision over maintenance and operation. It would undoubtedly be found, if the signaling was as efficient with one as with the other, that it was costing considerably more on the latter road.

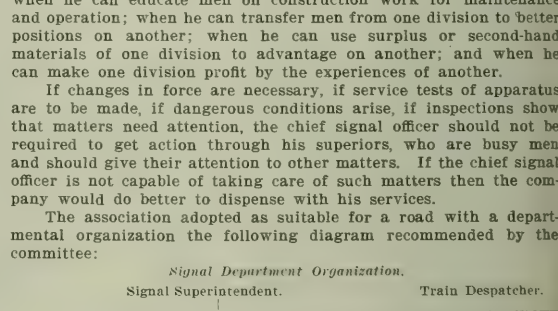
As railroad signaling is highly specialized and in a process of continual development, it is absolutely necessary that the signal officer keep closely in touch with it in all its phases in order that the construction, maintenance and operation be effective and efficient. The highest degree of efficiency can only be obtained when the chief signal officer has full charge, or authority approximating such, over all signal matters. He should come into actual contact with maintenance and operation in order to be thoroughly familiar with them and to act intelligently in construction matters.

Money is saved and good results obtained when the chief signal officer can use men from the maintenance force on construction; when he can educate men on construction work for maintenance and operation; when he can transfer men from one division to better positions on another; when he can use surplus or second-hand materials of one division to advantage on another; and when he can make one division profit by the experiences of another.

If changes in force are necessary, if service tests of apparatus are to be made, if dangerous conditions arise, if inspections show that matters need attention, the chief signal officer should not be required to get action through his superiors, who are busy men and should give their attention to other matters. If the chief signal officer is not capable of taking care of such matters then the company would do better to dispense with his services.

The association adopted as suitable for a road with a departmental organization the following diagram recommended by the committee:

Signal Department Organization.



For a divisional organization the association adopted a diagram* which was recommended by the committee for a small road after adding to it one line, from "signal supervisors" upward to the officer in charge of maintenance on the division, the intention being to have the supervisors report on construction and standards to the signal superintendent and to the division officer on maintenance and operation. These things having been decided, the report of the committee was adopted.†

In the discussion, a number of speakers strongly advocated

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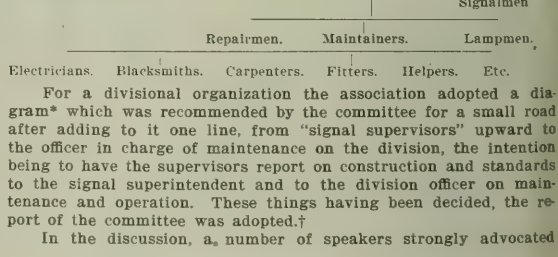
*Signal Department Organization.



†The meeting omitted to distinguish "signal engineer" from "signal superintendent," apparently by inadvertence.—Editor.

the departmental organization for signal work, and their exchanges of experiences showed that this opinion had largely arisen because of difficulty in getting division superintendents to adhere to correct signaling methods. Apparently a large number of division superintendents in the west still need much education in signaling. ("Why confine this statement to the west?" remarked a prominent eastern member.)

Committee No. 1, L. R. Clausen, Chairman, presented a report on "Circuits for Automatic Block Signals, for Steam and Electric roads." This report consisted chiefly of specifications and requisites of installation for track circuits, classified under the following heads: Relays, relay shelter; batteries; bonding and insulation; track insulation; battery shelter; insulated wire connections; track connections and trunking. The substance of this report will be given in a future issue. The report was subject to considerable criticism, for the committee had refrained from giving its own views, but had aimed merely to give on each point the view supported by the majority of the answers received in reply to a circular. About 100 circulars were sent out and 23 replies were received, of which four gave no information.

That part of the report relating to relays was recommitted because of the declaration of manufacturers that it was impracticable to make a satisfactory relay to close at .06 ampere and release at .04 ampere.

The discussion of this report disclosed that the disturbance of track circuits by foreign currents is still an important question in many places. At one point on a road west of Chicago, where there had been much trouble, the construction of a cable return by the trolley railroad had cured the trouble. The question was asked whether injunctions could not be secured from the courts to prevent interference, but it was said that the telephone companies which had sued electric light and power companies had uniformly lost their suits. The association finally ordered the appointment of a committee to investigate this question, and President Mock appointed as this committee the following members, the first five of whom are the ones who had made the report just discussed: L. R. Clausen, Chairman; E. A. Everett, C. H. Dryden, H. J. Hovey, C. A. Parker, C. C. Anthony, W. H. Elliott, Azel Ames, Jr., C. C. Rosenberg.

Committee No. 13, Azel Ames, Jr., Chairman, made a report on rubber covered wire, which will be found in another column. Mr. Everett Morss, President of the Simplex Electric Co., who said that he voiced the views of his own and three other companies, declared that it was impossible to make insulation to the specifications laid down in the report without using more than 30 per cent. of Para rubber. The other three companies referred to are the General Electric Co., the Standard Underground Cable Co., and J. A. Roebling's Sons.

Mr. Ames: But we are using wires made by the Standard Underground Cable Co., by the Hazard Mfg. Co., and the Okonite Co. that pass the tests.

The report was further discussed by Messrs. Morss, Langan, Eckert, Porter and Ham; the position of the manufacturers being, in brief, that to require 70 per cent. of dry inorganic mineral matter would make the product unnecessarily brittle and short-lived. But to allow the use of bituminous matter or wax for the purpose of making the insulation more durable makes it impossible to apply the chemical test to make sure of the presence of 30 per cent. of rubber. Mr. Morss suggested, therefore, that the only solution of the dilemma would be for the buyer to send his inspector to the factory and see the rubber weighed out and put into the compound. Being assured of a sufficiency of rubber, the buyer could then allow the maker to use his own judgment as to the composition of the other 70 per cent. Mr. Ames agreed that this would be satisfactory. The manufacturers declared that by insisting on rigid specifications the railroads could easily impose upon themselves a tax of 50 cents a pound for material not so good as could be furnished for 30 cents a pound were the maker allowed to exercise his own discretion. The report was accepted as a progress report and the meeting took up the report of the special committee on spetcacle castings, etc., as given in the Proceedings of the September meeting (page 37 of the pamphlet; page 272 of the *Railroad Gazette*). There was a proposition to approve the committee's conclusions down to the paragraph concerning the upward inclination of the semaphore arm, but the matter was finally laid on the table; and subsequently, when the meeting voted unanimously in favor of the upward inclination, it was the general feeling that action on the committee's work was unnecessary, if not inconsistent. This vote in favor of the upward inclination was taken after a very brief statement of its advantages by Mr. Rudd, and expressions of favor by one or two other members, but no discussion. The vote was simply on the question of the upward inclination, the further question of the number of indications (whether a two-position or a three-position signal) was not touched upon, and it was voted at this point to close the discussion.

The next subject was that of lamps, which was reported on by Committee No. 12, C. C. Rosenberg, Chairman. An abstract of this report is given in another column. Mr. Rosenberg explained that experiments with oil had not been fully carried out, for lack of time; and after a brief discussion the committee was instructed to make such investigations as might be necessary and then report specifications for oils for various uses; for a one-day lamp, a five-day lamp, etc. The discussion on oil brought out the fact that the Lake Shore and certain other roads use only one kind of illuminating oil; that required by the United States lighthouse standard. Samples were shown of a glass reflector made by the Corning Glass Works, for use in switch and signal lights, which is said to give 20 per cent. more light than a parabolic or a spherical reflector. The report was accepted.

After the conclusion of the discussion on lamps the papers of Mr. J. A. Peabody (published in the *Railroad Gazette* last week), and of Mr. E. L. Adams (published in this issue) were accepted without reading, and the authors thanked for them. Next came an elaborate paper by Dr. William Churchill, of the Corning Glass Works, on "The Roundel Problem." This paper, which was a long one, is deferred to a future issue. Dr. Churchill read to the association its salient features. This closed the Wednesday afternoon session.

The first speaker Wednesday evening was Dr. C. H. Williams, of Boston, whose experiments with signal lenses were reported in the *Railroad Gazette* last week, page 346. Dr. Williams showed his pocket photographic wedge and explained how it is used, three electric lights of widely differing intensity being fixed to the wall of the room for this purpose. The accuracy and refinement of the wedge readings was questioned, but Dr. Williams asserted that they were satisfactory for all practical purposes. In testing a signal light, or other small light, at a distance of half a mile, through the atmosphere, it is impossible to employ the precise methods of a laboratory test.

Following Dr. Williams, Dr. N. M. Black gave the results of some comparative tests which he had made of colored signal glasses of different makers.

Following the discussions of the evening, the association heard two propositions to amend the constitution, and voted to double the salary of the secretary, making it $300 a year. The first proposed amendment was offered in behalf of the associate members, most of whom are "supply men," providing that they be put on the same basis as honorary members; that is to say, to have all privileges except voting and holding office. The second proposition was to have two vice-presidents, one in the east and one in the west, so that meetings held in New York and Chicago would never lack a presiding officer. These propositions go over to the next meeting.

On Thursday morning little was done beside electing officers. The question of a membership badge, which had been decided on Tuesday by a small majority, was reconsidered, and it was decided to have a gold and enameled badge; but the design was not fully settled and the whole question was referred back to the executive committee. In accordance with action taken several months ago, each of the members present at this meeting wore on the lapel of his coat a numbered button. The Treasurer reported $1,159 in the treasury.

The election of officers for the ensuing year resulted as follows: President, C. H. Morrison (Erie Railroad, Jersey City, N. J.); Vice-President, J. A. Peabody (C. & N.-W., Chicago, Ill.); Secretary, H. S. Balliet (Grand Central Station, New York City); Fourth Member of Executive Committee, J. C. Mock (Electrical Engineer, Detroit River Tunnel Co., Detroit, Mich.). Mr. Mock is the retiring President and Mr. Morrison is promoted from the office of Vice-President. Washington, D. C., was selected as the place for the next annual meeting.

EXHIBITS.

Adams & Westlake Co., Chicago.—Switch and signal lamps; long burning founts.

Battery Supplies Co., Newark, N. J.—Gladstone-Laland batteries.

Bryant Zinc Co., Chicago.—Shoenmehl's primary battery.

Continuous Rail-Joint Company of America, Newark, N. J.—Rubber and fiber insulated joints.

Dayton Mfg. Co., Dayton, Ohio.—Silvey storage battery for car lighting and for signals.

Dressel Railway Lamp Works, New York City.—Switch and signal lamps; long-burning founts; 32-oz. oil cup of stamped metal.

Edes Mfg. Co., Plymouth, Mass.—Batteries, zincs and coppers.

Edison Mfg. Co., Orange, N. J.—Edison primary battery.

Electric Storage Battery Co., Philadelphia.—The "Chloride Accumulator."

Fairbanks, Morse & Co., Chicago.—Six h. p. gasolene engine and generator; velocipede hand car; gasolene velocipede car with double outrigger; No. 14 section-gang gasolene 7 h. p. motor car, to carry 10 men and draw a trailer; No. 15 inspection car, to carry 6 passengers.

General Storage Battery Co., New York City.—Bijur "High-Duty" storage batteries.

Gordon Battery Co., New York City.—Improved Gordon cells.

Gould Storage Battery Co., New York.—Storage batteries.

Hayes' Track Appliance Co., Geneva, N. Y.—Hayes' lifting derail and Hayes' pivot derail.

National Battery Co., Buffalo, N. Y.—"Unit" accumulators.

National Carbon Co., Cleveland, Ohio.—Wet and dry Columbia batteries.

Railroad Supply Co., Chicago, Ill.—The Chicago crossing signal.

United States Battery Co., New Rochelle, N. Y.—Storage batteries.

Weber Railway Joint Mfg. Co., New York.—Insulated joints.

Westinghouse Machine Co., East Pittsburg, Pa.—Storage batteries.

The Evolution of the Coal Car.

BY C. H. CARUTHERS, YEADON, PA.

"Coals" were first carried from the headings of the collieries of the English "North Countree," in wicker baskets known as "corves," upon the shoulders of men, and sometimes of women, to the foot of the shaft and thence up steep ladders to the pit's "eye." As the workings became more remote, and the shafts were deepened to reach lower seams of coal, hoisting machinery was introduced and the bail of the corf was formed into a U at its center to enable it to hang evenly upon the hook at the end of the hoisting rope.

Small trucks, or "Rollies," were also built upon which the corves were drawn or pushed to and fro, both in the pit and at the top, and these were soon made large enough to carry several corves at once. To enable the rollies to be handled easily upon the rough floor of the pit, planks were laid in parallel lines to form a roadway for the wheels. Some rollies for use at the top only were made in the form of a sled. After the coals arrived at the surface they were emptied into ordinary carts or wagons and hauled to the nearest point of consumption, or to the waterside for shipment to more distant places.

Owing to the wretched condition of the highways, it was soon found necessary to follow the practice adopted in the mines, of placing parallel lines of planks for the wheels of the wagons to travel on. Vertical planks were later placed at one side of each line to prevent the wheels slipping off into the frequent "chuck-holes"; and when iron coverings for the planks, and later still, rails entirely of iron, came into use, this feature of a flange formed upon one side of the rail was retained, for a time.

The experience of the passing years, and the desire to transport coals more rapidly, and in greater quantities at the same time, caused the building of a hopper-shaped type of wagon for this traffic alone, having a capacity of two and one-half tons. Experiments had proven the advantage of flanges cast upon the inner periphery of the wheels. This improvement being adopted upon the new type of wagon, caused the rapid disappearance of the flanges attached to the rails.

Thus far we have considered conditions prevailing at English collieries, the birthplace of the coal car, from 1630 to 1800. The success with which stationary steam engines had performed various duties about the pits during these later years induced the more progressive colliery owners and operatives to consider the construction of such an engine in locomotive form as a substitute for horses in drawing the wagons to and from the pits. These experiments have been described so often that it will suffice our purpose to say that among the engines constructed by Stephenson, Blenkinsop, Hedley and others, the "Puffing Billy" of Hedley, built in 1803, seems to have most fully met the early demands of the service, and thereafter locomotives of that type became numerous about the collieries, and continued at work for many years. An old book in the writer's library, which was published in 1839, shows two such engines in a view of a colliery. One is shown drawing a train of the wagons last described, and the other stands nearly off the rails—perhaps awaiting repairs, to which its long years of service doubtless richly entitled it. The speed of these engines would now be considered very slow, but the following extract from the work referred to will show how it was regarded in those days of long ago: "Sometimes a dozen or more wagons are dragged by one engine. A stranger is struck with surprise and astonishment on seeing a locomotive engine moving majestically along the road, at the rate of five miles an hour, drawing along from 10 to 14 loaded wagons; and his surprise is increased on witnessing the extraordinary facility with which the engine is managed. This invention is a noble triumph of science."

The improved service obtained by the use of the locomotive suggested possibilities in carrying other freight than coals, and even the idea that eventually passengers might be transported in this manner at a higher speed and in greater numbers than was being done by the stage coaches, was entertained by the more daring spirits; and again referring to the old publication named, we next find an engraving of a colliery in which a rude type of passenger carriage is shown attached to the end of a train of coal wagons, drawn in this instance by a rope from a distant stationary engine, a system of haulage followed in some localities at that time.

Although coal wagons were drawn in longer trains and at greater speed after the locomotives just described had superseded horses, the size and shape remained about as before until the successful results obtained from Stephenson's famous "Rocket" in 1829 increased the power and speed of the locomotive, and opened a new era in railroad practice. Within a few years thereafter a wagon of rectangular form and greater carrying capacity was designed, and this latter type remains practically the standard of all coal wagons used on the railroads of the United Kingdom to-day, having undergone but little change since its inception over 50 years ago.

Meanwhile the humble corf, the great ancestor of all coal wagons or cars, continued to be used in its subterraneous gloom, in its original form, at least until about 1840, as numerous other views of collieries shown in the work already referred to, reveal this very useful appliance in service in its original form; but between 1835 and 1840 its place began to be taken by rectangular boxes, of wood or iron, with the wheels rigidly attached thereto; but all to this day retain the ancient name of corf. During a visit to Pemberton colliery in Lancashire, England, a few years ago, the writer observed that the corves used at this queen of English pits were flangeless, and were guided by the men handling them after the manner followed with push-carts.

In America the earlier coal cars (we must follow American orthography and nomenclature now) were naturally a replica, at first, of those used in England, but after 1855 the eight-wheel type with its greater carrying capacity became the favorite and steadily increased in size until its development culminated in the monster steel car of 100,000 lbs. capacity, so generally used to-day. In American mines the coal has long been brought to the surface in mine cars having a capacity of about 2,600 lbs., or about five times that of the English corf.

Having traced the coal car from its origin in those misty days of long ago in lands beyond the sea, to its highest development in this western world; and having seen it ever in the forefront of aggressive suggestions in railroad practice, let us briefly consider a few of the successive types of its development as shown in the accompanying illustrations.

The corf is shown in Fig. 1. Its name is from the Low German and Dutch languages, and means a basket. In High German it is spelled korb. This word is originally derived from the Latin, corbis, which also means a basket. The plural, as has doubtless been noticed by the reader already, is corves.

Figures 2 and 3 present the rolly in the two forms previously described.

The wagon, as used until about the middle of the last century, is reproduced in Fig. 4, and Fig. 5 deals with its succeeding type, which is still so extensively used in Great Britain and on the Continent.

Fig. 6 now takes up the American features of the subject, and shows the mine car, or wagon, generally used in American mines, while Fig. 7 illustrates the type of coal car used in great numbers on American railroads from 1851 or 1852 until within the past 35 years; in fact, some were still in service in 1900. In this car, or "dumpy," as it was generally called, the bottom was of hopper form and the drop-doors were held shut by a simple device freer from trouble than some of the complicated schemes now used for the same purpose, and which seldom came open in transit, although the writer once witnessed an amusing exception. While returning from school he was enjoying the breeze which swept through the train on a hot afternoon, when suddenly a freight train passed on the westbound line, and at the same instant a dense white cloud poured into the coaches through the open doors and windows and set everyone sneezing like a parcel of hay-fever patients. The train was promptly stopped and we dismounted to investigate. In the distance could be seen the rapidly vanishing freight train and extending back to and beyond us, was a narrow white line. One of these dumpies used by a lime company was attached to the rear of the train and its drop doors had become unfastened and were spreading its snowy load down its path.

The springs of these cars consisted simply of two pieces of tough white oak wood separated by distance pieces and attached as shown, to the journal boxes and the side sills. A similar spring, set vertically, was also used at the bumper.

A few were built with pedestals and springs of india rubber or spiral steel, but most of those used in the bituminous coal fields of western Pennsylvania were of the type first described. The journal boxes were of a very simple design and consisted of a flat upper piece with an oil box at its front, and recessed on its under side to receive the top of the brass (and they *were* of brass in those days), and a semi-circular sponge cellar which was held in place by the same bolts which secured the entire box to the wooden springs. The brake was formed of a cross-shaft having double-cams on the ends, and a long lever at one end by which the cams were made to press against wooden brake-blocks suspended between the wheels. A few of these cars were made with side doors in the center panels to facilitate unloading at certain points, and some were also made without the hopper, using the side openings only. These were of two patterns; one with the small doors in the center panels as already mentioned, and the other having the entire side framing covered by two doors suspended from the top sill.

Between 1854 and 1860 the Philadelphia & Reading Railroad Company built large numbers of eight-wheel coal cars of the design shown in Fig. 8. This car contained several peculiarities. First, its line of draft was co-incident with the center line of the body framing. While this arrangement may have been satisfactory on the home road, it proved otherwise elsewhere when the practice of later years brought the cars into service on lines where the

general practice of placing the body framing above the line of draught caused these higher bodies to often over-ride the P. & R. car with disastrous results. The coupling was also effected by a large eyebolt at one end of the car which carried a three-link coupling chain and faced a hook of English type attached to one end of the next car, and the outer end of the chain was thrown upon this hook. It will be seen that such an arrangement necessitated keeping all such cars with the blind end of one car facing the hook of another, and caused no little "remark" on the part of trainmen when these cars passed on to other roads where the "Y" shaped approaches to sidings often turned a car end for end.

lot was sold and replaced partly by a somewhat similar car built on lines conforming to Pennsylvania Railroad standards, and equipped with drawheads and cast-iron dead blocks. The sills were also above the line of draught as at present, and the bodies were wider and shorter than the Reading car. The remainder of the new lot was filled with gondolas, as just at that time a demand for such cars seemed to have arisen in the coal trade. These gondolas were flat bottomed, but had small trap doors at the center.

Fig. 9 will recall to many persons a peculiar car which was used successfully for many years on the Baltimore & Ohio Railroad and on some of its connecting lines. It first came to the

Fig. 1—Corf.

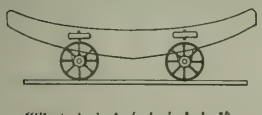


Fig. 3—Outside Rolly, Sometimes Used Without Wheels.

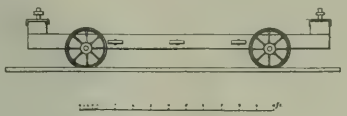


Fig. 2—Rolly. Carrying Four Corves.

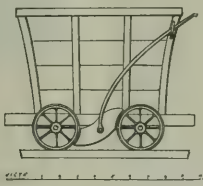


Fig. 4—Coal Wagon, 1840.

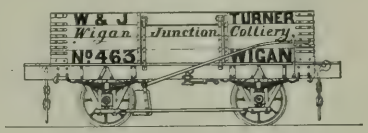


Fig. 5—English Coal Wagon, 1855-1905.

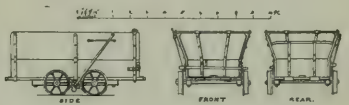


Fig. 6—American Mine Car or Wagon.

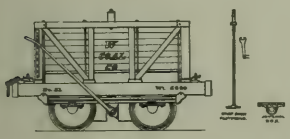


Fig. 7—Dumpy, 1853.

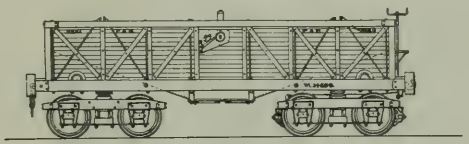


Fig. 8—Philadelphia & Reading R. R. After 1855.

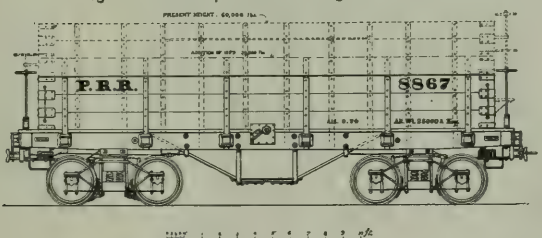


Fig. 10—Coal Car First Built by Pennsylvania R. R. Co. in 1874, Dotted Lines Show Later Additions to Increase Capacity.

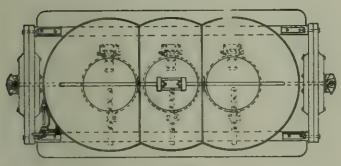


Fig. 9B.

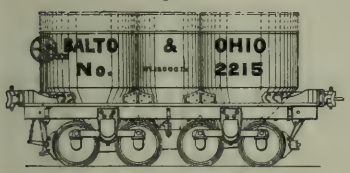


Fig. 9A—Baltimore & Ohio R. R., and Tributary Lines Iron Hopper Car, 1877.

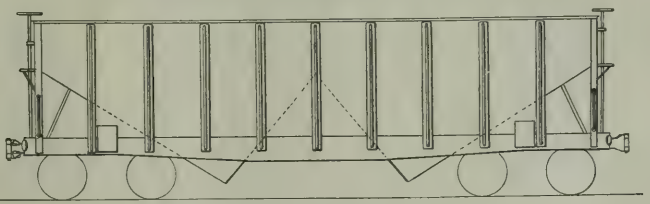


Fig. 11—Pressed Steel Car, 1898. 100,000 lbs. Capacity.

Each of the cars carried two numbers, as at the time of their construction and subsequent early service it appears that the Reading and a number of other railroads considered each four wheels a car. Through some error difficult to understand, two of the largest companies in the Western Pennsylvania Bituminous coal field placed an order in 1861 for 350 coal cars of almost exactly this pattern, and including all of the objectionable features except that draught hooks were placed at each end, and single numbers only, were used on each car. Yet these 350 cars were intended for use on the Pennsylvania Railroad and its allied lines where car construction differed so radically from that of the Reading, where these coal companies sent but few of their cars in those days. The error soon became apparent, and after about three years service the entire notice of the writer in 1877, at which time a number were brought to the Pennsylvania Railroad for the use of a coal company shipping coal to Baltimore. I do not know when the first of the type was built, but have seen a number yet in service on the Cumberland & Georges Creek R. R., at Cumberland, Md., in 1902. The courtesy of the General Manager of that road, Mr. Milholland, has enabled me to prepare a correct drawing of the car. The heavy lines show the dimensions of the '70s, and the dotted lines indicate the additions of later years. The car consisted of a sheet-iron body divided into three semi-cylindrical parts, each of which had a funnel-shaped bottom closed with a drop door. These compartments were carried on a simple type of frame, which it will be noted was below the line of draught, and was in turn carried on two trucks of very

few parts and set closely together. The drawbars were of a continuous type. During times of heavy grain traffic, these cars were often cleaned out and loaded with wheat, etc., the tops being covered with tarpaulins, and are said to have been quite satisfactory to the grain dealers. All cracks, bolt holes, etc., were carefully closed before loading the grain in bulk.

The type of car shown in Fig. 10 was designed at Altoona by the P. R. R. Co., in 1874; and great numbers were afterward built on these lines until the advent of the pressed steel car a few years ago. The dotted lines show the successive increases in size and capacity made by additions to portions of the body of the car. The trucks shown were also replaced in later years by a heavier type. Large numbers of these cars are in service on the principal American railroads, and doubtless many years will pass away ere they finally disappear from the lines.

The latest development of the coal car is that built of pressed steel and having a carrying capacity of 100,000 lbs. It has become so well-known during the past five years that a mere mention is all that is necessary here, and the sketch of it in Fig. 11 shows the principal parts only, and is merely given for purposes of comparison.

Concrete Curbing for Station Platforms on the C., M. & St. P.

Eight or ten years ago the Chicago, Milwaukee & St. Paul began to replace its wooden station platforms with brick. For a number of years wooden curbs were used for these brick platforms; but because of the temporary character and other unsatisfactory features of the wooden curbs, about four years ago it was decided to discard them for a permanent curbing material. The use of stone was begun, but the idea of applying concrete to this use occurred about the same time and was at once put into practice. The result has been entirely satisfactory, both as regards appearance, which was the primary consideration, and cost.

The concrete curbing is made in sections 3 ft. 6 in. long for depths up to 2 ft. Where the depth is greater than this the length is 3 ft. The drawings show two patterns, one 2 ft. deep and the other 3 ft. It will be noted that the outer edge at the top is neatly rounded and the ends are dovetailed into each other to preserve a good line when laid. The curbing is made of plain concrete, no reinforcing metal having been found necessary. The mixture is composed of 1 part of Portland cement, 2 of sand and 5 of crushed limestone broken not to exceed ½ in. cubes in size. Although a pretty rich mixture, it is not too rich for the exposed surfaces of the concrete, and it is considered cheaper to make the entire block of one mixture than to use two different mixtures.

The blocks are cast in wooden molds, of which there are a sufficient number to keep a crew constantly busy. They are made at two different points on the system and shipped where needed in whatever quantity desired. In shipping, the sections are packed in shavings or front-end cinders to prevent chipping or other injury. No trouble of this sort has been experienced.

A view of the station at Hartland, Wis., with double-track platforms, is shown herewith, which exhibits the good features of this curb, and especially the neat appearance it imparts to the platforms. The top of the curb on the track side is made level with the top of the rail. A 2-ft. deep curb is generally used in this location. For the outer sides a deeper curbing is often necessary. The view shows a reverse curve in the platform edge, involving both concave and convex curb sections. Squared corners are avoided by the use of such sections, which are made to two standard radii.

The first design used was about 1 in. thicker at both top and bottom than the present design. The thinner curb has been found to answer all requirements. The cost for the 2-ft. curb is between 12 and 13 cents a foot, exclusive of loading and setting. The first year of its use (1902) about five miles were laid. In 1903 this increased to eight miles, and 1904 was about the same. The present year, however, promises to exceed this.

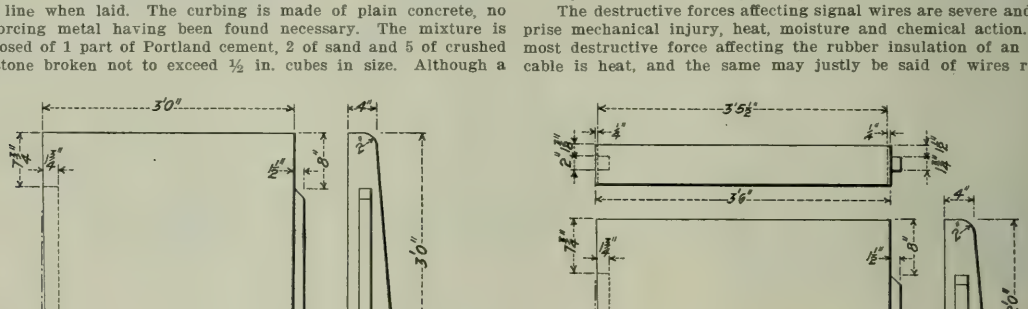
Station at Hartland, Wis., Showing Reverse Curve in Curbing.

We are indebted to Mr. C. F. Loweth, Engineer and Superintendent of Bridges and Buildings, for the illustrations and information.

Rubber-Covered Wire.*

Rubber-covered wire for railroad signal installation is generally used either as aerial cable or as single conductor or cable for ground use. Under the latter heading may be grouped all wires running in trunking or other conduit upon or under the ground or in the usual forms of shelters for batteries and relays. While most rubber covered signal wire carries a current of very low voltage, that used in electric interlocking plants or in the charging circuits of storage battery installations is subject to pressures of from 110 to 600 volts.

The destructive forces affecting signal wires are severe and comprise mechanical injury, heat, moisture and chemical action. The most destructive force affecting the rubber insulation of an aerial cable is heat, and the same may justly be said of wires run in trunking above the ground. Wires buried below the ground are as a rule either continually wet or alternately wet and dry, and in many localities the ground where they are run is saturated with oil, brine or acid. Frost, by the heaving of the ground and distortion of the conduit, is a potent factor in shortening the life of rubber covered wire in signal work.



Concrete Curb for Station Platforms—Chicago, Milwaukee & St. Paul.

It is both wasteful and unsafe to use any signal apparatus or material that is less than the best that skill can make or money buy. The signal engineer with a laudable ambition to do good work often finds that his purchasing agent has an equally laudable ambition to get the best prices. These are generally secured through competition which unless guided and restrained by proper specifications, for the materials purchased, results in obtaining an article whose only merit is its low first cost. These same conditions are met to an even greater degree on contract work, where in the absence of rigid specifications, signal companies are often tempted to supply cheaper grades of material to enable them to underbid their competitors. Some companies, in fact, have brought undeserved discredit upon their apparatus or systems by the use of rubber cov-

*Report of Committee No. 13, A. Ames, Jr., Chairman, to the Railway Signal Association, read at Niagara Falls meeting Oct. 10-12. Abridged.

ered wires, the insulation of which while of good quality, was so thin as to be quite unsuitable, especially upon 110 volt work.

Some manufacturers by the excellence and uniformity of their products acquire reputations which enable them to command prices which are considerably in excess of those that yield a reasonable profit, and in buying rubber covered wires and cables for signal work a number of roads have purchased almost entirely from some one manufacturer. Until recently but few concerns made high grade rubber covered wire for signal work, and a great deal of wire has been used in signal installations which was totally unfit for the purpose.

There is no manufactured product in the purchase of which the buyer puts himself so thoroughly in the hands of the manufacturer as in rubber covered wires and cables. The manufacturers have shrouded the subject in as much mystery as possible. There is no disposition to pry into trade secrets, but the purchaser of any article is entitled to know just exactly what he is paying for.

Omitting, at this time, all cables, the committee suggests that rubber covered wire be considered under the following heads:

1. The copper conductor . . { a. Suggested requirements. b. Physical tests. c. Conductivity tests. d. Tests of tinning.
2. The rubber insulation . . { e. Suggested requirements. f. Physical tests. g. Chemical tests. h. Electrical tests.
3. Taping and braiding . . . { i. Suggested requirements. j. Absorption tests.
4. Packing and shipping.

a. Conductors must be soft drawn, annealed copper wire, having a conductivity of not less than 98 per cent. of that of pure copper, . . . and provided with a heavy uniform coating of tin.

b. Each solid conductor must stand an elongation of 25 per cent. of its length in 10 in. before breaking. In torsion it must stand before breaking 30 twists in 6 in. It must be capable of being wrapped six times about its own diameter and unwound without showing signs of breakage after this process has been gone through twice. The tension and torsion tests will be made on separate pieces of wire.

c. The conductivity of the copper shall be determined by measuring the resistance of a length of the wire and comparing with Matthiessen's standard of copper resistance.

d. Samples of the wire shall be thoroughly cleaned with alcohol and immersed in hydrochloric acid of s. g. 1.088 for one minute. They shall then be rinsed in clear water and immersed in a sodium sulphide solution of s. g. 1.142 for 30 seconds and again washed. This operation must be gone through with four times before the wire becomes clearly blackened.

e. The vulcanized rubber compound must consist of not less than 30 per cent. of the best grade of fine Para gum mixed with sulphur and dry inorganic mineral matter only. The insulation must be tough, elastic, adhering strongly to the wire, homogeneous in character and must be placed concentrically about the conductor.

f. The rubber shall be so compounded and vulcanized that when test pieces taken from the wire (2 in. between jaws and ½ in. wide where possible) are subjected to a tensile stress, they shall show a breaking strain of not less than 800 lbs. per square inch and shall stretch to at least 3½ times their original length. The jaws to be separated at the rate of 3 in. per minute. A piece of the rubber insulation 4 in. in length must be stripped from the wire and marks placed thereon 2 in. apart. The piece must then be stretched until the marks are 5 in. apart, two minutes time being consumed in the elongation. Upon being released and allowed to contract, the original marks must not be more than 2½ in. apart. The rubber insulation must be subjected for one hour to a temperature of 260 deg. F., using dry heat, and at the expiration of that time must be tested for elasticity, elongation and permanent set and must conform to the specifications therefor.

g. The vulcanized rubber compound will be subjected to any chemical tests that may be necessary to insure that only a proper grade of fine Para gum is being used and that no other ingredients are used in addition thereto except sulphur and dry inorganic mineral matter.

h. This paragraph prescribes the cross-section in circular mills, the thickness of the rubber insulation, the minimum resistance in megohms per mile and the dielectric strength for the various sizes. For No. 9 B. & S. gage the area is 13,090; thickness, $^{5}/_{64}$ in.; minimum insulation resistanse 900, and test voltage, alternating current, 4,000.

The test for insulation must be made upon all wire without braiding, and after 48 hours immersion in water at a temperature of from 65 to 75 deg. F. Tests must be made with well insulated battery and galvanometer, with not less than 150 volts, and reading must be taken after one minute's electrification. The test voltage must be applied to the completed length of wire after the insulation test for a period of five minutes, using alternating current from a generator and transformer of ample capacity.

i. The rubber insulation must be protected with a layer of cotton tape thoroughly filled with a rubber insulating compound, and lapped one-half its width. The tape must not adhere to the rubber and must be so worked on as to insure a smooth surface. The outer braid must consist of one layer of closely woven cotton braiding $^{1}/_{32}$ in. thick, saturated with a black, insulating, waterproof compound which shall be neither injuriously affected by nor have injurious effect upon the braid at a temperature of 200 deg. F.

j. Six inch sample of wire with carefully paraffined ends shall be submerged in fresh water at 70 deg. F. for a period of 24 hours. The difference in weight of the sample before and after submersion must not be more than 10 per cent. of the weight of the sample before submersion less the weight of the copper and vulcanized rubber.

4. Packing and shipping. . . .

The manufacturer must provide at his factory all apparatus and other facilities needed for making the required tests, and give free access to the place of manufacture and opportunity to test at all necessary times. . . .

The committee expects to be challenged for its suggestion that a compound be used containing nothing but Para gum, sulphur and dry inorganic mineral matter, and it will doubtless be claimed by many that the life of the insulation will be increased by the admixture of a certain amount of bituminous matter, or mineral wax. The admission of any such substance renders the purchaser powerless to determine the most important fact of all, namely, whether he is getting 30 per cent. of a fine grade of Para gum in the compound.

Any grade of Para gum permissible in a high grade insulation will not contain more than 1.5 per cent. of resinous extract which may possibly increase on vulcanization to as high as 5 per cent. This much in a compound containing 30 per cent. of gum would yield .30 of 5 per cent. or 1.5 per cent. as the total percentage of resinous extract in the compound. Suggestion has been made that by limiting the total amount of extract obtainable by acetone and alchoholic potash to 5 per cent. of the compound that the proper grade of insulation would be insured. But the admission of 5 per cent. of extractive matter would permit the use of a lower grade rubber which might not have proper lasting qualities. The committee is inclined to seek a little further information on this point and have some tests made.

It is considered by some that the amount of free sulphur in the compound is highly important as affecting the copper and as permitting the process of vulcanization to continue under the action of any heat to which the finished wire may be subjected in use. The committee wishes to consider the value of this factor somewhat further before making a definite recommendation, and it may be that the dry heat test suggested may be of some service in determining the effect of free sulphur as well as in detecting readily the presence of partly combined resinous ingredients of low melting point when chemical facilities are not at hand.

It will naturally be asked "Why are so many tests necessary?" and the answer is that cheap and useless compounds can be made that will pass almost any one or two of the tests. For example, many substances could be introduced to give a high insulation resistance but which would deteriorate rapidly in service and the presence of which can easily be detected by the tensile strength of the insulation.

These and many other points lead naturally to the question as to how the purchaser at a distance from the wire mills is to be sure that his specifications are being lived up to. They must either be enforced or become a laughing stock. The answer is that where any quantity of wire is purchased the buyer should either send his inspector to the mills, arrange to use an inspector jointly with some other road or roads, or employ the service of some of the numerous inspection agencies or bureaus, who make a specialty of testing electrical material. Almost any signal engineer may, however, at slight expense get together simple apparatus for making most of the tests recommended except those for insulation resistance, and the puncture test. These latter require a more complicated and expensive equipment. . . .

Interurban Electric Railroads in California.

Interurban electric railroad development in California has lately been making big strides. San Francisco, Oakland, Los Angeles, Stockton, Sacramento, Napa, San Jose, San Bernardino, Santa Cruz, Bakersfield, Nevada City, Grass Valley, Marysville and Fresno are each the center of a system whose branches are being extended into the surrounding country. In many cases the electric lines are proving formidable competitors in interurban passenger traffic to the steam railroads. Indications are that they will shortly carry the competition into freight traffic also. Already the Los Angeles lines with their large passenger traffic have attempted to enter the field as freight carriers. They have been temporarily checked by a suit now pending in the courts which has been brought by the Southern Pacific Company to test the interurban

company's rights, under its franchise, to carry freight. A series of lines centering at Stockton is being developed expressly for the purpose of exploiting the rich fruit and vegetable producing lands along the fertile bottoms of the lower reaches of the Sacramento and San Joaquin rivers, for the transportation of their products and passengers to tidewater and to the markets of the San Francisco bay cities. These lines will be of very great value to the agriculturalists of this region as they will save the present long wagon haul to the river landings and railroad stations. It is not at all improbable that in time every interurban electric road in the state will become a freight carrier, for their franchises all contain a clause granting the right to carry freight. Applicants for electric railroad franchises in California have always demanded this privilege on the ground that it is essential to successful operation, because without it they would be unable to carry on their own tracks the necessary supplies for their repair shops and power houses and materials for keeping their wires and right-of-way in repair. As this right is granted in all the original electric line charters it is probable that the efforts of the steam railroad companies to restrict the electric lines, by law, to passenger traffic, will fail.

The success of electric railroads in California has been greatly stimulated by using water power from the high ranges back from the coast. The water courses on the western slopes of the Sierras have proved to be the cheapest sources of power obtainable. Great electric power plants have been built on the western flank of the range and are delivering electric energy at points as far as 225 miles distant from the point of generation, and this at a less cost to the consumer than power could be produced on the spot from fuel oil. As a result of this development the local power houses of all the interurban roads have been closed down or used for other purposes and current for the operation of the lines is drawn from the big electric power transmission lines. The Los Angeles interurban system, the largest in the state, gets its power from the Kern river plant, 110 miles distant; the Oakland system obtains its power from a plant on the South Yuba river, 140 miles away, and the San Jose system is supplied with power transmitted over 100 miles.

Wherever the interurban lines have come into direct competition for passenger traffic with the steam railroads they have come off victors. Last May, as a direct result of the competition of the Huntington-Hellman interurban lines, 25 regular passenger trains between Los Angeles and suburban points were withdrawn by the Southern Pacific after being operated at a loss for over 18 months. The points reached by this interurban line are Whittier, Santa Monica, San Pedro and Long Beach, the last three, popular watering places and ocean shipping points and all having a very large passenger traffic. Since their opening, the electric lines have had practically a monopoly of this traffic. At San Francisco a new ferry across the bay, known as the "Key Route," popularly suspected of being an auxiliary of the Atchison, Topeka & Santa Fe (although this has been repeatedly denied) has enabled the San Francisco & San Jose interurban line to deprive the Southern Pacific of the bulk of its North Oakland, Central Oakland, Berkeley and Piedmont passenger traffic, including a very large commutation travel. The popular belief in the interest of the Santa Fe is somewhat justified by the fact that the San Francisco & San Jose line connects and co-operates with the Santa Fe. The Southern Pacific's monopoly of passenger traffic is also disturbed or threatened by the Ocean Shore Electric Railroad, a double track line from San Francisco to Santa Cruz, as well as by a proposed extension of the San Jose & Los Gatos interurban line to Santa Cruz, a projected extension of the Huntington-Hellman system from Los Angeles to Oxnard, Hueneme and Ventura, and, later, possibly to Santa Barbara; a cross country extension of the Nevada City & Grass Valley electric line to Auburn, Lincoln and Marysville, and a line to be built west across the inner coast range in a direct line from the populous settlements in the fertile Walnut Creek and San Ramon valleys to Oakland. The promoters of several of these projected lines make no concealment of the fact that they intend to carry freight. The Ocean Shore Electric Railroad, which is incorporated with a capital of $5,000,000, has been surveyed and right of way secured along one of the most picturesque routes in the state, the whole being in close proximity to the sea and passing through Pescadero, Half Moon Bay and other good sized settlements which have hitherto had no railroad. It is intended to run trains between termini on a one hour schedule. The Southern Pacific trains on its south Pacific Coast branch take two and a half hours for this journey, and the time under the most favorable circumstances cannot be greatly shortened. Construction on the Ocean Shore line is now in progress.

In one respect, the electric lines have a great advantage over their rivals—they can build into districts which the steam lines are prevented from reaching by the topography of the country. For example, the Southern Pacific has thus far been unable to obtain a route with feasible grades into Lake County. These high grades are no serious obstacle to electric traction and an extension of the Napa Valley & Vallejo electric line is being built from Napa to Calistoga, the terminus of the Southern Pacific's Napa Valley Railroad, and thence to Lakeport, Lake County. An extension also of the Petaluma & Santa Rosa electric railroad is to be built to Napa and thence by a different route into Lake County.

An interesting development of co-operation between steam and electric lines is to be carried out in the building of the Western Pacific, the Gould line to the Pacific coast, on which construction, through the Feather River canyon, is about to be begun. Closely associated with this company are a number of electric lines which are to serve as feeders.

At the rate at which new electric railroads are now being projected and built, California will in a few years be well-served by interurban lines. It is not difficult to forecast their future. Although at present widely separated, it takes no expert to see that they are parts of a well considered railroad chain whose ultimate development includes the entire state from the Mexican to the Oregon boundary. Mr. Henry E. Huntington's association with many of them is so clearly defined that it is evidently his intention to develop out of these local parts a continuous network of electric lines paralleling every steam railroad in the state and entering many districts which the steam lines do not reach, with the possibility of a through electric line from one end of the state to the other.

Signal Lamps and Long Time Burners.*

To test the efficiency of lamps, burners, reflectors and oils, experiments were made with lamps furnished by Adams & Westlake, the Dressel Railway Lamp Works, and the Armspear Manufacturing Company. The representatives of these firms assisted in making the tests. Signal and switch lamps are now of much better quality than they were a few years ago. Solder, which got loose, has been abandoned, and lamps are riveted. Steel is used instead of tin plates, and the openings for ventilation have been rearranged so as to guard against extinguishment by wind on the one hand and by lack of ventilation on the other. By the use of a perforated cylinder and a cone the accumulation of moisture is more or less completely prevented. The question whether the standard makes of lamps would work well with the long time burners has been settled in the affirmative.

Experiments were made to test the ventilation of lamps. Placing the lamps against a wall, air was blown against them from a one-inch hose eight feet away, with a pressure of 30 to 80 lbs. The nozzle of the hose was gradually carried nearer to the lamp until the light was extinguished, but some of the lamps ventilated at the top could not be blown out.

To determine the efficiency of the long-time burner as a signal light, using different colors, tests were made in the evening of November 29 on the Lehigh Valley Railroad, 20 miles east of Buffalo. The longest possible range was 2.08 miles and at this distance all of the tests with red glasses showed the light to be very good. The greens were good at that distance, but the yellows could not be seen more than 1.05 miles. Lenses of two sizes were used, 4½ in. and 5⅜ in., with no appreciable difference. Further tests of the lights with red glasses were made the next night at a distance of 3.31 miles, at which the light was clearly defined. On a tangent 2 1-3 miles long, near Sayre, some tests were made with standard semaphore lamps in a heavy rainstorm to show the benefit or otherwise of reflectors. The lights were clearly defined in all cases, but were better when the reflectors were used.

In June and July last various burners were subjected to photometric tests, with and without lenses and reflectors. All the flames were adjusted to a height of ⅞ in. A one-day burner, flat wick, with a naked flame, gave 1.48 candle-power. Long-time burners, without reflectors, all burners removed from lamps, chimneys retained in place, gave from 0.28 to 0.35 c. p. Long-time burners with one-way reflectors gave, with spherical reflectors, from 0.41 to 0.43 c. p.; with parabolic reflectors, 0.83 c. p. In standard semaphore lamps, with 4½ in. and 5 in. lenses, of 3 in. and 3½ in. focus and one-way reflectors, long-time burners gave from 29 to 35 c. p. With four-way reflectors the efficiency of the light was much less. A number of comparisons between one-day and long-time burners showed the long-time burners to give 40 to 45 c. p., while the one-day burners gave from 52 to 70 c. p. In some duration tests, one long-time burner burnt 5 days 23 hours, giving, with parabolic reflecor, 33 c. p. at the start and 28 c. p. 4 days and 20 hours afterward. Another giving 21 c. p. at the start gave 17 c. p. 4 days and 10 hours afterward.

A glass reflector furnished by Adams & Westlake was found superior to any other kind of reflector tested.

The committee made some tests of oil, but did not finish its experiments. With nine lamps equipped with long-time burners the time required to consume 16 oz. of oil was from 112 to 180 hours. The saving which can be made by using long-time burners

*Abstract of the report of Committee No. 12, C. C. Rosenberg, Chairman, made to the Railway Signal Association, at its annual meeting at Niagara Falls, Oct. 10-12.

is shown by the following report from a division having 171 miles double and 158 miles of single track. The figures are taken from records of the last 12 months that the one-day lamps were in service and compared with the last fiscal year, long-time burners being in use.

		Material.				
Kind.	No. lamps.	Oil, gals.	Wicks, gross.	Waste, lbs.	Burners.	Chimneys.
One-day burner.....	803	17,690	36	1,789	411	...
Long-time burner.....	817	8,141	11	581	98	438

	Comparative Cost.		
	Material.	Labor.	Total.
One-day burner.....	$1,991.11	$14,534.96	$16,526.07
Long-time burner.....	900.28	7,072.30	7,972.58
Saved by long-time burner.	$1,090.83	$7,462.66	$8,553.49

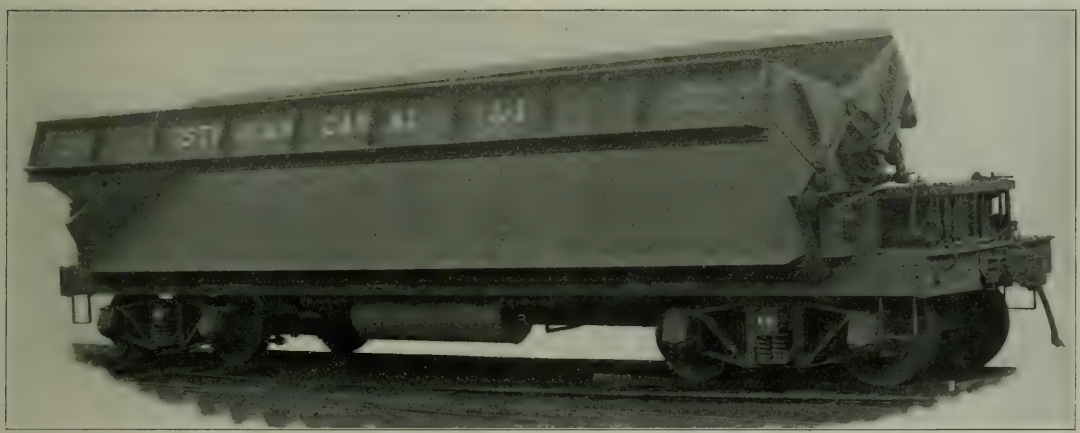
Average cost per year—one-day burner, $20.58; long-time burner, $9.76.

The committee presents a brief code of rules for the care of lamps. One of the requirements is that the lamp man shall cover his district at least twice a week, and one recommendation is that soft paper be used, rather than cotton waste or cloth, for cleaning lenses and reflectors.

The committee concludes that lamps should be made of steel and that the top draft is decidedly preferable because with it no moisture gathers on the inside of the lamp. In recommending the long-time burner the committee says that in all of the tests made the lenses were completely filled by the light from a 7/8-in. flame. In practice, however, the flame may be made higher, perhaps 1¼ in. All of the lights gave good red and green signals at two miles, and good yellow signals at one mile. The long-time burner will give efficient service for four days; and this is especially true if the glass reflector is used. The men to take care of lamps should be selected with care, and educated to study the lamps in their charge so as to be able to anticipate trouble.

Dump Car for the Panama Canal.

The accompanying illustration from a photograph shows a sample dump car of the King-Lawson type which has been built by the Middletown Car Works, Middletown, Pa., for the Isthmian Canal Commission, and will be shipped to Panama. The car will be thoroughly tested for its adaptability to work on the Panama Canal. It has a capacity of 80,000 lbs., is built entirely of steel and will dump on either side of the track. The light weight is 53,000 lbs. Ten of these cars are now in service on the Lackawanna handling all sorts of material. They have been tested with rock, sand, clay, earth, pig iron, iron ore and ingots, and so far have not developed any failures. One of these cars, the first which was built, has a capacity of only 50,000 lbs., but the other nine are all of 80,000 lbs. capacity. The body is dumped by two inclined air cylinders placed under the floor on each side of the center sills.



King-Lawson Dump Car for the Panama Canal.

The Railroad from the Red Sea to the Atbara.

About a year ago work was begun on a railroad in upper Egypt from the Red Sea to the Nile. Little has been said about it, but it is now reported that about 180 miles of track have been laid, leaving about 130 to complete the road, whose Red Sea terminus is not at Suakim, which has always been the port from which caravans have crossed to Khartum, but at a point 30 miles further north, where a better harbor is being built. This has been called Barud, but will be named Port Soudan. Thence the road pursues a southwesterly direction to the point where the Atbara falls into the Nile. Work was begun at both ends at once. There is very heavy work on the road, and many bridges, for though there is little rain, when it comes it comes in torrents. The railroad may be said to be a competitor of many of ours, for a chief reason assigned for building it is to encourage cotton-growing in the Soudan, by giving a cheap outlet to the sea.

Crop Export Movement.

In the movement of the surplus crops of the United States for export there are features of much concern to competitive ports, to the railroads, to steamship companies, and to the producers and handlers. An examination of the various problems involved is contained in a bulletin recently issued by the Department of Agriculture, by Frank Andrews, transportation expert, entitled "Crop Export Movement and Port Facilities."

The proportion of cotton, wheat, flour, and corn exported from Atlantic ports decreased during the 21 fiscal years ending in 1904, while the percentages exported from Gulf ports increased. The Gulf exported 44 per cent. of the total cotton exports of the United States during 1884-1888 and 60 per cent. in 1905, while the Atlantic seaboard exported 55 per cent. in 1884-1888 and only 34 per cent. in 1905. In the wheat trade the Atlantic ports share declined from 59 per cent. during 1884-1888 to 20 per cent in 1904, and the Gulf ports increased their exports from 2 per cent. to 55 per cent. during the same time. The Gulf exported 12 per cent. of the wheat-flour exports in 1904, a large relative increase over previous years.

No comparison is made with the first part of 1905 because on account of railroad rate wars and the small wheat crop it was an abnormal year. The percentage of the corn export trade handled by the Atlantic ports and by the Gulf ports changed but little during the period 1884-1904, but in 1905 the Gulf ports gained materially. The abnormal conditions in the export grain trade during the fiscal year 1905 were marked by a drop in the percentage of wheat exported from the Gulf ports from 55 per cent. in 1904 to 1 per cent. in 1905, and by the rise in the exports of corn from those ports from 16 per cent. to 29 per cent. during the same time.

During the 21 years ending with 1905, the Atlantic and Gulf ports together handled from 94 to 99 per cent. of the exports of cotton and from 87 to 91 per cent. of the corn exported; but, in the wheat and flour trade, a considerable amount was exported from the Pacific coast. In 1905 only 6 per cent. of the wheat exported went from Atlantic and Gulf seaports, while the Pacific coast cities handled 92 per cent. Of the wheat flour exported in 1905 the Atlantic and Gulf ports shipped 60 per cent., the Pacific ports 35 per cent., and 5 per cent. was exported across the border into Canada and Mexico.

The two groups of Atlantic and Gulf ports are compared in the following statement of the percentages of the national exports passing through them:

Years ending June 30—	Cotton		Wheat.		Wh't flour.		Corn	
	Atlantic.	Gulf.	Atlantic.	Gulf.	Atlantic.	Gulf.	Atlantic.	Gulf.
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
1884-1888.....	55	44	59	2	81	1	74	15
1889-1893.....	52	47	53	9	81	1	74	13
1894-1898.....	44	54	53	16	79	3	71	19
1899-1903.....	37	60	47	22	74	6	75	16
1904.....	33	65	20	55	63	12	74	16
1905.....	34	60	5	1	53	7	59	29

In 1904 nearly one-fourth of the cotton crop of the United States was produced in Texas, and more than one-half in Texas, Mississippi

and Georgia. Much of the cotton raised in Mississippi reaches New Orleans and Memphis, and some goes to Mobile and Savannah. The leading primary market for Georgia cotton is Savannah, while Galveston receives, in addition to a large share of the Texas crop, considerable quantities from the Indian Territory and Oklahoma. More than 5,000,000 bales were shipped to Galveston, New Orleans, and Savannah during the crop year ending August 31, 1904, and these three cities exported during the corresponding fiscal year nearly three-fourths of the total exports of cotton from the United States.

Most of the surplus wheat of the United States is produced in the country lying west of the Mississippi river, north of Oklahoma, and east of the Rocky Mountains. Owing to the great quantity of flour manufactured in Minneapolis, the receipts of wheat at that city are larger than those of any other in the United States. In 1904 they amounted to 87,000,000 bushels. In the same year the receipts of wheat at Kansas City were 39,000,000 bushels; at Duluth, 27,000,000; at Buffalo, 26,000,000; and at Chicago, 24,000,000.

The greater part of the corn crop of the United States is produced in the Mississippi Valley south of the lower limits of the Great Lakes and the southern boundaries of Minnesota and South Dakota, and north of the Ohio river and the northern boundaries of Arkansas and Oklahoma. The production of this region, together with the crop of Texas, amounted in 1904 to 1,574,000,000 bushels. In 1902, 1903, and 1904 Illinois was the leading state in the production of corn, Iowa second.

Corn appears in the export trade of the United States in the form of grain and also as an element of value in live stock and animal products. The practice of farmers in sending their corn to market "on the hoof" explains the great difference between the quantity of corn harvested and the quantity received in the form of grain at the various inland trade centers. The leading primary market for corn is Chicago, and during the six years ending with 1904 an average of 101,000,000 bushels of corn per annum was received there. This was more than the combined receipts at Buffalo, St. Louis, Peoria, Kansas City and Cincinnati. The total receipts of corn at all these six trade centers, although amounting to nearly 200,000,000 bushels, equaled only 8 per cent. of the corn crop of the United States.

The cost of exporting a 500-lb. bale of cotton from the interior of Texas to Liverpool, via Galveston, is estimated at $6, including freight charges, insurance, office expenses, and minor charges. The cost of exporting a bale from the interior of Alabama via Mobile to Liverpool, was estimated in 1897 to be $7.89, and in 1840 to be $18.15. It is also estimated that the charges for shipping a bushel of wheat by rail from Buffalo to New York amount to about 6.12 cents, allowing 5 cents for freight, 0.625 cent for weighing, 0.15 cent for elevator charges, 0.15 cent for trimming, and 0.22 cent for insurance.

Although New York's relative importance as a port from which agricultural products are exported is diminishing, it is, nevertheless, the third port of the world in the value of all exports and imports, being surpassed only by London and Liverpool. During the fiscal year 1904, 61 per cent. of the imports and 34 per cent. of the domestic exports of the United States passed through New York, and the total value of all classes of its foreign trade exceeded $1,160,000,000.

Certain characteristics of foreign trade in farm products pertain to each prominent American and Gulf port. About one-half of the wheat and cattle exported from Canada via the United States passes through Portland, Me. During the fiscal year 1905, 18,514 Canadian cattle and 2,531,449 bushels of Canadian wheat were exported through this port. Boston's exports consist chiefly of grain, flour, cotton, cattle, and meat, and include nearly two-fifths of the exported fresh beef. In 1904 Philadelphia exported $9,000,000 worth of meat and meat products, $8,000,000 worth of flour, $4,000,000 worth of cattle, and $4,000,000 worth of corn. Baltimore's exports of flour in 1904 amounted to $12,000,000; of lard, $8,000,000; tobacco, $8,000,000; corn, $6,000,000; cattle, $6,000,000; and cotton, $5,000,000. The leading farm products exported from Newport News that year were flour, $4,000,000; cattle, $3,000,000; and corn, lard, tobacco, and cotton, about $1,000,000 each. Norfolk's leading exports were lard, flour, tobacco and cattle. Cotton made up $18,780,288 out of $19,085,221 for all exports at Wilmington, N. C., in 1904. The cotton exports from Charleston, S. C., that year were valued at $2,300,172, and all other exports at $30,503. At Savannah and Pensacola, also, cotton is the chief product exported. Between Hampton Roads and New Orleans, no other city exports so great a variety of articles as Mobile, yet about one-half the value of exports in 1904 was in cotton and one-eighth in grain and flour. New Orleans and Galveston are the leading cotton ports and are coming to be among the first in the export of grain.

A Berlin station official proposing a substitute for the present method of shipping passenger's baggage in Germany, enumerates as follows, the clerical work now required, after the baggage has been weighed and labeled: "The clerk fills in on the baggage receipt the date, the number of the train, the number of pieces of baggage, the number of tickets presented with the baggage, the destination, the route, the total weight, the excess weight, and the amount paid."

The National Machine Tool Builders' Association.

The fourth annual convention of the National Machine Tool Builders' Association, was held at the Hoffman House, New York City, October 16 and 17. This association consists of 45 members, as follows:

The Hendey Machine Co.	Torrington,	Conn.
B. F. Barnes Co.	Rockford,	Ill.
Detrick & Harvey Machine Co.	Baltimore,	Md.
Baush Machine Tool Co.	Springfield,	Mass.
P. Blaisdell & Co.	Worcester,	Mass.
Draper Machine Tool Co.	"	"
Prentice Bros. Co.	"	"
F. E. Reed Co.	"	"
Whitcomb Manufacturing Co.	"	"
Woodward & Powell Planer Co.	"	"
Norton Emery Wheel Co.	"	"
Stockbridge Machine Co.	"	"
C. E. Sutton Co.	Toledo,	Ohio
Flather & Co., Inc.	Nashua,	N. H.
Mark Flather Planer Co.	Nashua,	N. H.
Binsse Machine Co.	Newark,	N. J.
Gould & Eberhardt.	Newark,	N. J.
W. F. Davis Mach. Co.	Rochester,	N. Y.
W. A. Wilson Machine Co.	Rochester,	N. Y.
The American Tool Works Co.	Cincinnati,	Ohio
Bradford Machine Tool Co.	"	"
Bickford Drill & Tool Co.	"	"
Cincinnati Milling Machine Co.	"	"
Cincinnati Planer Co.	"	"
Cincinnati Shaper Co.	"	"
Dietz Machine Tool Co.	"	"
Fosdick Machine Tool Co.	"	"
Greaves, Klusman & Co.	"	"
Lodge & Shipley Machine Tool Co.	"	"
R. K. Leblond Machine Tool Co.	"	"
The King Machine Tool Co.	"	"
The Queen City Machine Tool Co.	"	"
Rahn, Mayer Carpenter Co.	"	"
Schumacher & Boye	"	"
John Steptoe Shaper Co.	"	"
Hamilton Machine Tool Co.	Hamilton,	Ohio
Springfield Machine Tool Co.	Springfield,	"
Owen Machine Tool Co.	"	"
Fairbanks Co.	"	"
Jones & Lamson Machine Co.	Springfield,	Vt.
The Ridgway Machine Tool Co.	Ridgway,	Pa.
G. W. Fifield	Lowell,	Mass.
Windsor Machine Co.	Windsor,	Vt.
Builders' Iron Foundry	Providence,	R. I.
Bullard Machine Tool Co.	Bridgeport,	Conn.

The opening session was devoted to the reading of the minutes of the last meeting, reports of standing committees, and a discussion of general trade conditions. Immediately after the morning session the members of the association and a number of invited guests were tendered an excellent luncheon by the *American Machinist*. The afternoon session was devoted to unfinished business and to the report of the committees on motor drive and on the apprenticeship system. An address was also given by Charles A. Moore on the Conditions and Possibilities of Trade for American Machine Tools Abroad. No definite conclusions were arrived at in regard to motor drive, the report on this subject being referred back to the committee. The Tuesday morning session (October 17) was devoted to unfinished business and to an address by Fred J. Miller on Government Manufacturing. After the election of officers and the selection of the next place of meeting, the convention adjourned. The following officers were elected for the coming year: President, E. M. Woodward; First Vice-President, William Lodge; Second Vice-President, William P. Davis; Secretary, P. E. Montanus; Treasurer, F. E. Reed. The next meeting of the association will be held at Atlantic City.

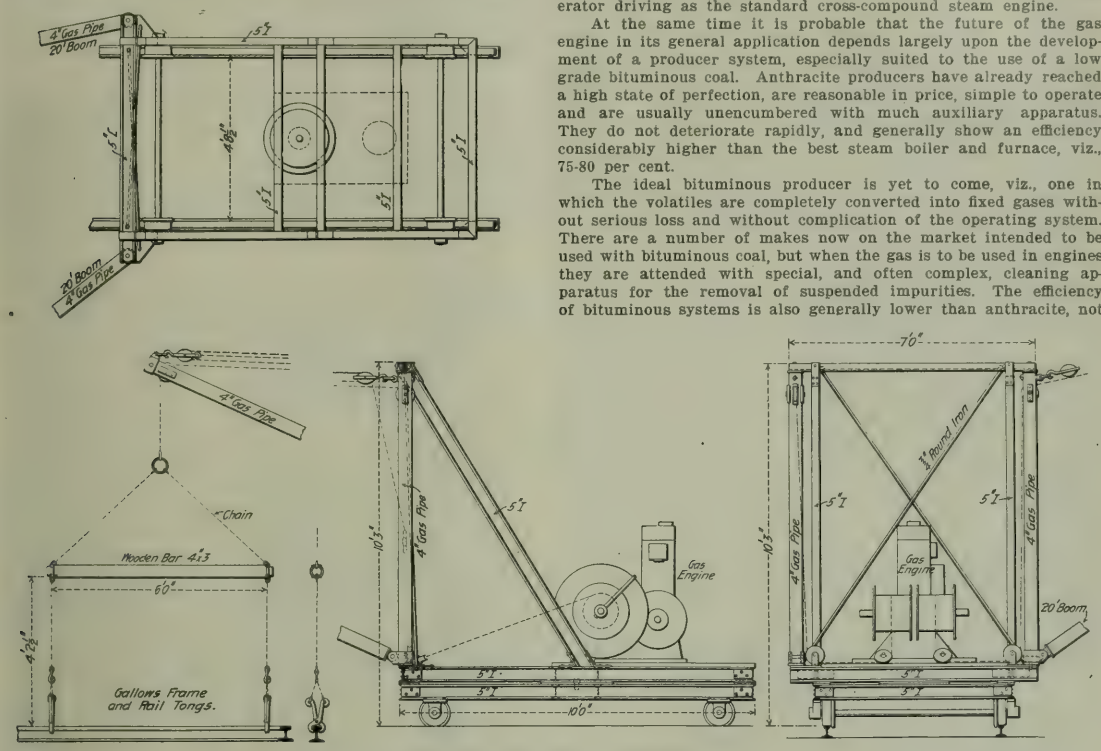
The Y. M. C. A. at Detroit.

The National Convention of Railroad Young Men's Christian Associations, held at Detroit, September 28-October 1, was attended by 1,437 delegates, representing 212 associations, including some in Mexico, British Columbia and Nova Scotia. On Sunday evening 51 meetings were held, mostly in churches, and the aggregate attendance was 12,000. About 1,300 men took part in these 51 meetings. At one midday meeting the workmen in a large number of shops and factories were invited, and about 9,000 attended. Religious activity has been so stimulated in Detroit that it is said meetings will be continued in the shops and factories.

One of the speakers at the conference was President George W. Stevens, of the Chesapeake & Ohio, who said: "We carry 3,500,000 passengers and 43,000,000 tons of freight a year, and last year lost but two employees and not one passenger's life. I give large credit for this condition to the influence of the Young Men's Christian Association." Other speakers were General Manager Garrett, of the Queen & Crescent; Hon. Leslie M. Shaw, Secretary of the Treasury, and Miss Helen M. Gould. Miss Gould's latest gift to the Y. M. C. A. is the sum of $150,000 for a building for the railroad association in St. Louis. The 212 associations represented now have a membership of 74,000 and a daily attendance of 34,000; students in educational classes, 2,664; in Bible classes, 4,183. One short road contributed $30,000 last year for the maintenance of associations.

The Travis Rail Loader and Unloader.

The accompanying illustrations show an effective device designed by O. J. Travis, Superintendent Bridges and Buildings, of the Colorado & Southern, for loading and unloading rails on and off of cars. The machine as shown is equipped with a turntable center so that the boom can be swung completely around, enabling it to unload rails from either end of the car. The device is carried over the road on an ordinary flat car and is especially useful for unloading rails from coal cars, in which case trestles or horses are placed in the coal cars. Skids are then used to run the loader from the flat car to the trestles, which must be of sufficient height to allow the unloader to clear the closed end of the coal car. By placing the loader on the trestles in the car, rails are just as readily loaded and unloaded from coal cars as they are from flat cars. The movement of the two booms is independent of each other and the rails can be picked up and unloaded on both sides of the track at the same time. It is claimed that this machine will do more work in a given time with six men than can be accomplished in the ordinary way with the average unloading gang of 40 men, and do it in a better and safer manner. Being mounted on standard gage trucks, this machine can also be used at wrecks for picking up coal, coke, grain, timber, etc. It can also be used to load coal in storage yards. If desired, it can readily be transferred to narrow gage trucks, and it is not confined to short lifts, as it can reach the load no matter where located, providing that it is within a reasonable distance.



The Travis Rail Loader and Unloader.

Friedrich List.

Recently a monument to Friedrich List was unveiled near Stuttgart, in memory of his labors for the establishment of a German railroad system. List was not always so honored there; for he came to America under sentence of banishment, after a term in prison. He lived for some time in the Pennsylvania anthracite regions and was interested in the Tamaqua & Port Clinton Railroad, opened in 1831, one of the earliest railroad projects there, and when he returned to Germany he gave his life chiefly to advocating railroad-building there. Under President Jackson he was for a time United States Consul in Leipsic, and he was the most active promoter of what became the Leipsic & Dresden Railroad. He also planned railroads in France, Belgium and elsewhere, but became so disheartened that he committed suicide in 1846. List is also noted as an advocate of a protection tariff in his "National System of Political Economy," the seventh edition of which was issued in 1877. He for a time edited a "Railroad Journal" in Germany.

Application of Gas Power to Electric Railway Service.

In a paper read before the American Street Railway Association at its recent convention in Philadelphia, Mr. J. R. Bibbins presented an argument in favor of the gas engine as a motor for electric railway plants.

He maintained that the uniformity of turning moment and speed regulation are as well suited to both D. C. and A. E. generator driving as the standard cross-compound steam engine.

At the same time it is probable that the future of the gas engine in its general application depends largely upon the development of a producer system, especially suited to the use of a low grade bituminous coal. Anthracite producers have already reached a high state of perfection, are reasonable in price, simple to operate and are usually unencumbered with much auxiliary apparatus. They do not deteriorate rapidly, and generally show an efficiency considerably higher than the best steam boiler and furnace, viz., 75-80 per cent.

The ideal bituminous producer is yet to come, viz., one in which the volatiles are completely converted into fixed gases without serious loss and without complication of the operating system. There are a number of makes now on the market intended to be used with bituminous coal, but when the gas is to be used in engines they are attended with special, and often complex, cleaning apparatus for the removal of suspended impurities. The efficiency of bituminous systems is also generally lower than anthracite, not only owing to the fact that some of the valuable distillates are lost, but on account of the distillation of volatile matter requiring heat for its accomplishment. Present types, however, sometimes exceed 70 per cent. efficiency, which rivals that of the best boiler plant.

In actual running, fuel consumption, gas power presents its most striking advantage over steam. It is difficult to obtain statistics truly comparative in every respect. Some data, trustworthy in the aggregate, are available from the tests conducted during the past year at St. Louis by the United States Government.

The most remarkable result is that the poorest grade coals and even lignites are entirely suitable for producer work. Thus, Montana, North Dakota and Texas lignites, averaging only 8,242 B.t.u. per pound (11,400 dry) yielded a gas of 169 B.t.u. per cubic foot, a gross producer efficiency of 66 per cent., and a duty of 2.5 lbs. per k.w.h. dry, or 3.6 lbs. per k.w.h. as fired. The best coals (West Virginia) gave an actual duty of 1.57 lbs. per k.w.h., and the poorest 3¼ to 4½ lbs. as fired. The average of the 17 tests showed a plant duty of 2.2 lbs. per k.w.h. dry, or 2.5 lbs. as fired.

Taking a common heat value for average bituminous coal 13,000 B.t.u. per pound, we observe that the plant duty is less than 2 lbs. per k.w.h. with gas and 5½ lbs. with steam.

Passing to some of the practical points, a producer, if provided with an automatic blast control, may be made almost instantly responsive to variations in demand for gas.

Although producers have been designed and successfully operated without a gas holder, the especially severe condition of heavy railroad work prescribes storage capacity at some part of the system, and electric storage is evidently the most desirable, as it relieves the machinery of the wear and tear of fluctuating loads.

In the matter of labor it is maintained that the cost in a

steam plant should be greater than in a gas plant of the same grade, though figures are not available by which it can be definitely proven. In oil consumption two 500 k.w. gas plants at Franklin and Bradford, Pa. (each consisting of five Westinghouse vertical enclosed type engine units), average through the year less than half a gallon per unit day, at a total cost of under seven cents (.0032 gallons per h.p. day).

Maintenance expense is frequently thought to be excessive in a gas station. When this is so we may look for faulty operation or design of the plant. Recent data from the station at Bradford, Pa., shows what may be accomplished when the equipment is *properly operated*. The plant is in its seventh year of service; yet the average cost of repairs on the engines for the last two years was $92.70 per year, 11.6 cents per h.p. year, or .0125 cents per k.w.h. generated.

The present exhaust valves average one year's working without regrinding, and even then are not in bad condition. Some valves have run 15 months. Admission valves require no attention. Igniters average about nine months without repointing. By reversing the current each day electro deposition is entirely avoided, so that the points wear evenly.

Comparative plant economy is best brought out in figures expressing the total operating cost of power.

In one case with a load factor of only 15½ per cent. and coal at $6.75 per ton, delivered, the total cost of generating current was 1.7 cents per k.w.h.; or, based upon current delivered to consumer, 2.13 cents per k.w.h., the average price obtained being 7.14 cents, and the net profit 9 per cent.

This same plant required throughout the year's run but slightly over two pounds of coal per k.w.h. generated.

At the Bradford, Pa., station (see table 5, appendix 4), although handicapped with old type belted machinery, the average yearly gas consumption is less than 25 cu. ft. of gas per k.w.h. on a 19½ per cent. load factor, and a total operating cost of power of about 0.8 cents per k.w.h.

The station at Franklin, Pa., operating on natural gas of exceptionally high calorific value, gives experience of similar character. The engines regularly operate 30 hours to a run. With a load factor of 15 per cent. to 20 per cent., as low as 17 cu. ft. of gas per k.w.h. was recorded for the year 1904, at a total operating cost of under one cent per k.w.h. In the cases of both the Bradford and Franklin plants building heating by natural gas is included in the gas charge for the engines.

The application of the gas engine to railroad service has in this country been limited; yet we find abroad many evidences of successful working. A prominent European engineer reported in 1903: "Nineteen stations on tramway work, totaling 6,000 h.p. capacity. These include Barcelona, Tunis, Lausanne, St. Gallen, Poictiers, Orleans and Zurich, from 400 to 600 h.p., each working on either producer or town gas." As a result of the excellent experience with the Walthamstow electricity station, 650 h.p. has been added to the plant for operating the new tramway system recently constructed. At Buenos Ayres, South America, two plants, aggregating 2,240 h.p., are at work for the Buenos Ayres Great Western and Great Southern Railways. Both use Mond gas.

But, eclipsing in interest probably all former gas power railroad undertakings is that of the Warren and Jamestown Railway system now under construction. This plant will practically inaugurate the use of the heavy duty type engine, in connection with single phase railroad systems in America.

The new engine equipment, now nearing completion, consists of two 500 h.p. Westinghouse double acting engines of the horizontal tandem type, each direct connected to a 260 k.w. A. C. engine type generator. These engines are both of the single crank type, but with the tandem arrangement a power stroke is developed at each half revolution, as in the double acting steam engine. The gas units will operate in parallel on the electrical end, without the necessity of synchronizing the cranks.

Natural gas fuel is entirely used in this territory, and at the present price and heat value will correspond with producer gas delivered at a cost of about two cents per thousand cubic feet. The economy in operating with natural gas is striking. In the old gas plant it is estimated that the cost of power averages .75 cents per k.w.h., including all items chargeable to operation, except repairs on building and battery; the corresponding gas consumption being 20 cu. ft. per k.w.h.

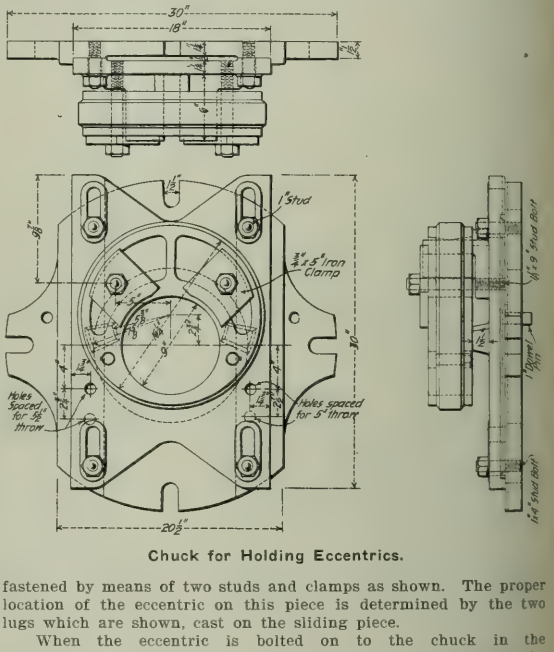
Among gas power stations in American and British territory we find a large number up to 2,600 h.p. capacity operating on producer, natural and oil gas, and many with the A. C. system with generators, running in electrical parallel.

The utilization of waste products of manufacture has within recent years made great progress. Gaseous by-products have already been put to use on a large scale, but the near future may readily witness the use of the producer in its present or in modified form for utilizing all combustible wastes recoverable in manufacturing processes. Blast furnace gas applications are now more or less familiar; coke oven gas from by-product coke ovens has many notable applications in Europe (a small plant is in use at Camden, N. J.); and oil gas (obtained by fractional distillation of petroleum—a by-product in the refining process) has lately been successfully applied in America.

The conclusions to be derived from a careful consideration of the subject are: That the gas engine has been brought to a state of development where it is capable of doing the same work as the steam engine, with far greater efficiency, and usually at reduced cost; that the producer has been so far perfected as to be a reliable and more efficient generator than the steam boiler; that the gas power plant "in toto" is entirely suitable for even the severe service incident to electric railway operation; that its component parts, engine and producer are possessed of characteristics leading to harmonious co-operation; that practical difficulties incident to gas power working have been so far overcome as to warrant commercial confidence; and that experience with gas power in almost every known line of modern industry has proven its general sufficiency for any power service.

Chuck for Holding Eccentrics.

The accompanying illustration shows a chuck for holding eccentrics, designed by Ben Johnson, Superintendent of Machinery, Aguascalientes shops of the Mexican Central Railroad. It consists of a body which is bolted to the face-plate of the lathe, its location on the face-plate being determined by two dowel pins which fit into holes in the face-plate. Sliding on this body and secured to it by four studs is a piece to which the eccentric is



Chuck for Holding Eccentrics.

fastened by means of two studs and clamps as shown. The proper location of the eccentric on this piece is determined by the two lugs which are shown, cast on the sliding piece.

When the eccentric is bolted on to the chuck in the position shown, the axle fit is bored, and then by loosening the nuts on the four studs, the sliding piece carrying with it the eccentric, is moved over an amount equal to the radial throw of the eccentric. It is then bolted in position by inserting the taper dowel pin in another hole and tightening up the nuts on the four studs in the slides. The outside of the eccentric is then turned. In this way the boring and turning are both done at one setting of the eccentric and a considerable economy is effected.

Complaints having been made that when there is a pressure of traffic at Russian stations, as there always is after harvest, no shipper stands any chance of having his freight forwarded unless he fees the railroad employees, some one cites the pay of employees as likely to induce such practices. Men temporarily engaged in the general offices get on the average $122 a year; permanent employees $466 (these including officers with the highest salaries). In the maintenance of way department the average pay is $105 a year; in train service $152. It is said that such pay is not enough for a family to live on. But the fact is that most of those in the lowest positions, whose pay is less than these averages, rarely if ever have a chance to extort money from the patrons of the railroads; and that according to popular belief, in other government service if not in railroad service, men in quite important positions have to be "seen" before they will do their duty.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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The President, in a speech made on his southern trip, has reiterated his "unalterable determination" to regulate railroad rates, but with equal and inspiring vigor he has modified his previous propositions in a direction which shows a possibility of his soon being at one with the railroads and the consumers, and at odds with the organizations of shipping corporations in Cincinnati, Chicago and St. Louis, who assume to represent a public demand. Instead of giving his countenance to the crude Esch-Townsend proposition to have rates fixed absolutely, by the Interstate Commerce Commission, he recommends the prescribing of maximum rates; and by an "administrative body." Leaving the railroads free to make reductions does away with an element of rigidity which would have been fatal to reasonable regulation. An "administrative body" can be constituted which would be free from some of the chief objections to the Commission. Does the President mean that he is ready to join in establishing such a body? Instead of asking Congress to authorize the establishment of new rates "immediately," Mr. Roosevelt now says that the orders should go into effect within a "reasonable time"; which time might well be fixed so as to allow some opportunity for review by a judicial body. Surely here is a hopeful opportunity for agreement on a reasonable provision. The President also says in plain English that the Sherman anti-trust law, as it was applied to the Trans-Missouri and the Joint Traffic Associations, is unwise and needs amendment. The country has been waiting for a powerful leader of public opinion to say this. Finally, by the mouth of the Secretary of War, at Akron, Ohio, the President says that the Government, in prescribing rates, may reasonably limit the effect of an order to a term of one or two years. In this utterance the administration gets to particulars in an encouraging way; much more encouraging than when it is listening to the demands of shippers' organizations which ask for what they call justice, but which is really discrimination in favor of their own cities. The weakness of President Roosevelt's address is the omission to tell how the admitted delays of the law are to be cured. He recognizes the right of appeal—and, of course, the railroads and probably the shippers will frequently appeal—but does not indicate how to settle the problem of getting the courts to decide in shorter time questions which are now held up for years. Secretary Taft's weakness is in believing that a promise from this administration, to disturb rates only with care and caution, can reasonably be accepted by the public as binding on all future administrations. One thing in Secretary Taft's speech needs explanation: He justifies putting the burden of proof on the railroads by saying that they can expedite cases in the courts better than the Government can. If this is a reflection on our judiciary, it is a grave, serious charge. If it is a reflection on the Attorney-General, the remedy is, without additional legislation, within the power of Government.

The fact, made public at Washington last week, that the Armour Car Lines have entertained claims for $140,000 for loss of fruit in the Southern States this year, because refrigerator cars could not be promptly provided to carry it to market, and that $80,000 of this sum has been paid, goes to show that the private-car owners' soft snap has its hard spots. Insofar as it shows that the risks of the business reduce the profits to a reasonable figure, it will tend to disarm the widespread criticism of the private-car business. But until the whole method of working of the private-car lines is made public, as railroad companies' business is made public, people will be inclined rather to the view that these large losses have been cheerfully borne with a view to insuring freedom from criticisms, which, if allowed to become public would lead to an investigation disclosing profits so enormous as to make these damage claims look small. That the income, or expenses, of the refrigerating business, or both, may thus be violently affected by emergencies only serves to emphasize the need of requiring complete publicity of this public service.

There is called to our attention a singular difficulty on some western railroads using automatic stokers in their locomotives. In particular cases, where Illinois and Iowa coal is used, there seems to be no difficulty in getting the coal into the firebox and getting it into the right place; but, due to causes apparently unknown or undiscovered, the flues become honeycombed. The means so far tried to prevent it have been unsuccessful. Is it due to the kind of coal used or is it due to combustion results of such uniform and even distribution of the coal in the firebox as is given with the automatic stoker? Under ordinary circumstances a scraper can be put in the door and the honeycomb scraped from the flue sheet. But the stoker is in the

way. It occupies a part of the door space so that it makes it inconvenient to use the scraper. Some roads have experimented with a sand blast thrown against the flue sheet to cut the honeycomb. Others have used crude oil to form a soot on the flue sheet to prevent the gathering of the honeycomb. Others have tried limestone laid on the grates next to the flue sheets to prevent the formation. Still others have used kerosene to make a fire hot enough to burn off the honeycomb. Perhaps some readers who have had experience, or have any theories to suggest in the matter will find interest in this subject.

The Car Service Committee of the American Railway Association has recommended an increase in the rate per day for the use of freight cars interchanged of 25 per cent.; that is, from 20 cents a day to 25 cents; and the Association has adopted the recommendation. This means that a formal vote will soon be taken by letter, and, no doubt, that the change will be put in effect a few months hence. For cars held beyond 30 days by one road the rate (after 30 days) will remain as now, one dollar a day. The adoption of the 25-cent rate will be a decided advance toward justice and equity. Twenty cents is unquestionably below the average cost of the service of a car for a day, and the most elementary business sense dictates that the rate be made at least as high as the actual cost, unless there are important reasons for not doing so, which is not the case. In view of the pronounced differences of opinion on the question and the numerous difficulties, the committee must be credited with both diplomatic ability and a good quality of grit. Roads which, like the New York, New Haven & Hartford, borrow more cars than they lend, and have a heavy share of terminal business will suffer, as they did when the 20-cent rate was adopted; but now, as then, will probably have to put up with suffering, for the general good. Now, as then, the only remedy is to be found in readjusting transportation rates and in making consignees pay for unreasonable detention of cars. This great burden on delivering roads is to be looked at, not as the result of the pernicious activity of revolutionary car-service theorists, but as a necessary correction of wrong business methods. Roads which desire to make the rate 30 or 35 cents, or higher, also had to be considered, no doubt. But in spite of the persistent and multifarious defects which constantly annoy the transportation officer—the unreasonable impositions of the private-car owners, the need of adjusting the rate to the capacity of the car, and the troubles of embargoes, accumulations of empty cars and dishonorable neighbors—a single arbitrary rate has the great and unique advantage of simplicity; and the 30-cent advocate, like the New Haven 13-cent advocate, can do the greatest good by acquiescing, as gracefully as possible, in the will of the majority.

DIRECTORS' RESPONSIBILITY FOR "LEGAL EXPENSES."

Officers of most corporations have at times to decide, or ask their directors to decide, whether or not they shall pay for protection against hostile legislation, threatened suits, or other action which will cause a loss to their stockholders. Every man makes his own conscience, or gets along without one; but many men of experience as trustees have concluded that they may justifiably do for those whose interests they hold in trust certain things which they would not do for themselves. They say to themselves that their own private notions must not influence their actions to the injury of the owners. There is no use here in discussing the ethics of this way of thinking; we take things as they are. When St. Paul, the most distinguished of the early diplomats, wrote to the Corinthians that he had "renounced the hidden things of dishonesty, not walking in craftiness," he simply announced that the time had come when he could do it.

One of the worst features of this miserable business is concealment and consequent lying. There is no ledger account headed, "Bribe and Blackmail," but such payments are usually buried in advertising or legal expenses. It is occasionally done without the knowledge of the directors, but more often with an intimation and a reluctant nod—a negative approval by some or all of them. They are ashamed as well as afraid to discuss it, and, as honorable men face to face, authorize transactions which they would not dare to make public.

An actual incident is more illustrative than description. We all know plenty of modern ones, but it is well to choose one old enough to be told. As the dressmaker replied to Marie Antoinette, who demanded a gown of absolutely original design: "There is nothing new in the world, except what is old enough to be forgotten."

A few years before the telephone was developed, the Law Telegraph Company was organized in New York to use the Edison printing telegraph instruments as a means of communication between lawyers, and between their offices and the court rooms, in precisely the same way that the telephone exchanges are now operated. The necessary number of subscribers was secured, but it was essential to the success of the scheme to have an instrument in each court house in the city. The Board of Aldermen was asked for a permit. It was a public benefit, expediting the business of the courts, and saving the time of lawyers and the money of their clients. The request was referred to "Billy" Maloney, Clerk of the Board and unofficial agent for the "Combine" which later dealt with Jacob Sharp in the matter of the Broadway railroad franchise. Billy said the permit would cost $1,600, and unblushingly explained that this sum included $100 each for thirteen aldermen, $100 for the "Organization" (Tammany Hall), and $200 for himself. This last because he had to divide with some one "higher up." The manager, being inexperienced, called a meeting of his board of directors and presented the whole case to them for decision. It is nearly, if not quite, true that if he had privately asked these directors separately they would have advised him to do the best he could, and say nothing about it; but they could not look each other in the face and officially take such action. They refused to pay blackmail and resolved, if necessary, to dissolve the company and stand their losses. This stubborn attitude, and a good deal of diplomacy, secured the permit and avoided the crime.

This is recalled because it is typical, we believe, of the methods of the great majority of the corporations in this country. It would seem to be the plain duty of the directors, not the officers, to take the responsibility when the company's business success is put in peril by strikers. When there is an impasse, they are the ones to decide whether the law or their trust is to be violated.

The other extreme from the case above cited, is to have an officer or agent in charge of "legislation." The publicity given to this method by the insurance companies investigation, although long known to every man of affairs, has shocked the public and jarred many directors. Carrion breeds maggots no faster than such a disbursing agent breeds blackmailers. The limit in his game is that of the poker player, his available cash, and when he has disbursed the liberal allowance of his company he says to the striking legislators: "That's all, boys; all I've got for you this year." Then the strike-bill business has a dull season, and the agent has rest until near election time, when the friends of the company need election expenses. "We have found," said Mr. Jay Gould in his testimony before the Erie Railroad investigating committee, "that it is cheaper to make legislators than to buy them." Mr. T. C. Platt's testimony, based on long experience in this industry, would not presumably be dissimilar.

There is what seems a better course, adopted by some large corporations, which, from the nature of their business, are peculiarly subject to hostile legislative action in the various States of the country. The method, in brief, is publicity. The menace is met, but met in the open, and the expenditures necessary are made in such a way that their purpose cannot be misconstrued or misunderstood. Appropriations are made for definite periods of time, and the expenditures are put in the hands of a special committee. Expenditures are made under the direction and supervision of that committee. Payments are made by check, and detailed vouchers reciting exactly the purpose for which the money was spent, and, of course, giving the name of the people to whom the money was paid, are taken in every case. All these expenditures are subsequently reported to the full board, and when the appropriation is exhausted, no further expenditure can be made without additional action by the board. This method must necessarily eliminate about all the items which might with propriety otherwise be called doubtful.

A corporation which does business in many states is certain to face the necessity for considerable expenditures in connection with proposed legislation, but that these expenditures have taken on a doubtful character in the experience of nearly every such corporation does not prove that all such expenditures are unnecessary or improper. They are necessary, and the expenditures may be made in a perfectly proper way. There is nothing the striker and blackmailer is so much afraid of as daylight. He doesn't like to indorse a check or sign a voucher. If he has to do both, it is pretty certain that he rendered a legitimate service in return for a legitimate expenditure.

In referring to this subject there is no intention to do any preaching, nevertheless, we might go so far as to mention that a good many successful folks think that honesty is the best policy; and also to suggest that the direction in which to work for a remedy is toward the greatest feasible publicity. Sunlight kills germs.

WHERE SOME GROSS EARNINGS GO.

A Comparison.

Last year, the gross earnings of the Chesapeake & Ohio increased $1,426,846 and its net earnings $959,070. The Norfolk & Western increased $1,370,283 in gross and only $429,177 in net. In another column, the principal statistics of these two roads are grouped for comparison because of their wonderful similarity, and it seems well to examine further here to find why the C. & O. got more net earnings than the N. & W. out of nearly the same increased gross earnings. The C. & O. found it necessary to add to its expense account only $467,800. The N. & W. increased its operating expenses by $941,100. Unfortunately for a close comparison, the two companies use different detailed classifications of expenses, but it is not hard to draw some conclusions from the general classification. As a back-ground for comparison and in order to approximate a standard, results on seven other roads, comparable on account of their similar situation or traffic, are included in the examination.

Increased business, especially low-grade traffic (coal and coke tonnage increased 26 per cent. last year on the C. & O. and 20 per cent. on the N. & W.), naturally shows its immediate and greatest effects first, on conducting transportation, the actual cost of getting and moving the business; second, on maintenance of equipment, the keeping in serviceable condition of the immediate physical agencies which carry it; third, on maintenance of way and structures, the up-keep of buildings and roadbed; and last, on general expenses, the cost of management. As expenditures accompanying an increase in business vary from this general order, variations from the normal in the spending policy of a management may generally be determined.

There were changes last year in the amounts spent by the C. & O. and the N. & W. in each of the principal expense accounts as compared with the preceding year as follows, all but two of the figures being increases:

	Chesapeake & Ohio.	Norfolk & Western.
Maintenance of equipment	Inc. $419,000	Inc. $366,300
Conducting transportation	Inc. 257,000	Inc. 323,000
Maintenance of way	Dec. 118,800	Inc. 241,800
General expenses	Dec. 88,600	Inc. 10,000

These figures must, of course, be reduced to percentages for a fair comparison as in the following table, which includes also the percentages of increase in gross earnings:

	Chesapeake & Ohio.	Norfolk & Western.
Gross earnings	Inc. 7 per cent.	Inc. 6 per cent.
Maintenance of equipment	Inc. 11 per cent.	Inc. 10 per cent.
Conducting transportation	Inc. 4 per cent.	Inc. 5 per cent.
Maintenance of way	Dec. 5 per cent.	Inc. 8 per cent.
General expenses	Dec. 22 per cent.	Inc. 2 per cent.

The striking fact is that on neither road did conducting transportation or general expenses increase as fast as gross earnings. This is only another way of saying that more was spent on maintenance.

From an operating standpoint, the Chesapeake & Ohio shows the better results, with an increase of only 4 per cent. in conducting transportation and a decrease of 22 per cent. in general expenses to take care of a 7 per cent. increase in gross earnings. Conducting transportation on the Norfolk & Western increased 5 per cent. and general expenses 2 per cent. against an increase of only 6 per cent. in gross. In maintenace expenditures, however, the Norfolk & Western makes the more satisfactory showing. Both roads increased their maintenance of equipment expenses very largely and to about the same extent; but in maintenance of way expenditures the Norfolk & Western shows an increase of 8 per cent. against a decrease of 5 per cent. in the same expenditure on the Chesapeake & Ohio.

It was in maintenance of way, evidently, that the Chesapeake & Ohio made its largest saving. The policy of the management toward this account was to a great extent responsible for the showing in net earnings at the end of the year. It is at once interesting to observe whether this saving was justified. In 1904 the Chesapeake & Ohio spent on maintenance of way $2,308,000, or $1,398 per mile. In that year expenditures on the line by the Norfolk & Western amounted to $2,854,000, or $1,657 per mile. Last year the margin between them in this important item was widened, the Chesapeake & Ohio spending only $2,189,000, or $1,308 per mile, against an expenditure by the Norfolk & Western of $3,096,000, or $1,657 per mile. This is a difference of $900,000, or over $400 per mile in roadway expenses, which seems a very great difference on two roads so similarly situated. The 1904 figures, and especially the very large expenditures on roadway made during the past few years by the Norfolk & Western, show that this state of affairs is not an exceptional one due to unusual conditions. It looks as though the Chesapeake & Ohio were not spending enough for maintenance of way to keep its line in first rate condition to carry its heavy traffic. This is further borne out by comparison with the other roads which have been selected, on which maintenance of way cost the following amounts per mile; the figures in each case being from the last annual report:

Baltimore & Ohio	(1904)	$1,702
Chicago & Eastern Illinois	(1905)	861
Delaware & Hudson	(1904)	2,046
Erie	(1905)	1,652
Hocking Valley	(1905)	1,921
Lehigh Valley	(1905)	2,315
Philadelphia & Reading	(1905)	2,698
Average, seven roads		1,880
Chesapeake & Ohio	(1905)	1,308
Norfolk & Western	(1905)	1,721

With the exception of the low figure on the Chicago & Eastern Illinois, no other road spent within $300 per mile so little as the Chesapeake & Ohio, and only the Erie and the Baltimore & Ohio spent less than the Norfolk & Western. It must be taken into account, however, that both the Virginia roads have little double track compared to, for instance, the Lehigh Valley or the Reading, and also that the large expenditures on both lines in recent years would naturally have the effect of reducing current maintenance figures. On the other hand—and this applies to maintenance of equipment as well—the heavy train loads (585 tons on the C. & O. and 531 tons on the N. & W.) and a freight traffic density of over 2,000,000 ton miles per mile of road on each railroad, mean heavy service charges in both classes of maintenance. A fair conclusion, therefore, seems to be that the Chesapeake & Ohio could, with advantage, enlarge its roadway expenditures to at least the Norfolk & Western's figure, without being accused of attempting to conceal earnings in the right of way.

On equipment up-keep they stand more nearly on an even footing, but the position of the two roads is reversed. The Chesapeake & Ohio with its smaller traffic spent for maintenance of equipment more, absolutely, and per each equipment unit than the Norfolk & Western. The figures are $4,078,000 (30.7 per cent. of total expenses) on the Chesapeake & Ohio against $3,917,000 (26.8 per cent. of total expenses) on the Norfolk & Western. The following table shows the expenditures and those of the seven other roads per unit of equipment:

	Maintenance of Locomotives, per locomotive.	Maintenance of Freight cars, per car.	Maintenance of Passenger cars, per car.
Baltimore & Ohio	$2,783	$59	$630
Chicago & East. Ill.	2,609	35	641
Delaware & Hudson	2,097	50	455
Erie	3,318	50	629
Hocking Valley	2,767	61	554
Lehigh Valley	3,394	54	745
Philadelphia & Reading	2,907	66	541
Av'ge, seven roads	2,839	54	598
Chesapeake & Ohio	2,381	100	947
Norfolk & Western	2,304	53	722

These are not the figures given by the companies, but are the sum of the amount directly expended for repairs and renewals of each class of equipment and a proportionate share, for each class, of the other maintenance of equipment expenses, such as superintendence. Here the Chesapeake & Ohio and Norfolk & Western make a better showing in the general comparison than in maintenance of way. Both fall short of the average per equipment unit of the other roads in maintenance of locomotives and the Norfolk & Western in maintenance of freight cars. On the other hand, the Chesapeake & Ohio spends much more than any other road per freight car and per passenger car, and the Norfolk & Western more than any except the Chesapeake & Ohio and the Lehigh Valley per passenger car. The most striking figure among the unit charges is the Chesapeake & Ohio's maintenance charge of $100 per freight car, an increase of $10 per car over 1904, which is $34 more than the next largest expenditure by any road and nearly twice as much as the general average. There is a chance to do some thinking on the following comparison: The C. & O. earned $3,894,000 with 255 passenger cars, with a maintenance cost of $947 each; while the N. & W. earned $3,159,000 with 324 passenger cars with a maintenance cost of $722 each.

The most accurate test of general operating efficiency is the cost of conducting transportation. These are current expenditures which generally have no effect on the future. They are the butchers' and grocers' bills of a railroad. Last year they were on the C. & O. 32.2 per cent. of the total earnings, and on the N. & W. only 29.6 per cent. Combining conducting transportation and general expenses to represent the total of what, as opposed to maintenance, we may call the non-productive expenditures,

on the C. & O. the two together took 33.7 per cent. of the total earnings against 31.6 per cent. on the N. & W.

Comparison with the other coal carrying roads will show how their efficiency in this respect compares with the general showing. The following table shows the percentage of conducting transportation to total operating expenses and the percentage of the two "non-productive" accounts to total earnings. Taxes have in all cases where necessary been eliminated from operating expenses. The numbers in parentheses show the relative positions of the nine roads in economy of the non-maintenance expenses.

	Percentage conducting transportation	
	To operating expenses.	Plus general expenses to gross earnings.
Baltimore & Ohio	56.7 (6)	40.7 (7)
Chicago & Eastern Illinois	60.6 (9)	44.7 (9)
Delaware & Hudson	58.4 (7)	36.8 (6)
Erie	58.5 (8)	42.9 (8)
Hocking Valley	46.6 (1)	31.9 (3)
Lehigh Valley	53.8 (5)	34.4 (5)
Philadelphia & Reading	53.3 (4)	30.1 (1)
Average, seven roads	55.4	37.4
Chesapeake & Ohio	50.4 (3)	33.7 (4)
Norfolk & Western	48.8 (2)	31.6 (2)

The good margin between the C. & O. and N. & W. percentages and the general average of the other roads is proof of a high order of operating efficiency, which is amply corroborated by the figures for train load and traffic density.

Had maintenance charges been skimped while gross earnings were growing larger, it would have been easy for either company to show much larger net earnings for the year, but in that case it would be natural to assume that neither was taking advantage of prosperity to fortify itself for the larger traffic of the future or the slim earnings of some possible panic year to come. But when the large increases in gross earnings are met with still larger proportionate expenditures for maintenance, and conducting transportation does not increase as fast as earnings, it is safe to conclude that both roads are being put on a secure footing for both good times and bad. The difference then in net return means simply that one company has devoted more of its earnings to productive maintenance expenditures than has the other. The Chesapeake & Ohio decreased maintenance of way expenditures in face of increased business, but on the Norfolk & Western both classes of maintenance increased faster than gross earnings.

September Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of September, printed in another column, contains accounts of 24 collisions and 17 derailments. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
5th	Brush, Colo.	3	15
7th	Obion, Tenn.	4	4
8th	Zeeland, Mich.	3	0
9th	Tabor Junction, Pa.	3	0
16th	Kimmel, Ind.	2	20
17th	Ironton, Mo.	3	12
21st	Moor's Mill, Pa.	6	10
25th	Paoli, Pa.	6	21
25th	Woodstock, Ala.	1	27
27th	Glenwood, Ind.	1	8

The most fatal accidents in this list occurred not far apart, and almost on the same day—at Moor's Mill and at Paoli, both in Pennsylvania. In the Moor's Mill collision the man in charge of the train at fault was a trainmaster; and the coroner's jury found that the collision was due to his gross and wanton neglect. "Notwithstanding his knowledge that the passenger train No. 10 had the right of way, and that according to schedule it was then due at the point of collision, he recklessly endeavored to reach Moor's Mill, a station two miles west of the accident. We also find that he had full control of the pay train which he was piloting, and that his wanton and reckless conduct was all the more inexcusable, because of his official knowledge and control of the trains of this division."

The Paoli collision was due to the failure of the engineman of the express—one of the most important trains on the road—to heed a stop signal; and most critics will conclude that this failure is to be charged to habitual dependence on the sight of a clear track instead of on the indications of signals. The engineman saw the train ahead of him; he saw that it was clear of track No. 2 (on which the express was entering); he had seen an accommodation train (not this one) at the same place frequently before; he knew that in the ordinary procedure the signals would be cleared through to the east end of the yard for him immediately after the passage of the accommodation train, and so he assumed that the ordinary procedure had been carried out in this case. This train of thought or reasoning may have been partly unconscious, or so rapid as to be substantially so; and yet it is just the thing which must be guarded against. The moral is, simply, to trust *nothing* as a substitute for a signal indication. The signals at Paoli are on signal bridges, and the line of the road is straight. There is a theoretical objection to an arrangement, like that at this place, where fast trains are habitually run at pretty good speed without the benefit of clear distant signals. The crossovers may be traversed at 50 miles an hour or faster, so that when the view is clear it is necessary to slacken the speed but little. This practice impairs the force of the under-control rule; for it is easy for a runner to fall into the mental habit of assuming that where he is allowed to run fast the way has surely been cleared for him. To provide a separate distant signal for the route through the crossover, or separate distants for each of the successive home signals is, however, objectionable, and therefore there seems to be no better recourse than to the more perfect enforcement of our present rules; the simple but difficult problem of perfect discipline. The query arises whether surprise checking has been sufficiently tried in situations like that which this occasion developed at Paoli.

The number of electric railroad accidents reported in the newspapers in September was 20, in which 21 persons were killed and 247 injured. These figures include the disaster on the elevated road in New York City, September 11, which was reported in the *Railroad Gazette* of September 15 and 22. The negligent motorman has not been arrested, and so there have been no further developments; though the newspapers asserted, a week or so after the accident, that the motorman had been seen in Philadelphia and could be arrested if wanted. This accident accounts for 12 of the killed and 50 of the injured. In a butting collision of electric cars, one a passenger and one a freight car, near York, Pa., on the evening of Sept. 9, four passengers were killed and 50 injured.

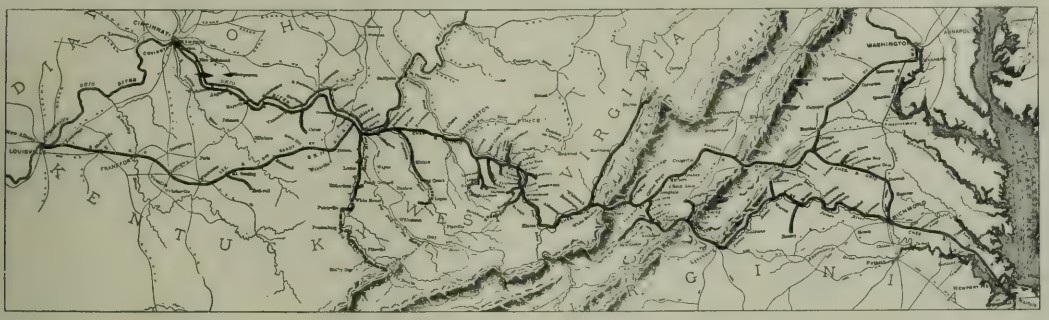
Chesapeake & Ohio and Norfolk & Western Compared.

In mileage, location, traffic and operating problems the Chesapeake & Ohio and the Norfolk & Western are remarkably alike. Both are coal carriers and run from the Atlantic seaboard at Hampton roads, across the Blue Ridge and the Alleghenies, to the Ohio river at Cincinnati. Both are roads which, from the nature of things, must be run on a narrow margin of profit; their solvency depends on reducing expenses below the very low rates received. In many ways, therefore, the annual statements of the two companies, lately issued, furnish material for a comparison.

The Chesapeake & Ohio runs from tidewater at Newport News to Cincinnati and to Frankfort, Ky., whence it enters Louisville over the Louisville & Nashville. From a point west of Richmond, on the more northern of its two lines across the Blue Ridge, it reaches Washington over the Southern Railway tracks. The original Chesapeake & Ohio company was formed in 1868 to consolidate the Virginia Central, one of the oldest of the Virginia roads, and the Covington (Va.) & Ohio, which was undertaken by the state of Virginia as a western connection for the Virginia Central, and on which, before the opening of the war, some $3,000,000 had been spent. Five years later, in 1873, the Chesapeake & Ohio Railroad failed to make its interest payments and in 1878 it was reorganized as the Chesapeake & Ohio Railway. The road was at that time controlled by Mr. C. P. Huntington, who some years later organized, under the laws of Connecticut, the Newport News & Mississippi Valley Company, an early development of the modern "holding company." In 1886 this company leased the Chesapeake & Ohio for 250 years and also two other allied companies. One year later, after default, receivers were appointed for the Chesapeake & Ohio, thus severing its lease to the Newport News & Mississippi Valley Company, which a few years later disappeared entirely. With the reorganization of the Chesapeake & Ohio in 1888, control passed from Mr. Huntington to a five-year voting trust which included Mr. J. P. Morgan, and was generally assumed to be in the interest of the Vanderbilts. Mr. Melville E. Ingalls, President of the Big Four, was elected President of the Chesapeake & Ohio also, and the two companies became very closely allied.

The road turned over to the new owners was in wretched physical condition and all departments were thoroughly run down. A large part of the track had never been ballasted. The state's expensive work in railroad building across the mountains, however, could not be destroyed by misuse nor fail to be a permanent asset. The colossal character of much of this work is illustrated by two fills, together containing 2,000,000 cubic yards, the larger containing 1,100,000 cubic yards, said to be the largest fill in the world. The rock cutting was tremendous, a stretch of 17 miles, including a tunnel, across the Blue Ridge, having cost $100,000 a mile, and another section of 22 miles having cost $4,000,000. The first important step in putting the property on its feet was the completion, on Jan. 1, 1889, of the Ohio River division to Cincinnati. A few months later the Richmond & Allegheny was acquired. This gave the Chesapeake & Ohio its wonderfully favorable second line from Clifton Forge, in the valley between the Alleghenies and the Blue Ridge, across the Blue Ridge to Richmond, and a continuous low-grade line from Cincinnati to Newport News. At once a much more economical han-

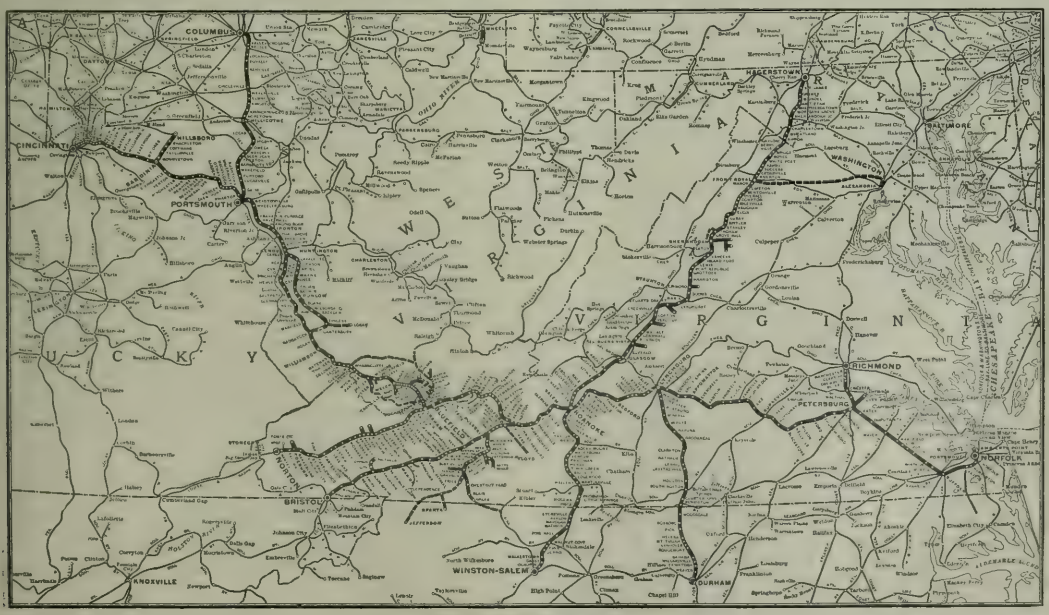
dling of traffic was made possible. On the whole road expenditures were large and the work done was of the highest standard. In 1890 there was included in operating expenses for betterments, $900,000, which left net earnings just sufficient to pay fixed charges and taxes, well illustrating the policy of the new owners to use, in improving the property, every cent available. During the next two years $1,300,000 was similarly taken from net earnings for improvements. The results of this policy were soon evident, gross earnings in 1892 ($9,004,600) being twice what they were in 1887 under the receivership. Though at the end of the receivership trains enough to earn interest on the debt could scarcely be moved over the road, after 1890 the Chesapeake & Ohio began boldly to enter the field as a trunk line competitor. At Newport News, grain elevators and a tidewater terminal were built and a steamship line to England established. The road could carry grain very cheaply—none more so—and at times was suspected of carrying it more cheaply than was sufficient to pay even operating expenses. Its rate cutting during this period of competition caused severe losses to the other trunk lines. As a result of the splendid operating condition to which the property had been brought, it came through the panic years following 1893, when seemingly more powerful roads were going to the wall, without default or foreclosure. Control is now in the hands of the Pennsylvania and the Morgan-Vanderbilt interests, who, together, own a majority of its stock and are directly represented by six of its nine directors.



Chesapeake & Ohio.

The Norfolk & Western serves much the same territory and has a similar history. Like the Chesapeake & Ohio it is controlled by trunk-line influence, the Pennsylvania in 1900-1901 having acquired control by purchase of over $32,000,000 of its common stock. The line runs from Norfolk, Va., to Cincinnati and Columbus, with branch lines reaching south, two of them into North Carolina; and a line from Roanoke, Va., to Hagerstown, Md., where it connects with the Cumberland Valley to Harrisburg, thus forming a through line, under Pennsylvania control, from the Virginia coal fields to Philadelphia and New York. The original companies from which the Norfolk & Western has grown were chartered previous to 1852 and were controlled by the state of Virginia. They were consolidated in 1870 as the Atlantic, Mississippi & Ohio, which ran from Norfolk to the Virginia-Tennessee line, with a total mileage of 428 miles. In 1876 the consolidated company having defaulted on its bonds, it was put in the hands of a receiver and was in 1881 reorganized as the Norfolk & Western. The reorganized company remained solvent longer than the Chesapeake & Ohio after its corresponding reorganization in 1878, but was forced into another receivership by the hard times resulting from the panic of 1893, which brought disaster to the ambitious plans of its managers. Their policy was to construct numbers of branch lines as feeders and to build up a very large mineral traffic. On its face, this seems like a wise policy. It was defeated by the heavy increase in capital charges which accompanied it and by the industrial depression. With prosperous times and more modest capital expenditures the road would have undoubtedly remained solvent. In 1892 net earnings showed a margin of less than $40,000 over fixed charges, and in 1893 there was an actual deficit of $543,000. The sharp increase in fixed charges, particularly in car trust obligations incurred for new rolling stock required by the increased coal traffic, together with the deficiency of earnings on new branch lines—always prompt to reflect industrial depression—put the road in 1895 into a receiver's hands. In the next year it was reorganized as the Norfolk & Western Railway, and has since been increasingly prosperous.

Thus both these roads were originally built before the war by state aid, were consolidated soon after the close of hostilities, and in each case, within five years, had defaulted on their interest payments. Each was reorganized and—the Chesapeake & Ohio in 1888



Norfolk & Western.

and the Norfolk & Western in 1896—went through a later reorganization. Each is now controlled in the interest of the trunk-line situation by the strongest of the trunk-line powers.

The total capitalization of the two roads is similar. The Chesapeake & Ohio, which operates 1,673 miles of line, has $87,427 total capital per mile, $49,467 stock, and $37,960 bonds. The Norfolk & Western operates 1,799 miles and has a total capitalization of $85,773 per mile, made up of $37,537 stock and $48,236 bonds.

With its somewhat larger capitalization the Chesapeake & Ohio earns almost exactly $1,000 per mile less than the Norfolk & Western. Its gross earnings for 1905 were $20,724,371 ($12,388 per mile), and the Norfolk & Western's $24,089,260 ($13,390 per mile). These were increases for the Chesapeake & Ohio of $1,426,846, and for the Norfolk & Western of $1,370,283 over the preceding year. With increases in gross earnings so nearly the same, the Chesapeake & Ohio saved $959,070 of the increase for net earnings against $429,177, or less than half as much increase in net on the Norfolk & Western. In other words, while the operating ratio on all business was 63.9 per cent. on the Chesapeake & Ohio, and 60.6 per cent. on the Norfolk & Western, the increased business was handled at the operating ratio of 39.3 per cent. on the Chesapeake & Ohio and 68.7 per cent. on the Norfolk & Western. The net income after fixed charges was 3.37 per cent. on the Chesapeake & Ohio against 2.38 per cent. in 1904; and on the Norfolk & Western 6.30 per cent., against 6.06 per cent. in 1904.

Both roads must carry freight cheaply or not at all. Their problem is to run long trains of low-grade freight and make a profit. With an average revenue for the last two years on both roads of less than one-half cent per ton per mile (0.468 cent), the seriousness of this problem is evident. Unless the expense of handling per ton mile can be reduced below that figure, they may just as well go out of business. This narrow margin of profit calls for the most economical management. It has necessitated large improvements in roadbed, the use of the most modern equipment, and remarkably large train loads.

During recent years, the train load figures of both companies have shown a wonderful increase. In 1890, for instance, on the Chesapeake & Ohio, the revenue train load was 225 tons; in 1896, what was then remarked in the *Railroad Gazette* as the very extraordinary figure of 325 tons; in 1899, 425 tons; in 1900, 488 tons, and in 1905, 557 tons. The Norfolk & Western, in 1897, at the end of the first nine months of operation of the reorganized company, was carrying an average train load of 325 tons. This has in seven years been increased to 531 tons. The average train load on both roads has very considerably increased during the past year, from 508 tons to 557 tons on the Chesapeake & Ohio and from 488 tons to 531 tons on the Norfolk & Western. These large train loads go a long way toward accounting for the fact that there is a profit in carrying freight for less than one-half a cent per ton per mile. To make up for its smaller train load, the Norfolk & Western, probably because more of its traffic is local traffic, seems to be able to obtain slightly higher ton mile earnings than the Chesapeake & Ohio. In 1904, it received per ton mile 0.498 cent, against 0.470 cent on the Chesapeake & Ohio, and in 1905, 0.477 cent, against 0.427 cent on the Chesapeake & Ohio.

The number of passengers carried one mile per mile of road last year on the Chesapeake & Ohio was 115,299, against only 78,466 on the Norfolk & Western. The total number of passengers on the Chesapeake & Ohio increased from 176,075,000 in 1904 to 192,838,400 in 1905. On the Norfolk & Western in 1904, there were 136,561,600 passengers carried, and in 1905, 141,159,800. The average distance each passenger was carried was 56 miles on the Chesapeake & Ohio, and 40 miles on the Norfolk & Western, showing that the Chesapeake & Ohio has a considerably larger share of through traffic. This is also borne out by the average revenue per passenger per mile, which was last year 2.019 cents on the Chesapeake & Ohio and 2.238 cents on the Norfolk & Western.

The number of tons carried one mile per mile of road was, on the Chesapeake & Ohio, 2,244,776, against 1,917,741 in 1904, and on the Norfolk & Western, 2,373,674, against 2,223,328 in 1904. The average distance each ton of freight was carried was 282 miles on the Chesapeake & Ohio and 269 miles on the Norfolk & Western.

The large amount of low-grade traffic hauled makes it necessary for both roads to have heavy car trust obligations. For years they have in this way made large purchases of high capacity equipment. Their equipment liabilities are probably as high per mile of road as those of any other road in the country. The amount of equipment trusts outstanding on June 30 was $8,165,000 on the Chesapeake & Ohio, or $4,880 per mile of road, and $7,300,000 on the Norfolk & Western, or $4,058 per mile of road. The Chesapeake & Ohio paid out of income last year $735,000 as principal of equipment trusts, and the Norfolk & Western, $200,000 for the same purpose.

In addition to these payments out of income, both companies made liberal charges against income for improvements. On the Chesapeake & Ohio, such extraordinary expenditures, including $465,000 for new equipment, amounted to $1,217,477, which was charged directly to the year's income account. The Norfolk & Western pays for improvements through a Betterment Fund created out of surplus income year by year. To this fund was charged during the year, for improvements, $1,848,484, while at the same time there was added to the fund out of the year's income $1,000,000. In other words, $848,484 out of surplus income of previous years and $1,000,000 out of current income was expended for extraordinary betterments. In addition, there was charged against the Fund for Acquiring Additional Equipment, new equipment costing $1,440,000, and the $200,000 of equipment trust payments already mentioned. Out of the current income of the year there was added to this fund $1,250,000; or, from the other point of view, $390,000 was spent for new equipment out of the income of previous years and $1,250,000 out of current income. In short, while the Chesapeake & Ohio spent for betterments and new equipment during the past year $1,952,477 out of income, the Norfolk & Western spent for like purposes $3,688,490 out of the surplus income of previous years and charged to current income for future improvements $2,250,000.

There is no need to look further for an explanation of the relative financial strength of the two companies, or a reason for the N. & W. directors' action on Wednesday in raising the common stock dividend rate to four per cent. Both companies are prosperous, but with a funded debt $12,000,000 smaller than that of the Chesapeake & Ohio, the Norfolk & Western not only earns more gross, net and per mile, but spent last year nearly twice as much out of earnings for improvements. As operating properties, both roads are notable as examples of favorable location and the most painstaking of careful management, which has succeeded in making profitable the hauling of low-grade traffic at a remarkably narrow margin of profit.

The principal statistics of operation follow:

Chesapeake & Ohio.	1905.	1904.
Mileage worked	1,673	1,651
Passenger earnings	$3,894,145	$3,648,233
Freight earnings	16,039,313	14,869,188
Gross earnings	20,724,371	19,297,525
Maint. way and structures	2,188,835	2,307,620
Maint. of equipment	4,077,943	3,659,382
Conducting transportation.	6,677,255	6,420,666
Operating expenses	13,250,966	12,783,190
Net income	2,871,639	1,944,511
Betterments chrgd agst income	1,217,477	861,366
Surplus for the year	291,258	5,241

Norfolk & Western.	1905.	1904.
Mileage worked	1,799	1,723
Passenger earnings	$3,158,773	$3,150,859
Freight earnings	20,249,400	18,894,941
Gross earnings	24,089,260	22,718,977
Maint. way and structures.	3,095,910	2,854,164
Maint. of equipment	3,917,268	3,550,968
Conducting transportation	7,136,484	6,813,496
Operating expenses	14,614,434	13,673,328
Net income	5,833,454	5,688,303
Betterments chrgd agst income.	2,250,000	2,000,000
Surplus for the year	449,995	524,719

NEW PUBLICATIONS.

The Panama Canal.—System and Projects of Lindon W. Bates. Published by the Author. Cloth, 180 pages, and 15 plates.

Mr. Lindon W. Bates has made a careful study during his engineering career of the many complex problems involved in the development of deep waterways and canals. Some years ago he began on the collection of data and information relating to the geologic and climatic conditions of the Isthmus of Panama, from which he has evolved two alternative but seemingly equally feasible projects for building the ship canal from the Atlantic to the Pacific with the minimum cost and time. In this monograph he presents the details of these two projects and the reasons for making his claims that they are more meritorious than any which have yet been considered since the French company first conceived this gigantic enterprise. Readers of the *Railroad Gazette* will remember that some months ago (June 2, 1905) an abstract of Mr. Bates' original pamphlet was published, together with two maps showing his plan for harbor improvements and the construction of a lake waterway for most of the distance across the Isthmus. Therefore, an outline of his project is not now necessary. It is sufficient to say that from a casual examination the plan proposed appears to be based on sound engineering principles and worthy of consideration by the Board of Consulting Engineers. It may not be the best plan but it is a good one if we can judge from our own meagre knowledge of the situation and a study of the data presented in this book. The text is accompanied by 15 plates showing the different canal projects which have been proposed and some of the engineering details of Mr. Bates' plan.

TRADE CATALOGUES.

Switchboards.—The Stanley-G.I. Electric Mfg. Co., Pittsfield, Mass., sends its bulletin No. 409, in which is illustrated and described a number of standard switchboards made by this company for use in connection with small direct current electric plants.

Automatic Brake Slack Adjuster.—The American Brake Company, St. Louis, Mo., sends its 1905 part catalogue for the "American" automatic slack adjuster. It is in pamphlet form and is pre-

pared for binding with similar Westinghouse publications. It supersedes the 1901 edition and illustrates various improvements. The preface explains the need of automatic regulation of piston travel and the operation and advantages of the "American" device. The succeeding pages illustrate by plates the details of the various forms for different services and fully explains them. There are nine plates, the last of which chows the method of attachment.

Locomotive Boiler Maintenance.—The Kennicott Water Softener Co., Chicago, sends an attractive pamphlet containing a reprint of the paper on The Locomotive Boiler Water Changing Plant of the Pittsburg & Lake Erie, by Mr. A. R. Raymer, Assistant Chief Engineer of that road, read at the October, 1904, meeting of the Western Railway Club. This paper was printed in the *Railroad Gazette*, Oct. 21, 1904. The Kennicott Company controls the manufacturing and selling rights of the device described in that paper.

Rock Drills and Air Compressors.—The Sullivan Machinery Co., Chicago, sends its Bulletin No. 101. It contains an interesting description and illustrations of the destruction of Henderson's Point in Portsmouth, N. H., Harbor, on July 22, 1905. The destruction of this point was accomplished by novel methods in which the Sullivan rock drills and air compressors took an important part.

Pipe Crushing and Shearing Machine.—The United Engineering & Foundry Co., Pittsburg, Pa., sends a small pamphlet illustrating a new type of machine for crushing and shearing wrought-iron pipe at one operation. It is intended for use in tube mills, steel plants and scrap yards where large amounts of pipe scrap have to be prepared for reworking.

An Automatic Belt-Tightening Idler.—The Crocker-Wheeler Company, Ampere, N. J., sends its "Flyer" No. 276, which illustrates and describes in detail a newly designed automatic belt-tightening attachment for the Standard Crocker-Wheeler form L Motors. This device is specially adapted for use wherever the limited center distances between pulleys require an increased belt contact on the pulley surfaces.

CONTRIBUTIONS

Forms and Arrangements of Signals.

138 Liberty street, New York, Oct. 17, 1905.

To the Editor of the Railroad Gazette:

You are doing the railroads and signal contractors a valuable service in ventilating the subject "Forms of Signals." My views on the subject coincide with those expressed by Mr. Salmon in your issue of October 6, and in offering a few suggestions I shall assume the uniform use of semaphore signals. More simplicity and uniformity for the guidance of trainmen are of the greatest importance.

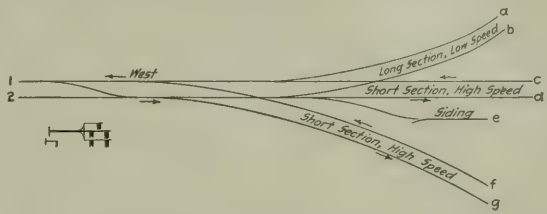
It is quite obvious why it is necessary to distinguish an automatic from a non-automatic signal, but I cannot understand why any further distinction is required for draws and train orders. A red light or a square ended blade means "stop"; "do not pass here," except where the automatic is in use. When train orders are to be given to the trainmen is not the present practice sufficient, viz., bringing the train to a stop at the signal, then lowering it and presenting a hand signal to bring forward the train to the desired point?

Drawbridges might be protected where possible by a turnout track, diverting instead of derailing a train over-running the stop signal. Where this is not practicable, two stop signals might be used, one in the usual position, and the other some few hundred feet in its rear, to give trainmen a chance, in case of an accidental over-run. The best plan of all would be to keep a train back a section when a draw is open.

In the placing of signals they should be so arranged as to render it impossible for there to be any mistake as to the tracks they are intended to govern. The ideal plan is, that every signal shall be in the same vertical and lateral position in relation to its track. Exact uniformity in this respect is obviously impracticable, but this ideal should be adhered to as nearly as possible in all cases.

"Home" or "stop" signals may be either two or three position, but never more than one on one stand or post. A distant signal for the next section may be placed on the same post. At points where two or more high and moderate speed tracks diverge there should be a home signal for each track, each signal on a separate post supported on a bracketed post, and the distant signals similarly arranged. These signals should be as near together as practicable. This arrangement is consistent with the requirements of only one home and one distant signal on one post. One or more of the diverging routes may consist of a short section requiring a distant signal on the home signal post at the point of divergence, and with this plan this can be provided. The curves of some of the routes may be such as to admit of the highest speed being maintained. Another or others may have curves necessitating slowing down. A distinction for these can be provided by elevating the high-speed signals above the horizontal line of the slow-speed signals. Where one of the diverging tracks leads into a freight yard a dwarf signal might be used, placed at the foot of the bracket post and a screen placed before it so that it would be obscured from the sight of the approaching engineer until within any distance that might be determined by conditions of grade and so on.

In signaling parallel tracks the signals should be as far apart

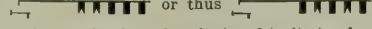


laterally as the distance between track centers. Where space permits separate posts can be used, and in the absence of sufficient space the signals should be supported by a bridge spanning the tracks. Thereby a distinction is maintained between signals for diverging and signals for parallel tracks.

With regard to the distinction between automatic and non-automatic signals, is not the present distinction, a number on the signal, sufficient? It is only when the signal is in the danger position that a distinction is needed. When a signal is in the danger position the engineer is required to stop his train. In the case of an automatic signal he is permitted after a lapse of time to proceed past the signal in its position of danger. During this period of waiting he can surely distinguish, by the presence or absence of a number, whether the signal is automatic or non-automatic.

The arrangement of signals I have here suggested has the advantage of uniformity and is adaptable to the most complex arrangement of tracks as well as a simple one. For instance, let us assume the layout sketched above, showing a suggested arrangement of signals in which all of the signals are for westbound movements on Track No. 2. This arrangement is a common enough practice but is not uniformly adopted by all railroads.

The alternative signal would be, according to some practice, thus


or thus

with varying rules as to the application of each signal to its track. To avoid a little extra cost some companies are led into the use of obviously mystifying arrangements such as those shown by the two smaller sketches.

Now in regard to the distinction between the home and the distant signal. The distinction at present is obtained by using for night a green light for the distant and a red light for the home. For day a green painted forked blade for the distant and a red painted square ended blade for the home. A signal engineer of long experience and excellent standing on one of the principal railroads in this country has advanced the opinion that this distinction for the day signal is inconsistent, and I think he is right. The fact that the distant signal is simply a cautionary signal has been established by the use of the green light at night. By day a semaphore signal is undoubtedly what is known as a position signal, that is, the blade in the horizontal position indicates "danger." Inclined at about 45 deg. below the horizontal, indicates "caution." Nearly vertical indicates "clear." Therefore the proper distinction for a distant signal is to construct it so that its two positions are, for caution, about 45 deg., and for clear, nearly vertical. Under this arrangement (position, not color being the sign) the blade could just as well be painted red, the most assertive color obtainable. Apologizing for taking up so much of your valuable space, I am, etc.,

HENRY JOHNSON.

The Tax on Alcohol Used in the Arts.

New York, Oct. 24, 1905.

To the Editor of the Railroad Gazette:

A movement is now being carried on by a committee of American manufacturers to secure the removal of the tax from alcohol rendered unfit for beverage purposes. No other national legislation now suggested would be of more value in stimulating the industrial development of this country than the freeing from taxation alcohol rendered unfit for internal use by the admixture of some poisonous substance. Indirectly the railroads of the country would be benefited by the largely increased volume of freight traffic, consequent on the establishment of new industries which cannot now be carried on profitably in this country, owing to the high cost of alcohol,

and the development of many existing industries, the sale of whose products is necessarily limited by the excessive price of this important material.

It is estimated by competent authorities that within a very short time after the enactment of legislation for this purpose at least 100,000,000 gallons of alcohol would be used annually for industrial purposes. This would, of course, mean much additional freight for the railroads, besides the carrying of corn and other products to the distillers.

One phase of this subject, which is of special interest to railroad companies, is that of furnishing an unlimited supply of excellent motor fuel for internal combustion engines, for motor vehicles, power boats and launches, and engines for running farm machinery of various kinds. Some of the railroad companies have already begun experimenting with the gasoline engine for rail motor cars, and the American Locomotive Company is about to engage in the manufacture of internal combustion motors.

The price of gasoline has more than doubled within the past ten years, and with the increasing consumption of that material by motor vehicles, power boats, farm engines, etc., coupled with the decreasing supply of petroleum from which the lighter distillates can be secured, there is serious danger of a yet much greater increase in its cost. The supply of alcohol is unlimited, as it can be distilled from corn, potatoes, beet sugar waste, sorghum and many other farm products.

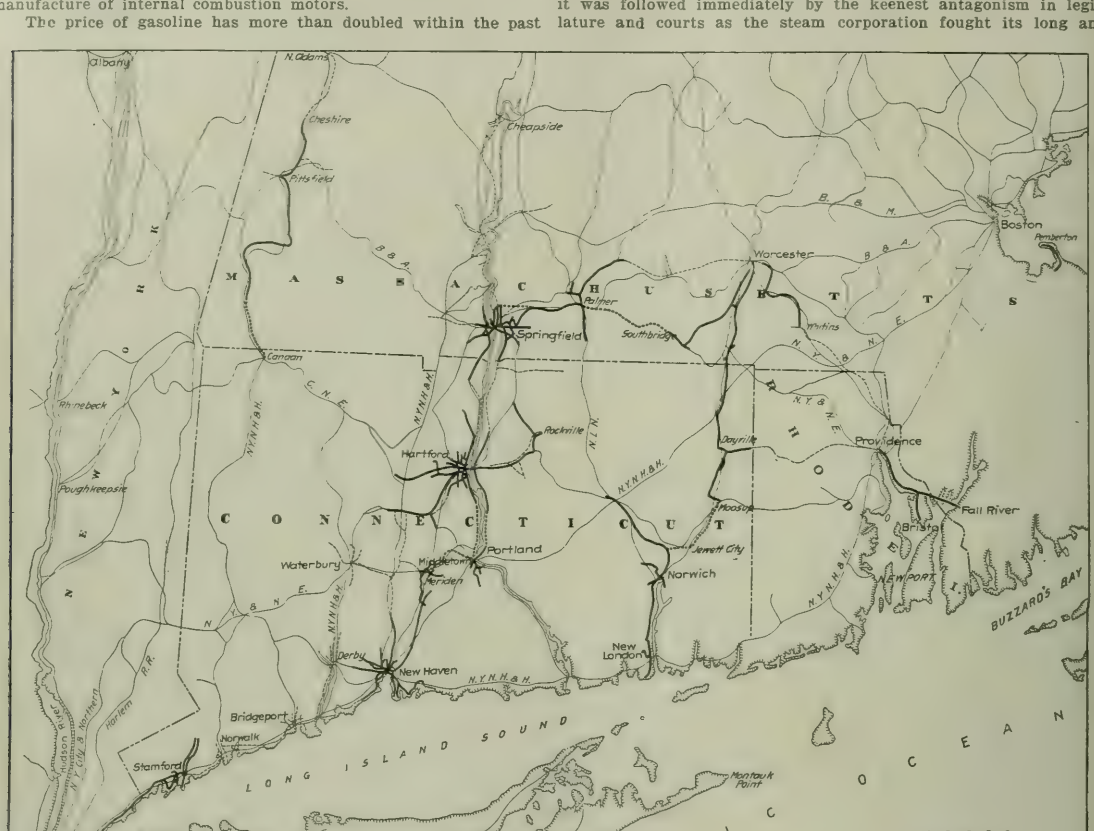
This movement relates wholly to the removal of the internal revenue tax from a domestic material, and has nothing to do with the duty on foreign alcohol.

A matter of secondary interest to the railroads is that considerable quantities of alcohol are used in the manufacture of cars, in the form of shellac varnish, and in all the railroad repair and machine shops, etc. At present, owing to the tax of $2.07 per gallon of grain alcohol, wood alcohol costing 90 cents or $1 per gallon is used. This is an inferior product, and it can only be sold because it is not taxed. Under the proposed legislation denaturized alcohol costing not more than 25 cents, and probably somewhat less, would be substituted for the inferior wood alcohol, thus effecting a considerable saving, and giving a much better material.

HENRY DALLEY, *Chairman.*

The New Haven's Electric Railway System.

The story of the upbuilding of what is now the great electric railway system of the New York, New Haven & Hartford Railroad Company goes back for almost 15 years and includes three pretty distinct periods of which the last has been a rapid and dramatic one. The first period runs back to the early onset of the new trolleys on the old steam road. It was an epoch when a considerable part of the local passenger business of the steam corporation was cut to pieces by the aggressive and advancing trolleys; and it was followed immediately by the keenest antagonism in legislature and courts as the steam corporation fought its long and



The New York, New Haven & Hartford's Electric Lines.

Parthian battle in resisting electric parallels. During this period President C. P. Clark adopted the plan of buying in local trolley systems in Connecticut to break up, if possible, electric parallel projects on a large and, potentially, "long distance" scale. But his purchases were meagre. They included only the Meriden and Stamford street railways—of but some 27 miles taken together and both on the main stem of the steam corporation. To this period belongs also the costly third-rail experiment of Mr. Clark on the Nantasket branch which has been a substantial failure; and the expensive but more successful third-rail line between Hartford and New Britain—with later extension to Bristol—which will be briefly referred to hereafter.

The second period, which included the comparatively brief administration of President John M. Hall, had two electrical features, one of them unique. He electrified by trolley the Providence, Fall River and Bristol lines which have done a large business, especially between Providence and Fall River; and he started a novel venture

in self-parallelism by building a competing trolley line in northeastern Connecticut under the charter title of the Peoples' Tramway Company, paralleling a part of his Norwich & Worcester (steam) division. The project included the construction of large water works for the general supply of electric power and, more remotely, lateral lines to factory villages to furnish a freight business to the Norwich & Worcester, which is essentially a freight road. The enterprise in a narrow and fiscal sense has not been successful even as expanded by President Mellen. But it has served as an important geographical outpost for protection against rival schemes; it has considerable opportunities for profit when extended southward to join the Norwich and New London systems, themselves united by the Montville railway; and it supplied the liberal and expansive charter, later amended with enormous additional powers, which is the basic charter on which almost the whole big electric system of the New Haven corporation rests.

When President Mellen became head of the New Haven corporation two years ago his company owned but three trolley lines—the Stamford and Meriden properties and the Peoples' Tramway line, the whole represented only by about 43 single track miles, those figures not including, however, former steam lines electrified. The policy of the new president was then cryptic. He had been quoted as opposing the whole Clark policy in regard to electrics, but he has stated recently that he disapproved only of the early electrification of steam lines. But his policy very quickly was proclaimed. He entered almost immediately on the purchase of trolleys, especially those of a competing character, and has carried it forward on a scale that has dwarfed not only the accomplishments but the projects of his predecessors. Leaving for later consideration stock and floating debt the annexed table of electric lines now under New Haven ownership or control shows what has been done in the short span of 18 months as measured by track mileage and funded debt:

	Miles of track.	Funded debt.
Constituent Companies.		
Worcester & C. E. Ry.	30.5	$1,992,000
New Haven system	111.6	1,633,000
Meriden system	20.0	500,000
Norwich system	17.0	350,000
New London system	9.0	150,000
Montville Ry.	10.4	250,000
Middletown Ry.	10.4	180,000
Stamford Ry.	18.3	75,000
Greenwich Ry.	9.1	320,000
East Hartford & Glas. Ry.	9.9	200,000
Suffield Ry.	4.7	.....
Branford Ry.	7.2	370,000
Hartford system	75.9	2,810,000
Total	334.0	$8,830,000
Leased Lines.		
Worcester & Webster Ry.	14.9	$150,000
Webster & Dudley Ry.	5.6	30,000
West Shore Ry.	7.4	30,000
N. Y. & Stamford Ry.	16.3	426,000
Total	44.2	$636,000
Controlled Lines.		
Springfield system	87.0	$1,500,000
Worcester & South. Ry.	27.6	700,000
W. & B. V. Ry.	15.7	.....
Berkshire Ry.	40.1	1,000,000
Willimantic Ry.	11.2	240,000
Total	181.6	$3,440,000
Recapitulation.		
Constituent Companies	334.0	$8,830,000
Leased lines	44.2	636,000
Controlled lines	181.6	3,440,000
Total	559.8	$12,906,000

To the funded debt is to be added $12,275,000 of the Consolidated Railway Company, the great holding corporation under which the New Haven Company has financed the 22 tabulated lines with the exception of the Springfield system, which has been financed under a special holding corporation, the "Springfield Railway Companies." The $12,275,000 is represented, mainly, if not entirely, by issues of what may be called a kind of "blanket" debenture but with a proviso that they must be cared for before the substitution of any underlying mortgage—thus giving the security a consolidated mortgage quality. That sum carries the total funded debt up to $25,181,000, about half of it underlying bonds of the merged lines. The figures of mileage, by recent extensions and additions, it is stated officially are carried up to about 588; and, if to this are added electrified steam lines, the total rises to nearly or quite 700 miles. In the street railway lines alone the system inherited by President Mellen has grown from about 43 miles to 588 miles during a year and a half of his administration—figures which, standing by themselves, show the magnitude and boldness of his work.

The task of computing the real stock capitalization is extremely difficult as so much of the original stock of merged corporations has been issued for holding purposes only. The $10,000,000 of Consolidated Railway stock stands, however, against about the same amount of the steam corporation's debentures issued to buy up the New Haven trolley system. The steam company, in addition, has other stocks of the various railway companies amounting to $6,080,170 besides holding $1,212,256 of floating debt, only $78,000 of the latter being in the hands of the public. Owned by the public are also $2,848,300 of stock of the Springfield Railway Companies. Without attempting to squeeze out original water and taking instead actual market values, the appraisal of the 22 merged properties rises considerably above $40,000,000. The first year of operation, incomplete for several of the properties, shows $4,567,978.52 gross, $1,682,356.88 net, and $431,333.65 applicable for dividends from which, deducting $350,000 interest on the steam corporation's debentures a net profit over all appears of $81,333.65—and that after digesting deficits of probably not less than $120,000 in fixed charges of merged lines. For the first two months—July and August—of the present fiscal year the net earnings show a large increase especially marked in the large urban systems as a whole.

A glance at the map will show the motif and coherency of the New Haven's great electric venture. There is a protective outpost in the Berkshires; a long line of electric defence from Worcester southward toward the Sound through eastern Connecticut and soon to be continuous; another through southwestern Connecticut to New York City; and, most important of all, the central fortifications covering New Haven, Hartford and Springfield. Any invading long distance electric line must first pass the flanks and would then find itself practically excluded from the central cities. Two regions of the New Haven steam system are, however, still unprotected. One is Rhode Island, the second the great and intricate system south of Boston, where the former Old Colony system is bunched closely. What President Mellen will do in those uncovered territories is still a question of the future; but enough has been done already to thwart any long distance parallel schemes on a large scale, saying nothing of additional defence obtained by the repeal of the Connecticut general railroad law. An interesting question of the future will be the attitude of Massachusetts as regards the acquisition of trolleys by the steam corporations which was raised but left unsettled by the last legislature of that state. The "Springfield Railway Companies" as a "holding" device may yet supply a test case.

Finally, but by no means least in importance, is the subject of the vantages gained by the New Haven's far excursion into electrics. Those vantages have been along several lines: (1) Harmony of operation between the steam roads and formerly competing electric parallels so as to economize expense and adapt mutually service to traffic. (2) Harmony as to schedules between the electric lines themselves. (3) Centrality of offices and of management doing away with salaries on separate lines—a plan of which has been worked out but has not yet gone into full operation. (4) Economies through the purchase of railway material by large contracts, and (5) simplification of the problems of electrifying short distance steam lines. To illustrate this latter, the question of continuing the third rail on the Hartford-Bristol line changes its bearings now that the steam company owns the Hartford street railway system. All these gains are likely to appear more vividly when two full years of operation of the extensive Consolidated Railway system allows comparison of details. Beyond lies the greater problem of interchangeable traffic when the electric locomotive unifies the street railway with the steam road—an ultimate sharply suggested by President Mellen's coming tentative test of electric locomotives for express passenger traffic between Stamford and New York city.

Circuits for Automatic Block Signals.*

The work of the committee has been the collating of the information called for on blanks which were drawn up by the 1904 committee. The membership for the year 1905 was as follows: E. A. Everett, C. H. Dryden, H. J. Hovey, C. A. Parker and L. R. Clausen. Mr. Clausen was Chairman.

The committee received only 23 answers, and four gave no information. The conclusions relative to the installation, arrangement and maintenance of track circuits are based on a review of the information received.

Relays.

The working parts of relays should be enclosed in transparent dust-proof casing.

A 3,000-volt alternating insulation test should be required between separate insulating parts, and between insulated parts and frame or magnet cover.

Four ohms is a good resistance to use for average conditions, and special conditions may require higher resistance, but it is not advisable to use lower resistance than four ohms.

The following specifications are acceptable:

.06 amp. for raising armature.

.04 amp. at release of armature.

.11 amp. average current through relay in service.

Platinum to carbon front contacts.

Platinum to platinum back contacts.

*From Report of Committee No. 1, L. R. Clausen, Chairman, presented to the Railway Signal Association, at Niagara Falls, Oct. 10-12.

Points should open $^1/_{16}$ in. and armature $^1/_{16}$ in. from poles open.

$^1/_{32}$ in. from poles closed.

Armature pins, bone, $^1/_{32}$ in. long.

Armature stop not adjustable.

Cut sections represent good practice if the relay breaks the circuit and shunts rails of adjacent track circuit.

Relays should be sealed and maintainer not allowed to adjust.

Relay Shelter.

Wood or metal boxes on wood or iron posts are satisfactory.

Where convenient to do so, relay boxes may be supported on signal masts or signal bridges.

If wood boxes are used, one thickness of matched pine with double hinged door, arranged for padlock is acceptable.

If iron boxes are used, single hinged door, ¼ in. thick, and arranged with dust gasket and for fastening the padlock, is satisfactory.

Iron boxes should be lined with wood, and wood board used for relays.

Iron boxes need not be connected to the ground.

All relays should be arranged in relay boxes so that all binding posts are accessible without moving the relay.

Relays may be placed in mechanism cases, if mounted on wood or other insulation.

Batteries.

Two gravity cells in parallel are satisfactory for average conditions, but special conditions may require more cells to be used on a track section.

Four-pound round mercury alloy zincs represent the best practice.

An ordinary flat leaf copper is acceptable, but it is advisable to use a shape of copper that will allow bending of same to prevent pulling upward through the copper sulphate.

Glass jar 6 in. x 8 in. for track cells represents the standard practice.

Track batteries should receive attention every two weeks.

Zincs should have life of one month in track battery service.

Storage cells in glass jars may be used, placed above ground, either in box or enlargement of signal post.

One storage cell on track circuit with one ohm in each leg of the circuit between cell and rail is recommended.

Bonding and Insulation.

The following specifications represent standard practice:

Two No. 8 Washburn & Moen gage E. B. B. galvanized iron wires for bonding purposes, placed outside of splices and inside of rail.

Two No. 6 B. & S. soft copper wire in tunnels, located outside of splices and inside of rails.

Two No. 6 B. & S. soft copper wire inside of splices and outside of rails used through platforms, crossings, etc.

Wire should be 16 in. to 18 in. longer than splice, with expansion loops provided on one end.

Wire should be inside of all spikes and should not be stapled to tie; bends should be made by hand.

Wires not to be twisted together.

Life of wires should be five to eight years under average conditions.

Frogs should be bonded in circuit in series with two wires not twisted which may be stapled to ties if required.

Ten inches to 15 inches slack should be allowed.

Hand switches should be included in circuit and insulated rods used.

Switch points should be bonded into circuit in shunt, two wires being used.

Sidings should be bonded to fouling point in shunt, two No. 8 B. & S. or No. 9 B. & S. copper wires being used for the shunt connection.

Sidings and main line cross-overs should be bonded into circuits whether operated by pipe line from one end or not.

Block signs are not used on sidings.

Switch instrument should be used on all siding derails and at both ends of all cross-overs.

Both ends of main line cross-overs should shunt both main track circuits.

All switch instruments should be arranged to shunt track circuits, two wires being used for connection to each rail and four contacts of the switch instrument if possible.

Interlocking switches and derails should be included in circuit, if expense and complications introduced are not too great, insulated rods being used for the purpose.

The channel pin type of bond plug should be used.

Copper plating of bond plugs is satisfactory, but tin plating may prove better.

Track Insulation.

Type of joints to be used on main line and in yards of terminals to have mechanical and insulating qualities equal to the best standard makes now on the market.

The 24-in. and 26-in. joint with four bolts is found to be long enough for satisfactory service.

One common fiber end post is sufficient with some types, others require two.

On light traffic sidings six bolt wood joints are satisfactory.

Joints need not be oiled and will give two to three years life under average conditions.

Fiber plates have life of one year under average conditions.

End posts six to nine months.

Electric crossings should be cut out of circuit, one joint in series being used for this purpose.

The effect of the high potential circuit on electric line rails may be reduced or nullified by one of the following methods, or combinations of the same:

A. Bonding the rails of the electric line together.

B. Introducing more insulated joints in the steam line.

C. The locating of track battery at crossing.

D. Using 16 ohm relay at crossing and breaking block wire through same.

E. Grounding sections of track of electric line.

F. Grounding sections of track of steam line.

G. Shunting street railway rails.

H. Introducing extra battery on track.

I. Removing ballast from rails of steam line.

J. Inspecting bond wires on steam line and keeping same in good condition.

K. Providing better path for high potential current on electric line.

No special devices are used to insulate track circuits through platforms or crossings.

For insulating rails from steel bridges, wood blocks or fiber insulated bolts, with wood or fiber shims below the rails are used.

Nearly all lines report trouble with foreign current, and the various methods for taking care of the trouble are enumerated immediately above in connection with electric crossings.

Battery Shelter.

Both chutes and wells may be used for housing track battery.

Chutes should be cylindrical, of cast-iron.

Nine in. by 7 ft. for two cells and 9 in. by 8 ft. for three cells is satisfactory under ordinary conditions with a maximum depth of frost of five feet.

Where four and six cells are used, two chutes placed side by side should be used.

Walls of chutes should be ¾ in. to ½ in. thick.

Chutes should be placed with top 9 in. above ground, and frost covers used.

It is not practicable to use air tight chutes with a view of reducing the evaporation.

The connections in chutes should be fastened in connectors to keep them from grounding on chutes.

Wood elevators provided with rope for raising are satisfactory.

Lamps in chutes, manure, mineral wool, or similar material placed in and around chutes are recommended for protection against extremely cold intervals.

It is recommended, however, that the chutes be placed below the frost line.

Insulated Wire Connections.

No. 8 B. & S. or No. 9 B. & S. rubber covered copper wire should be used for track circuit; same size being used for all purposes, except battery chutes.

Two wires in parallel should be used around switches or crossings and other siding connections for each side of circuit.

Thickness of wall of rubber insulation recommended as $^3/_{32}$-in. for No. 8 B. & S.; $^5/_{64}$-in. for Nos. 9, 10, 12 and 14 B. & S.

One layer of braid should be provided.

No. 12 B. & S. standard wire should be used in chutes of approximately 18 strands.

Smaller wire for relay connection need not be used.

Wires may be placed either above or below surface of ground. Both are considered good practice.

Track Connections.

Twelve-inch slack is allowed for track connections.

Soldered joints at track connections should be poured.

Iron wire should be used for track connection to the rail and connections should be made three feet from rail joint.

Trunking.

Forty per cent. extra space should be provided in trunking containing track wires.

Stakes for supporting trunking should be 7 ft. apart and trunking 2 to 3 in. clear, if placed above the ground.

Bevel joints should be used, placed directly over supports and carried on a supporting piece.

Three x 3 inches is a good size trunking for track wiring.

Trunking should not be painted inside.

Trunking should be painted outside.

Trunking should not be nailed in slots, but through sides.

When crossing track, trunking should be placed 1 in. below rail.

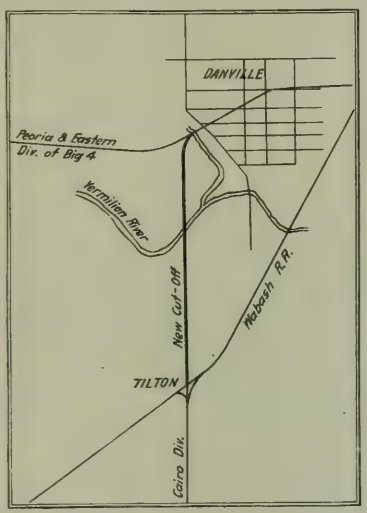
or 16 in. below rail, depending upon whether it is run above or below the ground.

White or yellow pine and redwood are satisfactory for this purpose.

With a few changes the association adopted this report, except the part concerning relays, which was referred back because the difference between .04 ampere and .06 ampere was deemed too small a difference for practical service. On the second specification under the head of bonding in tunnels, there was some discussion as to the use of copper, which is very liable to accidental breakage. One member uses in tunnels two copper wires and one galvanized iron wire; and he moved that this be the recommended practice, but as another member had found that galvanized iron would rust out in two or three weeks the motion was lost. It was voted that all bond wires should be fastened to the web of the rail. It was voted that the bonding from the main line to sidings should be of No. 6 wire instead of No. 9. A similar proposition for the use of larger wire was made at other points but was not approved by the meeting. The last specification under track connections, was made to read "not less than 3 ft."; and the second paragraph, under trunking, was made to read "not over 7 ft. . . . not less than 3 in." After these and a few verbal changes the report was adopted and the committee directed to prepare specifications.

Rebuilding the Cairo Division of the Big Four.

The Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis extends from Cairo to Tilton, Ill., 258 miles. At Tilton it joins the Wabash and uses its tracks into Danville, about two miles farther north. Originally it was composed of several small roads, including the Cairo & Vincennes, the Danville & Southwestern and the St. Francisville & Lawrenceville, built 35 to 40 years ago. They were consolidated and taken over by the old Wabash, St. Louis & Pacific and operated as its Cairo division for a time. In 1885 it was surrendered by the Wabash, pending foreclosure, and for four years was operated by order of the court as the Cairo, Vincennes & Chicago. It was reorganized in 1889, and shortly after its reorganization, control of it was acquired by the Big Four, which has operated it ever since as its Cairo division. In addition to the main line there is a branch from St. Francisville to Vincennes, eight miles. A map of the line is shown herewith.



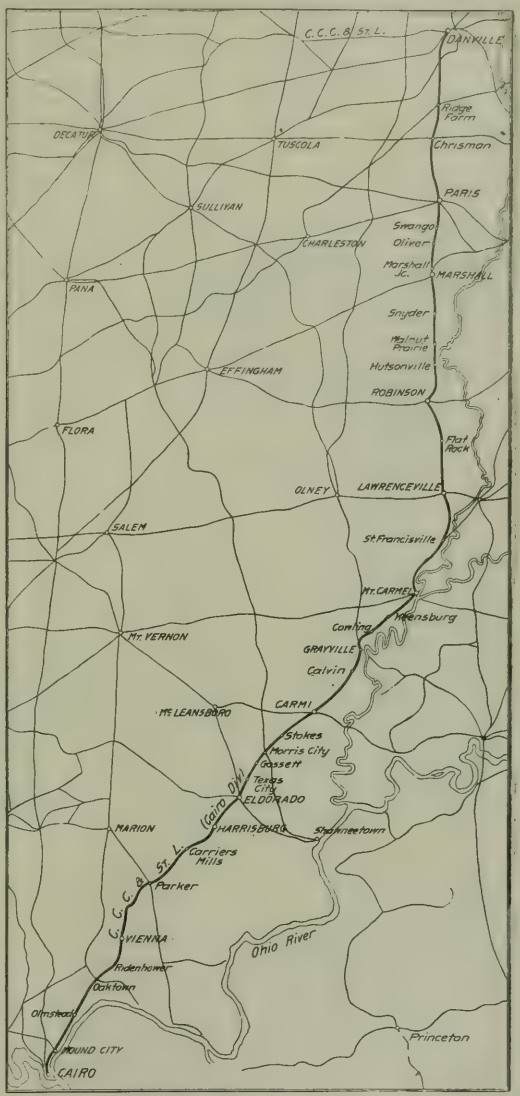
Cairo Division Connections at Danville, Ill.

Up to the present time this division has been one of the weaker members of the Big Four system. It was a light single-track line with numerous heavy grades and curves, and full of sags. It was largely dirt ballasted, no rails were heavier than 60 lbs., and the bridges, which were mostly trestles, were all wood. The line did not contribute a paying traffic and no money was spent to improve it.

However, with the development of the immense coal fields surrounding Harrisburg this line acquired a new value, which was greatly augmented by the purchase by the Vanderbilt interests of an immense tract in this new coal bearing region. To take advantage of the traffic possibilities, a low-grade direct line to Chicago was needed. This will be obtained in conjunction with the Indiana Harbor, also a Vanderbilt property, which was formerly a Chicago belt road but which is now being extended to Danville, and will parallel the Chicago & Eastern Illinois from that point to Chicago.

The Cairo division of the Big Four north of Harrisburg is being entirely rebuilt in order to convert it into a line adequate to the needs of the enormous traffic which will be available. Grades are being reduced from 1.5 per cent., the former maximum, to 0.3 per cent. northbound and 0.5 southbound; curves are being reduced or eliminated, the maximum on the new line being 2 deg., and the majority 1 deg and under; all new bridges are of permanent construction, concrete masonry being used throughout, the majority of the structures being entirely of plain or reinforced concrete. The entire line will be relaid with heavy rails, and ballasted.

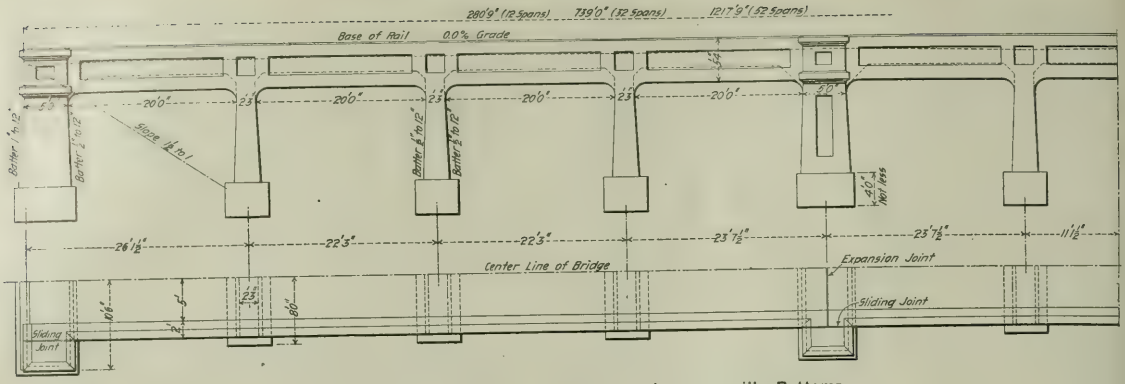
The work, which is being done with the minimum possible disturbance to traffic, may be said to consist of three classes. The first of these, involving no change of grade or location, the railroad company is doing itself. It consists of standardizing the banks and cuts, putting in new track, and ballasting. The second class involves offset locations in order to make grade and curvature revisions without interfering seriously with traffic. The amount of the offest depends, of course, on local conditions such as the amount of grade and curvature change, etc., but will average



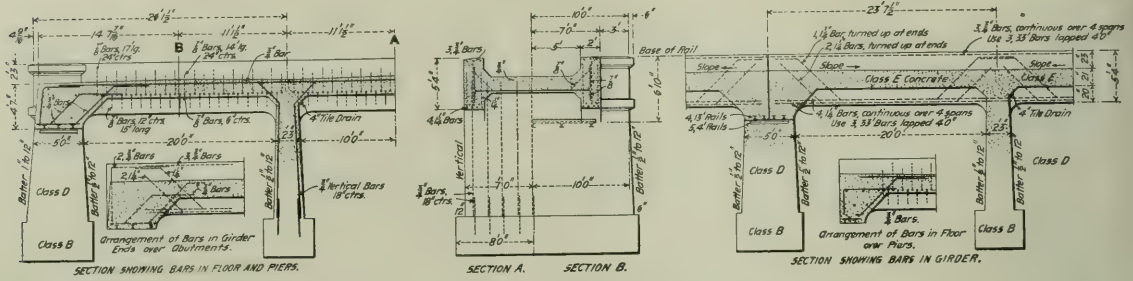
Map of the Cairo Division of the Big Four.

about 25 ft. This offset location work wherever it occurs has necessitated widening the right-of-way, by the purchase of additional land. The third class requires entire relocation of the line. This is being done at a number of points. The net result of this on the total length of the line will be to shorten it about three-quarters of a mile. The distance from Danville to Harrisburg is 199 miles.

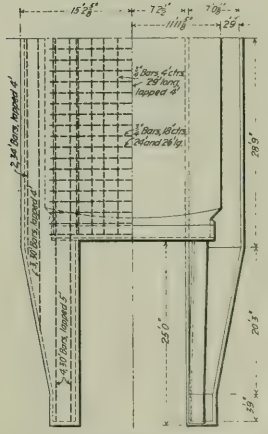
Taking Danville as the initial point in considering the improvements, one of the most important pieces of work is being done here. The Danville situation is outlined in one of the illustrations, which shows a small section of the town near its center, and the railroad connections most closely affecting the Cairo division. As al-

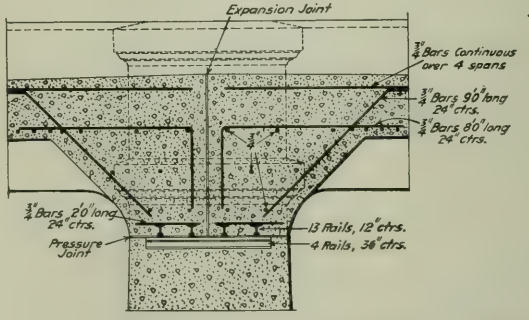


Reinforced Concrete Girder Viaduct over Lawrenceville Bottoms.

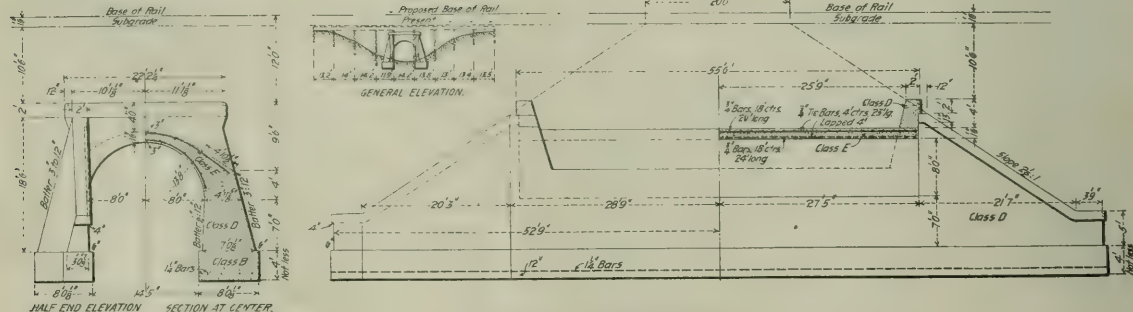


Details of Reinforced Concrete Girder Viaduct over Lawrenceville Bottoms.




Expansion Joint
⅞" Bars Continuous over 4 spans
¾" Bars 90" long 24" ctrs.
¾" Bars 80" long 24" ctrs.
¾" Bars 20" long 24" ctrs.
13 Rails, 12" ctrs.
4 Rails, 36" ctrs.
Pressure Joint

Detail of Expansion Joint in Lawrenceville Bottoms Viaduct.



16-ft. Reinforced Concrete Arch.

ready mentioned, this line now ends at Tilton, using the Wabash into Danville. From Tilton a cut-off about 2½ miles long is being built due north into Danville to connect with the Peoria & Eastern division of the Big Four. The new Indiana Harbor line will join this same division a little farther east. The building of this cut-off involves the construction of what will be a notable reinforced concrete arch bridge across the Salt Fork of the Vermilion river. It will be a three-arch structure, containing one 100-ft. and two 80-ft. arches, and will be 90 ft. high above the bed of the river. The new line will go under the Wabash and also under a trolley line and a street. This involves some heavy cutting, the material from which is being hauled across the river and dumped from a trestle 85 ft. high to form the approach to the Vermilion river bridge. This piece of work will involve 500,000 yds. of earthwork and 12,000 yds. of masonry.

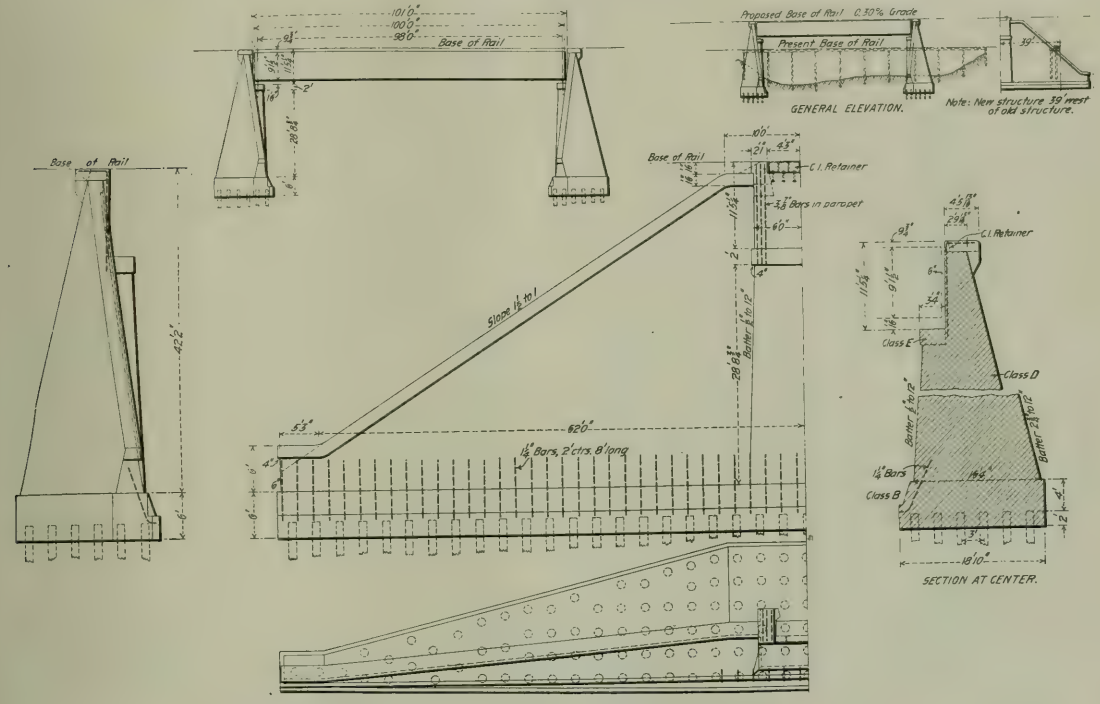
The next large piece of work will be just north of Paris, where about three miles of offset location occurs to revise the grade, which is now 1 per cent. maximum on this section. Beginning a short distance south of Paris and extending to Oliver there will be about six miles of relocation. A part of this is to avoid Swango Hill, where there is a northbound grade of over 1 per cent. about 1½ miles long. A uniform grade of 0.3 per cent. will be established on the new line. There will be about 250,000 yds. of earthwork and 1,600 yds. of masonry.

Another relocation stretch of about equal length, involving 200,000 yds. of earthwork, begins about 2½ miles north of Marshall Junction and extends 3½ miles south. The new line will include a steel viaduct over Big Creek about 400 ft. long and 80 ft. high, the plans for which have not yet been made. From Snyder to Walnut Prairie about 3½ miles of offset location, involving 175,000 yds. of earthwork and 2,600 yds. of masonry, is being done to reduce the present 1 per cent. northbound grade. A similar stretch is being done at West York. Between Robinson and Flat Rock there will be about 6½ miles of relocation, and on each side of Lawrenceville there will be relocation stretches amounting in all to about four miles. This work takes the line through the Lawrenceville bottoms where much trouble from washouts has been experienced in the past. To avoid difficulties on the new line from this source, about 2,200 ft. of reinforced concrete trestle will be built, there being three structures approximately 1,200 ft., 700 ft. and 300 ft. long respectively. The materials to be handled will approximate 300,000 yds. of earthwork and 10,000 yds. of masonry. The work will include a crossing of Embarras river.

At St. Francisville there will be about three miles of relocation, involving 140,000 yds. of excavation, to reduce excessive curvature and the present grade of 1 per cent. each way. The Vincennes branch, which starts here, will have to be extended a short distance west and a new Y put in for connection to the new line.

Beginning about a mile north of Mt. Carmel and extending beyond Keensburg, there will be about 10 miles of offset location for grade reduction. South of Cowling about one mile of relocation will be done. Starting at Grayville there will be a stretch of about three miles of offset location, another stretch of six miles from Calvin south, and a similar stretch from Carmi to Stokes, all for grade reduction. The last-named stretch will join the Stokes-Texas City relocation, which is about 12 miles long and the longest relocation stretch on the line. This makes about 18 miles of continuous new work on this section. The primary purpose of the relocation work here is to avoid Gosset Hill, about five miles north of Texas City. The present line climbs over this hill on a 1¼ per cent. grade about two miles long northbound, and has four heavy curves, two being 4 deg. and two 3 deg. The new line will run around this hill, passing about a mile to the east of the present line.

The plans outlined in the preceding paragraph involve some heavy work, the Mt. Carmel-Keensburg piece having about 275,000

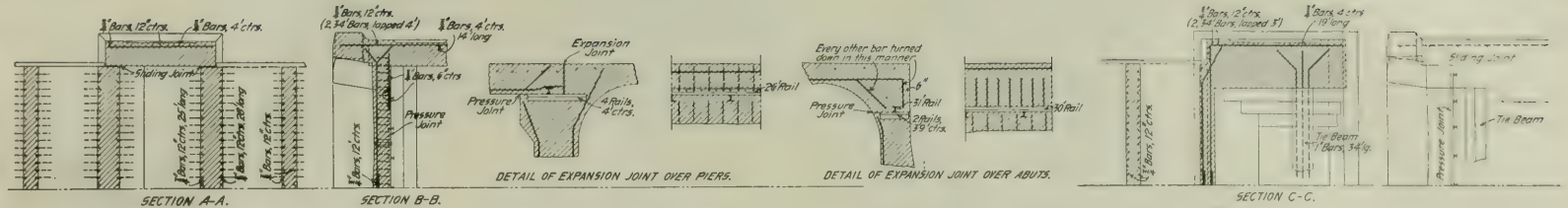


Bridge No. 146 and Details of the Concrete Abutments.

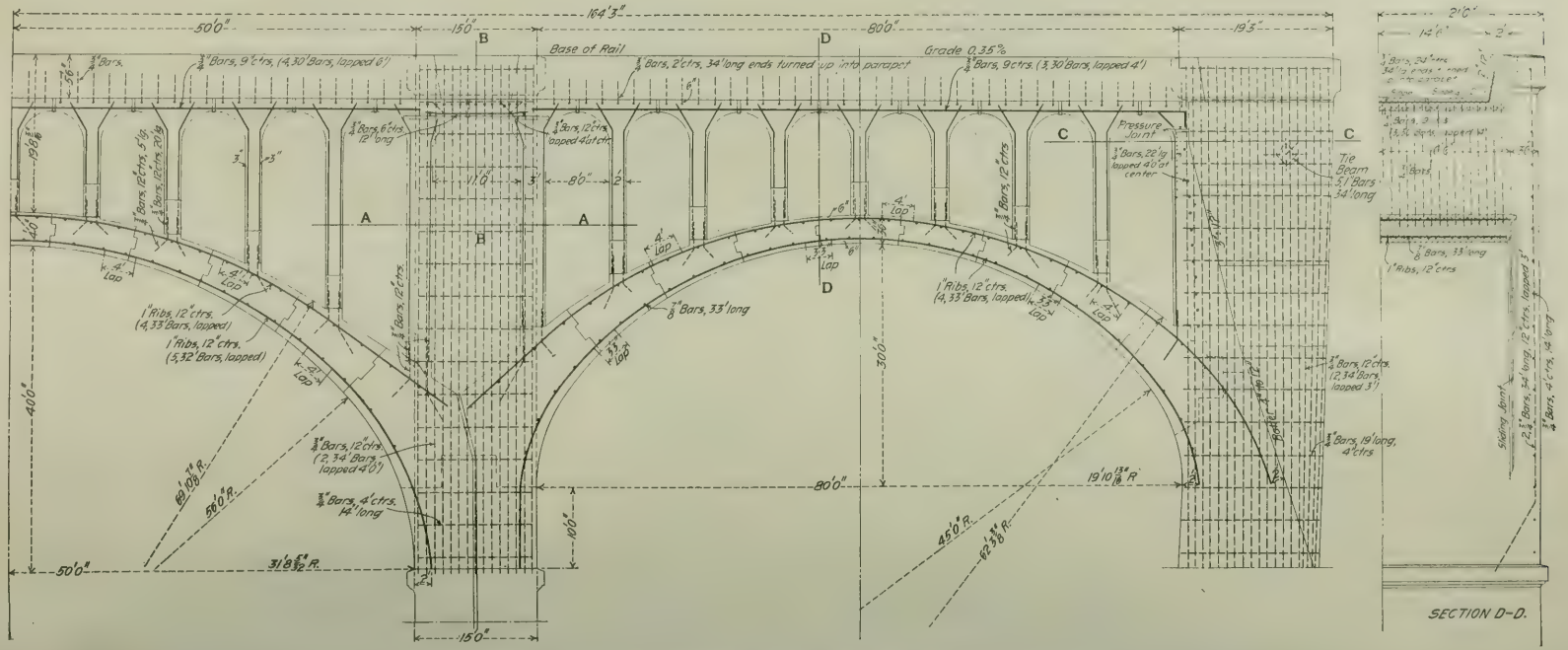
yds. of earthwork and 1,700 yds. of masonry; the Grayville offset about 270,000 yds. of earth and 3,000 yds. of masonry; the Carmi-Stokes offset about 195,000 yds. of earth and 3,500 yds. of masonry; and the Stokes-Texas City relocation about 540,000 yds. of earth and 6,000 yds. of masonry. In addition to what has been enumerated for the entire line there will be numerous short stretches of offset location work for grade revision and flattening of curves. The total estimated amount of materials involved in the entire work is 4,000,000 yds. of earthwork and 75,000 yds. of masonry.

The line will be gravel ballasted, the company having a large gravel pit at West York. It will be laid with 80-lb. and 90-lb. rails. The former will include about 75 miles of 80-lb. rails taken from the St. Louis division of the road. The remainder of the work will be laid with new 90-lb. rails.

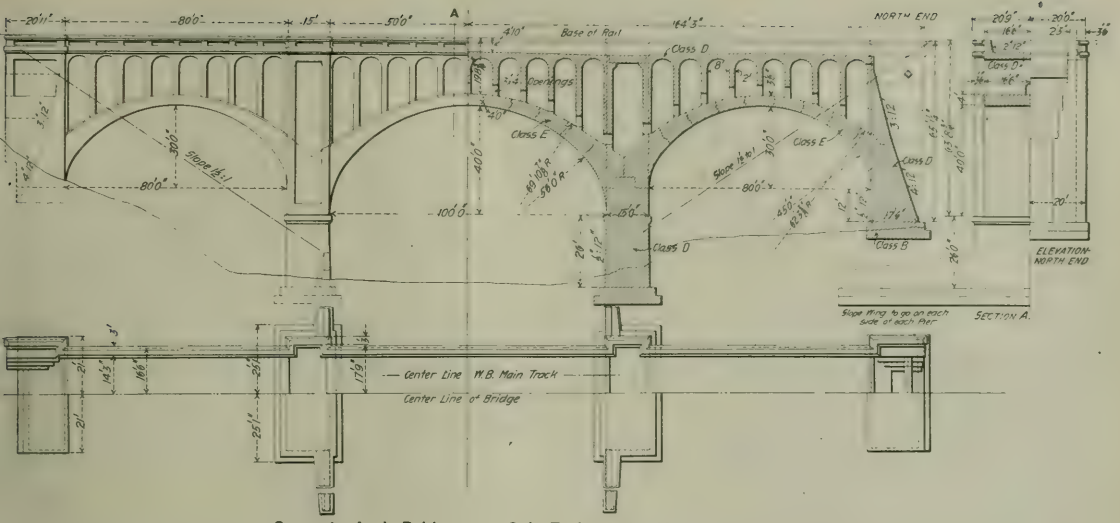
Perhaps the most interesting features of the work will be the concrete bridges, typical examples of which are illustrated herewith. Two of these designs—the Vermilion river bridge and the Lawrenceville Bottoms trestle—have already been mentioned. The first is a symmetrical three-arch double-track structure, the 80-ft. arches flanking the 100-ft. central arch. A three-centered arch is used, the smaller ones being 30 ft. high above the springing line, and the larger one 40 ft. The thicknesses at arch crowns are 3 ft. 6 in. and 4 ft. respectively. The spandrel arches are 8 ft. The bridge is designed as a plain concrete structure, the Johnson corru-



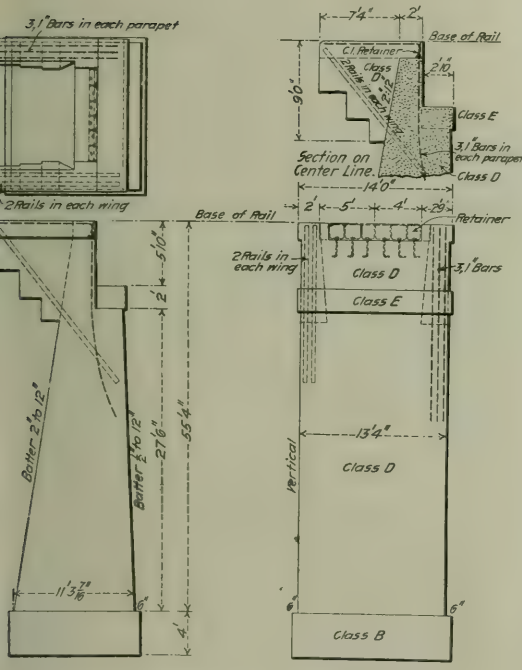
Details of Steel Reinforcement in Vermillion River Concrete Arch Bridge.



Details of Steel Reinforcement in Vermillion River Concrete Arch Bridge.



Concrete Arch Bridge over Salt Fork of the Vermillion River.

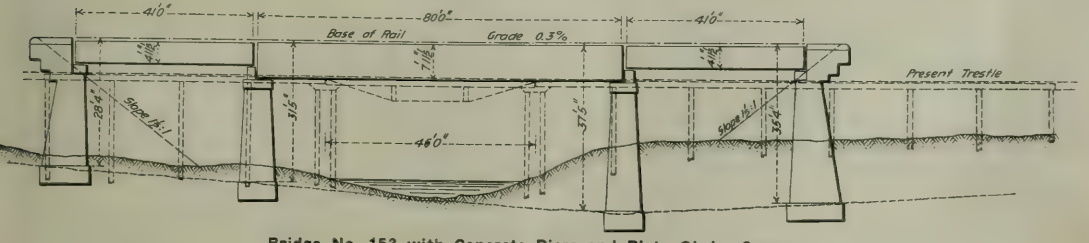


Details of Abutments for Bridge No. 153.

gated steel bars used being a precautionary measure only. Three mixtures or classes of concrete are used in the bridge, being designated on the drawings as classes B, D and E respectively. The first of these is a 1 cement-9½ gravel mixture, equivalent to a 1-4-8 stone mixture. Class D is a 1-6½ gravel mixture, equivalent to 1-3-6 stone, and class E is a 1-2-4 stone mixture. The first is used for foundations, the second for abutments, wing walls, bench walls, etc., and the third for arch rings, box culvert covers, girders, etc. The foundations for this bridge are carried down to shale. For the piers, the foundations are spread at the bottom to 25 ft. 2 in. for the north abutment to 22 ft. 6 in. and for the south abutment to 18 ft., due to the difference in elevation of the abutment footings.

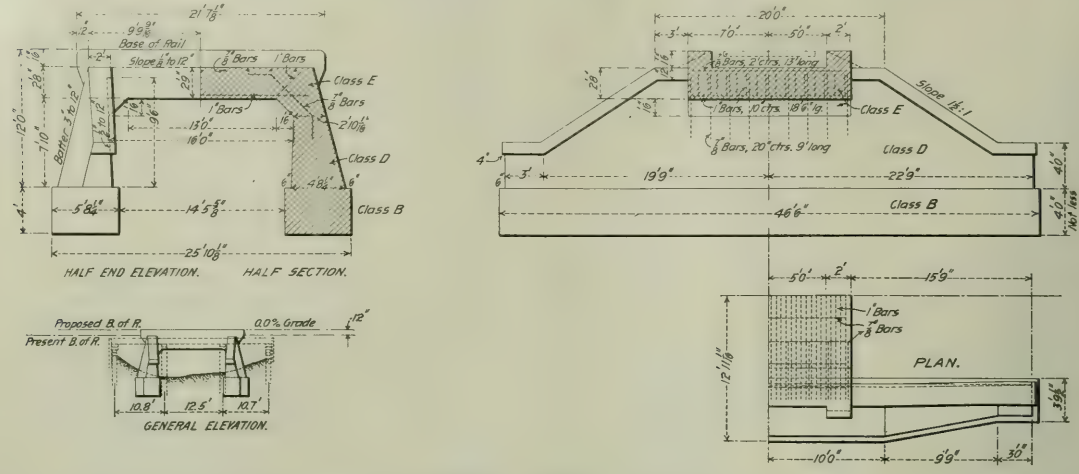
The piers up to the arch haunches are class D concrete, as are the abutments, spandrel arches and entire upper structure. The half longitudinal section shows the manner of putting the voussoirs into the arch rings, the numbering on the different sections indicating the sequence. Details of novel expansion joints over the piers and abutments are shown. For the abutments the pressure surfaces have lengths of 60-lb. rail imbedded in them, the upper surface having one 31-ft. length placed transversely, ball down, and the lower surface 2-ft. lengths placed longitudinally, 3 ft. 9 in. on centers. In each case the balls extend ⅛-in. from the surface of the concrete, which has a smooth flat finish to enable contact to be made at the rails only. Two layers of felt are placed between the surfaces. The arrangement for the piers is similar except in the lengths and spacing of the rails. The cross walls of the spandrel arches have each a 4-ft. x 3-ft. 4-in. arched opening to form a passageway between arches. The position of the embankment slope at each end of the bridge is indicated, from which it will be seen that the end arches will be from one-half to two-thirds filled up. These flanking arches are primarily to take the slopes of these embankments and are not necessary as a waterway. The bridge will contain approximately 11,000 yds. of concrete.

The most novel structures on the line are the Lawrenceville Bottoms trestles, all three being similar in design and differing only in length. Each is, in effect, a series of 20-ft. boxes joined into a continuous structure. The longest will have 52 spans, the next 32 spans, and the shortest 12 spans, their lengths over all being 1,217 ft. 9 in., 739 ft. and 280 ft. 9 in. respectively. The height from top of foundation to base of rail varies from 10 ft. to 14 ft. 6 in. due to irregularities of the ground surface. Other pier and footing dimensions vary to correspond. For the box tops, instead of slabs



Bridge No. 153 with Concrete Piers and Plate Girder Spans.

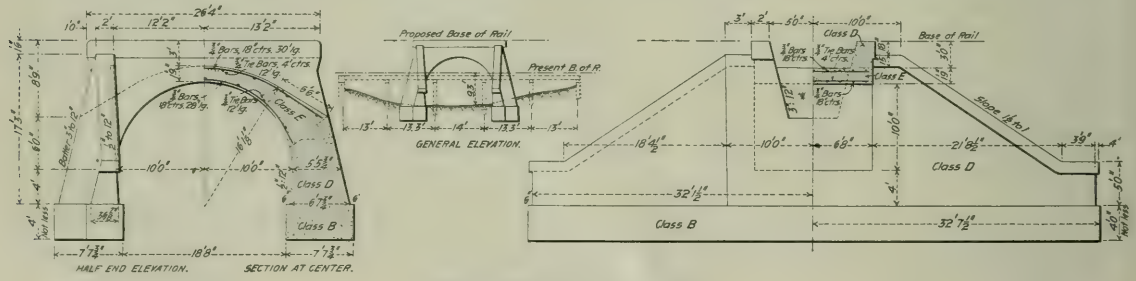
a reinforced concrete through girder design is employed. There are two girders 5 ft. 4 in. deep and 2 ft. wide, with a 1-ft. 9-in. floor between, integral with the girders. The top of the floor is 1 ft. 11 in. below the girder top and its bottom is 1 ft. 8 in. above the girder bottom, a heavy fillet being provided at the corners where floor and girders join. The width outside of girders is 14 ft. The girders, of course, form the coping for the structure, and it is claimed that the design is economical of material. Johnson corrugated steel bars varying from ¾ in. to 1¼ in. are used for reinforcing, their disposition being shown in the various sections and details. Expansion joints are provided over the abutments and at every fourth pier, similar in design to those used in the Vermilion river bridge, except that there are three transverse rails over the abutments



16-ft. Reinforced Concrete Box Culvert.

and four over the piers, and the longitudinal pieces are spaced 3 ft. on centers. The three classes of concrete are used in these structures in the manner already stated: Class B for the foundations, class D for abutments and piers, and class E for the girders and floor.

All of the smaller structures are box culverts or arches, typical designs of which are shown. Also, two designs of abutments for steel girder bridges are included. In one of these the projecting parapet wall, first used on the Chicago, Indianapolis & St. Louis Short Line work of the St. Louis division of the Big Four (*Railroad Gazette*, March 11, 1904), is employed. Each wing is reinforced by two lengths of rail, and by three 1-in. corrugated bars along the upper surface of the parapet and extending down into the abutment is shown. Both designs have a cast-iron retainer or curb



20-ft. Reinforced Concrete Arch.

placed transversely between parapets at the outer edge of the masonry to permit the standard depth of ballast to be used over the front wall of the abutment.

The contract work has been let by sections as follows: Danville-Tilton, grade work to the McArthur Brothers Company, Chicago; masonry to the Bates & Rogers Construction Company, Chicago. Tilton-Allandale, grade work to W. J. Oliver, Knoxville, Tenn.; masonry to the Collier Bridge Company, Indianapolis, Ind., except the Lawrenceville Bottoms work, which was let to Wells Bros. & Brown, St. Louis, for earth, and Moore & Mansfield, Indianapolis, for masonry. Allandale-Harrisburg, grade work to Walsh & Johnson, Davenport, Iowa; masonry to the Widell-Finley Company, Chicago. Mr. F. W. Smith, Division Engineer of the Construction Department, is in immediate charge of the work, under the direction of Mr. W. M. Duane, Superintendent of Construction. Acknowledgments are due Mr. G. W. Kittredge, Chief Engineer of the Big Four, for the data for this article.

Transportation of Explosives.

A special committee, appointed by the President of the American Railway Association last April, has made an exhaustive study of the subject, and, in a report presented to the association at its Chicago meeting, October 25, says that a general code of regulations for the transportation of explosives ought to be adopted by all of the railroads of the country. A set of regulations has been compiled; and while the committee, for reasons given, does not recommend final action, it is desirable that all railroads adopt the new rules, as far as practicable, without delay. Before final action is taken it may be found desirable to ask Congress for a Federal law regulating the transportation of explosives.

The committee making the report consists of Messrs. James McCrea, Pennsylvania Lines; A. W. Sullivan, Missouri Pacific; A. H. Smith, New York Central; N. H. Maher, Norfolk & Western, and Dr. Charles B. Dudley, Pennsylvania Railroad. The regulations presented are in their main features similar to those recently adopted by the Pennsylvania Railroad and noticed in the *Railroad Gazette* of July 14 last, page 43. The report is supplemented by a report from Dr. Dudley embodying a highly inter-

esting study made by him of all the conditions surrounding the transportation of explosives; also a report made by Dr. Charles E. Munroe, of George Washington University; President Henry S. Drinker, of Lehigh University, and Dr. Charles F. McKenna, of New York City, who were called in as expert advisers; two pages of the views of manufacturers; a list of 165 establishments which make explosives, of which 57 are in the State of Pennsylvania; an abstract of the laws of the United States and of all the states and a large number of cities, and a compilation of replies from railroad companies showing the regulations in force on their respective lines. This last includes a copy of the regulations which were in force on the Pennsylvania Railroad previous to the adoption of the new code this year, and also contains suggestions from

some of the roads concerning possible further improvements. Many railroads reply that they have in force regulations similar to those of the Pennsylvania (which are dated Sept. 25, 1899).

A cursory examination of the regulations presented by the committee shows but few points of difference between these and the new regulations of the Pennsylvania. Only box cars of at least 30 tons capacity must be used. Steel underframe box cars are "recommended." The rules apply to explosives in any quantity; those of the Pennsylvania deal chiefly with lots of 5,000 lbs. and over. A car containing explosives must, when practicable, be not closer than 15 cars from the engine or 10 cars from the caboose, unless the length of the train will not permit. Explosives must not be placed in a train within five cars of each other, and not more than three such cars placed in any one train.

Dr. Dudley's report gives a mass of interesting information concerning the manufacture of all kinds of explosives and the behavior of different explosive substances when used or when stored. He tells of a railroad accident in which a wooden keg containing 25 lbs. of black powder was blown a distance of 3,000 ft. and recovered intact. The use of refrigerated cars for carrying nitro-glycerine powders is held to be inadvisable because the subsequent artificial thawing out of these powders would probably increase the danger, as a whole. Dr. Dudley finds that 216 million pounds of explosives were made in 1900, and estimates that the business has largely increased since that time, making the traffic in the United States at present perhaps 50 carloads a day.

It would appear that the regulations recently adopted by the Pennsylvania Railroad, as well as those now reported, are necessarily unsatisfactory in some respects because of the impossibility of getting all shippers to agree to the restrictions which the railroads would like to impose, and the suggestions made to the committee by the Pennsylvania Railroad for further improvement in the conditions are therefore of interest. These suggestions are:

1. Manufacture should be supervised by Federal authority and packing and marking should be in conformance with standard practice recommended by the American Railway Association. Inspection should be made by common carriers through a recognized inspector.

2. Boxes containing high explosives in quantities from 50 to 100 pounds should be made of ¾-in. lumber. Boxes containing less than 50 pounds should be made of ½-in. lumber; each package to be stenciled "High Explosive—Dangerous" on sides, ends and top.

3. Rates for transportation in car-loads should be sufficiently increased to warrant such transportation. Rates on less than car-loads should be made prohibitively high so as to force car-load shipments to distributing centers and the construction of magazines for distributing purposes.

4. Legislation, Federal or State, should be secured making it a misdemeanor to ship explosives under other names.

5. An individual road can hardly go farther than Pennsylvania R. R. Circular No. 174A (the new rules) without placing an undue burden on manufacturers located on its lines, compelling them to suffer loss by competition.

Convention of the Superintendents of Bridges and Buildings.

The fifteenth annual convention of the Association of Railway Superintendents of Bridges and Buildings was held in the Monongahela House, Pittsburg, Pa., October 17, 18 and 19. Contrary to expectation, the attendance was somewhat smaller than usual, there being only about 20 per cent. of the members present. President C. A. Lichty (C. & N. W.) was in the chair. The address of welcome was delivered by Mr. W. B. Rodgers, City Solicitor, Mr. J. H. Cummin (Long Island R. R.) responding on behalf of the association. The Secretary reported the addition of 20 members since the last meeting, the total membership now being 314. A balance of $917 was reported in the treasury.

The officers for the ensuing year are: President, J. B. Sheldon (N. Y., N. H. & H.); First Vice-President, J. H. Markley (T., P. & W.); Second Vice-President, R. H. Reid (L. S. & M. S.); Third Vice-President, R. C. Sattley (C. & N.-W.); Fourth Vice-President, J. P. Canty (B. & M.); Secretary, S. F. Patterson (B. & M.) re-elected; Treasurer, C. P. Austin (B. & M.), re-elected; Members Executive Committee, J. S. Lemond, C. W. Richey, H. Rettinghouse, H. H. Eggleston, F. E. Schall, A. E. Killam. Messrs. Jas. McIntire, formerly of the Erie, now retired, and E. F. Wise, formerly of the Illinois Central, now retired, were elected to life membership in the association. Boston was selected as the next place of meeting.

The association established last year the policy of having standing committees, ten such committees having been appointed during the past year. There were in addition eight subjects assigned for special committee report at this meeting. Most of the standing committees were not yet prepared to make reports on their subjects, there being but two printed reports submitted. Two other brief reports in manuscript form were presented at the meeting, while other committees simply reported progress.

Five of the eight special committees submitted reports. The first of these was on "Construction and Maintenance of Docks and Wharves." A typewritten report read by the chairman of the committee, Mr. H. H. Rettinghouse, gave information regarding merchandise wharves and ore docks on the Great Lakes only, letters of inquiry to members on the seaboards having been unanswered. The report was devoted principally to the ore docks, giving the costs per lineal foot, per thousand feet B. M., and per ton of storage capacity of the Duluth, Missabe & Northern dock at Duluth, Minn., the Duluth & Iron Range dock at Two Harbors, Minn., and the Wisconsin Central dock at Ashland, Wis. These docks have respectively 384, 116 and 314 pockets and storage capacities of 80,640 tons, 33,600 tons, and 48,356 tons. The report gave all other important dimensions as well. Information relative to the life of such docks and the parts first needing repairs was included. The discussion was brief and related principally to the costs of materials, disclosing considerable variations between different parts of the country.

There was no report on subject No. 2, "Relative Value of Concrete and Timber Piles," and no discussion was offered by members when the subject was presented.

The report on subject No. 3, "Concrete Building Construction, Including Platforms," was presented in manuscript form by the chairman of the committee, Mr. C. W. Richey. As indicated by the title, the report consisted of descriptions of various kinds of concrete buildings, station platforms being included and forming the initial section of the report. All of the buildings included, which are notable examples of this type of construction, have already been described in engineering journals, and the report is therefore not reproduced here.

In the discussion Mr. W. F. Steffens (N. Y. C.) thought that for certain railroad buildings reinforced concrete might prove rather costly from the maintenance standpoint, a point that does not appear to have received the consideration it deserves, mention being made especially of engine houses. In the event of a locomotive punching a hole in the back wall of such a house, how would it be repaired effectively? The New York Central had a design of reinforced concrete roundhouse prepared, but abandoned the concrete for brick after consultation with practical men on the system, who thought its use would be a mistake.

Advocates of reinforced concrete pointed out that it would not be an easy matter for a locomotive to punch a hole in such a wall, and in comparison with brick the force that would make a hole in the reinforced concrete wall would probably knock down the entire brick wall. Mr. Richey suggested that the reinforced concrete wall could be strengthened against impacts from locomotives by having a buttress built into it at the proper place. Mr. Pickering (B. & M.) suggested that some means might be adopted for localizing the damage to a wall from such a blow and thus simplify the repairs. A brick wall could have the section with which the locomotive would come in contact enclosed in a frame, which would permit that portion only to be knocked out, and easily replaced. For a reinforced concrete wall the steel could be omitted from that portion of the wall.

Some members objected to concrete platforms because they are slippery. It was pointed out, however, that this is a defect of construction, such platforms having doubtless been given a neat cement finish, which was troweled. If the surface is properly treated it need not be slippery.

Mr. Cummin (Long Island) reported that his road is building concrete stations and platforms on its elevated lines. He also referred to the effect of fire on concrete construction, which will withstand considerable heat without apparent injury, but when water comes in contact with it under such circumstances it disintegrates. This point was worthy of consideration in connection with concrete buildings. In the event of a hot fire adjacent to such a building, what would be the result to the building should the firemen turn water on it?

On subject No. 4, "Anchors for Plows and Derricks," little discussion was offered. Mr. H. H. Eggleston (C. & A.) said that they unload their trains while in motion, the material being spread with a bulldozer.

The next subject was "Methods of Repairing Roofs." The chairman of the committee, J. N. Penwell (L. E. & W.), read some letters on the subject which had not been included in the report. These letters dwelt on the advisability of more frequent inspection and repairs of roofs, as the trouble and cost are much greater when injuries and leaks are neglected. Information was asked for regarding the use and durability of lead or copper flashing on roundhouse skylights. Mr. Tanner (M. P.) said they had used copper on a house at Omaha and it was eaten out in about four years. Paper, protected by pitch, was then substituted. Mr. Killam (Intercolonial) said they had had no trouble from the use of lead. Mr. Cummin (L. I.), who had asked the question about metals for flashing, said he had tried everything in practice, but none lasted. He cited the case of a copper-lined ventilator on which he had obtained a five-year guarantee from the builder, and which the latter was obliged to renew once in that time. Afterward felt with sheathing outside was substituted and was satisfactory. He further stated that they

were abolishing hanging gutters on their roundhouses as far as possible, and forming the gutters in the roofs instead.

Mr. Clark (B. & O.) said their practice was to roof all stations and shop buildings with slate. On roundhouses and temporary buildings patented roofings were used and were satisfactory. He thought the foundation for such roofings was an important factor in their durability. If there were cracks and knot holes to allow the gases to reach the under side of the material, it would deteriorate much more rapidly. Mr. Perry (P. & R.) thought the pitch of the roof also is a factor, flat-pitch roofs covered with patented material lasting longer than those of steeper pitch. A slag roof should not have a pitch to exceed 3 in.

Mr. Canty (B. & M.) said the rapid decomposition of the nails was a chief trouble with them. If they could find a nail that would last, their roofs would be longer lived. He mentioned a composition nail used in slate roofs that was lasting fairly well. Mr. Richey (Penn.) recently took down a slate-roofed roundhouse 20 years old in which the tinned iron nails were in a good state of preservation. Mr. Killam said the roundhouses of the Intercolonial of Canada have no regular gutters. The roofs are made of several layers of paper, suitably lapped, covered with a material composed of asbestos, asphalt and tar, the roofs costing about $6.50 a square foot. They expect their roofs to last 25 or 30 years, not considering them satisfactory otherwise. They use an iron nail, galvanized.

There was no report on the next subject, "Methods of Watering Stock in Transit."

The report on subject No. 7, "Protection of Water Tanks and Water Pipes from the Action of Frost," was made up of extracts from letters received in answer to a circular of inquiry sent out by the committee. These letters disclosed wide variations in practice, as was to be expected. Many of those taking part in the discussion had outlined their practice in their letters and offered little additional information. Mr. Staten (C. & O.) asked if any more trouble from freezing was experienced with iron than with wooden tanks. Mr. Canty (B. & M.) said they found no difference. They make a practice of keeping piping out of the tank. The float valve is in a pit under the tank, being operated from the float within the tank by suitable rods and levers. Mr. Killam said the mechanical department had charge of the water stations on the Intercolonial. But despite the fact that the temperature sometimes goes to 42 deg. below zero, they are not troubled from freezing up of their tanks. The frost boxes have several air spaces well lined with paper. The tanks are formed of 4-in. white pine staves, and have a double roof, the first being flat, and the outer one pitched, of matched lumber and covered with galvanized iron. Where they pump into the tank, the exhaust line is run up through the tank. Where the tank is fed by gravity, the space beneath is enclosed and a stove installed.

Mr. Penwell (L. E. & W.) finds their trouble to vary according to the source of supply. The most trouble is encountered where the water is taken from shallow streams. Where they take water from springs and pump with hydraulic rams, there is much less trouble and when a deep well furnishes the water there is no trouble at all. Also, the amount of water used per day at a station is a factor, there being much less difficulty where large quantities are taken.

There was no report on the last subject, "Recent Practice in Cofferdam Work." There was some discussion of the use of steel sheet piling under this head, however, Mr. Schall (L. V.) having asked regarding the experience of members with this piling. Not many had ever used it. Mr. Soles (P. & L. E.) told of having recently witnessed the efforts of some contractors to withdraw a steel sheet piling they had driven, and of the great difficulty they experienced. Mr. Steffens (N. Y. C.), chairman of the committee, said he understood that steel sheet piling was quite satisfactory for use in soft ground, but was not very successful in coarse gravel or rock.

The standing committee subjects were next taken up. There was no report on the first, "Pile and Frame Trestle Bridges." There was a brief discussion, during which the President asked members to forward drawings of their standard pile and trestle bridges to the committee for use next year. Mr. Clark (B. & O.) described their standards. They use a double cap and omit corbels, considering the latter bad practice.

There was a printed report on the second subject, "Steel Bridges." Mr. R. H. Reid (L. S. & M. S.) had contributed a written discussion, which was printed with the report. In some remarks in the convention he emphasized the points contained in the written discussion, and also told of a case where they had taken out a 60-ft. deck plate girder bridge with a steam derrick and replaced it by a heavier one in 18 minutes, the operation including uncoupling and taking off the rails, lifting the old bridge out and onto cars, bringing in the new one and lowering it into place on the masonry, coupling it up and putting it in shape for traffic. Referring to cleaning and protecting the steel from corrosion, he said that the brine from refrigerator cars dripping on the steel forms a hard scale, which has to be cut off with hammer and chisel. They know of no paint that offers a satisfactory protective covering. They tried putting sheet lead on the stringers, but it squeezed out; also, it does not protect the lower part of the stringer. Paper had been tried but failed, first by cutting through at the edges of the stringer and then all the way across under the ties.

The matter of the use of riveted and pin-connected spans came up. Mr. Staten (C. & O.) thought pin-connected truss bridges could be erected to better advantage and with much less delay to traffic than riveted spans. H. H. Eggleston (C. & A.) suggested that this objection could be overcome by building the riveted span at one side and afterward sliding it into place. Mr. Reid said it was entirely a question of erection and first cost between the two. About 180 ft. is the economical limit for riveted spans on the basis of comparative cost, riveted and pin-connected spans balancing in cost at about 200 ft. In pin-connected spans of the latter length, the members are heavy enough to hold them down and give a stable structure; while with riveted spans at this and greater lengths, serious difficulties are offered in the field by the detail parts in connecting up, etc.

Mr. Sheldon (N. Y., N. H. & H.) asked the length and size of field rivet that can be driven to fill its hole properly and do its full duty. Mr. Reid said they had driven ⅞-in. steel rivets with a 5-in. grip and 1-in. rivets with a 6-in. grip. He regarded this as the limit for hot driving. Cold driving may be done up to 2½ in. diameter and 10-in. grip, but powerful machinery is needed. The Lake Shore specifications require that the length of rivet should not exceed five times its diameter. In regard to hand and pneumatic hammer driving, he thought the latter was better than the most careful hand work; and air hammers can also be used in places inaccessible to hand driving. Other members thought the latter the chief advantage of air hammers, believing hand driving to be more efficient, and fully as cheap, if not cheaper.

There were no reports on the next five subjects, namely: Buildings; Docks and Wharves; Water Supply; Fire Protection; Fences, Crossings and Cattle Guards. Some discussion occurred on Fire Protection. Mr. Rettinghouse (Wis. Cent.) said all buildings should be kept scrupulously clean and should be constantly and carefully inspected; bridges likewise. Mr. Reid said the Lake Shore had tried protecting the stringers of its wooden bridges by covering them with tin; but gravel and cinders got under the tin and made holes; also it hides the stringer from sight and causes it to dry out much more slowly than if not so covered. Mr. Cummin has a trestle 4 miles long over Jamaica Bay, Long Island, on which trestle are three fishing stations. At each station he has a small house about 8 ft. square containing a hand car on which is mounted a double-acting force pump with 20 ft. of 2-in. suction and 25 ft. of 1-in. discharge hose. These equipments have already prevented the spread of several fires that promised to be disastrous. He said that men should be drilled in the use of fire apparatus wherever installed if it is to be effective.

Mr. Canty (B. & M.) mentioned some points regarding which special care should be experienced, such as the proper protection of the floors under stoves; tissue records should be kept in fireproof rooms or storage quarters; gas brackets are not allowed in buildings on his road. Mr. Pickering (B. & M.) spoke of whitewashing wooden roofs as a protective measure against fire. He said that on parts of his road it is required by insurance companies. The preservative and preventive effects will last from two to six years on good cedar shingles. Mr. Sheldon (N. Y., N. H. & H.) spoke of the practice of boarding up platforms to prevent the accumulation of combustible material underneath. While effective for that purpose, moisture does not dry out readily, and decay is therefore much more rapid. Mr. Rettinghouse told of an ore dock on the Great Lakes which burned recently, along which the fire traveled with incredible rapidity. In rebuilding the dock transverse partitions of matched lumber were placed every 200 ft. to prevent drafts and an automatic sprinkling system installed.

There was a printed report on subject No. 8, "Preservatives for Wood and Metals," but there was no discussion.

The only report by the committee on subject No. 9, "Coaling Stations and Cinder Pits," was the reading of a circular which will be sent out to members the coming year to obtain material for the next report.

A brief manuscript report on the final subject, "Records and Accounts," preliminary in nature, was read, and there was a short discussion. Mr. Reid (L. S. & M. S.) described a note book for bridge record field notes used on his road. It is of a size convenient for the pocket. They also have ruled sheets arranged to show the stresses in all members of each of their bridges under different loads. Mr. Killam explained a plan by which he had a description of every structure of the Intercolonial belonging to his department, and along with the description of each a record of each yearly inspection for the past nine years, the term of his service with the road. These data the road has had printed in book form.

The subjects for the next convention are:

1. Concrete bridges, arches and subways.
2. Experience and use of concrete piles.
3. Concrete building construction, including platforms.
4. Methods of watering stock in transit.
5. Recent practice in cofferdam work.
6. Modern coaling stations and cinder pits.
7. Bumping blocks for passenger and freight service.

The subjects for standing committees remain the same as for last year, except No. 9, which was transferred to the above list as No. 6.

EXHIBITS.

L. W. Barker, Clinton, Iowa.—Small working model of Barker mail crane.

Barrett Manufacturing Co., New York.—Barrett "Specification" roofing and waterproofing.

F. W. Bird & Son, East Walpole, Mass.—Samples of "Paroid" roofing.

The Philip Carey Mfg. Co., Lockland, Ohio.—Carey's magnesia flexible cement roofing and asphalt roofing paint for roofs, bridges, etc.

Paul Dickinson, Chicago.—Sample "Universal" cast-iron smoke-jack, and 40-in. circular section of "Vitribestos" smoke-jack.

Jos. Dixon Crucible Co., Jersey City, N. J.—Placards advertising Dixon's protective paint. Souvenirs.

The Eastern Granite Roofing Co., New York.—Samples of roofing. Large photographic views of buildings covered with this roofing.

Fairbanks, Morse & Co., Chicago.—New Duff roller bearing jacks, ratchet jacks, small model of standard hand-car and of Sheffield standpipe. Photographs of coaling stations, water stations, motor cars, etc.

H. W. Johns-Manville Co., New York.—Transite asbestos smoke-jack, asbestos roofing, pipe covering and other asbestos-magensia products. Electrical products.

The Lowe Brothers Company, Dayton, Ohio.—Lowe's red lead "Lute."

McClintic-Marshall Construction Co., Pittsburg, Pa.—Large photographs showing steel bridges, buildings, etc., built by this company. Also views of shops, recently extended to make combined capacity 120,000 tons a year.

National Roofing Co., Tonawanda.—Samples of "Security" brand roofing.

The Patterson-Sargent Co., New York.—This company distributed souvenirs and pamphlets showing views of the Thebes bridge, painted with its product.

Arthur E. Rendle, New York.—Sample "Paradigm" Skylight and side light.

The Sherwin-Williams Company, Cleveland, Ohio.—This company gave away handsome sterling silver souvenir spoons bearing the Sherwin-Williams trademark.

Standard Paint Co., New York.—Samples of "Ruberoid" roofing; photographs of buildings with roofing applied.

The United States Graphite Co., Saginaw, Mich.—Large colored sign advertising its product.

Heavy Ten-Wheel Locomotives for the Lehigh Valley.

The American Locomotive Company has recently completed at its Schenectady works ten heavy 10-wheel (4-6-0) locomotives for passenger service on the Lehigh Valley Railroad. The engines are fitted with the Wooten boiler for burning fine anthracite, and weigh 199,200 lbs. in working order, of which 150,200 lbs. are upon the driving wheels. This is well up in the upper limits of the weights imposed on driving wheels for passenger service and is probably close upon the point where a permanent set will be given to the rail or tire or both on account of weight. The cylinders are 21 in. in diameter with a piston stroke of 28 in., and these give the machine a maximum tractive force of 31,380 lbs.

The engine is fitted with the plain flat slide valve instead of the piston type that is so extensively used with large cylinders. The boiler upon which the efficiency of the engine depends has an inside diameter of the smallest ring of 68 in. with plates $^{13}/_{16}$ in. thick. The firebox is carried by expansion plates at the front end resting on brackets on the frame. Just back of the center and at the rear it is supported by buckle plates of the ordinary type. The section of the fire-box shows the shape of the inner and outer plates which follow the practice of the past few years and swing in even regular curves from the mudring on one side to the other. These sheets are stayed by 25 rows of radial stays and two rows of sling stays at the front end. The former are set at right angles to the inner sheet which brings a number of them at a rather acute angle to the outer, but in no case so that a full thread cannot be obtained. The side sheets are held by the Tate flexible stays at the front, bottom and back. That is to say, the five vertical rows at the front and back and the four at the bottom are flexible. The balance forming the nest at the center and top are of the ordinary rigid type. These are shown on the engraving of the boiler by single circles while the flexible stays are indicated by double lines.

The following are some of the principal dimensions of these engines, in addition to those already given:

Heating surface, tubes	3,084.26 sq. ft.
" " firebox	199.98 "
" " total	3,284.24 "
Grate area	85.08 "
Axles, driving journals, diam. 10 in.; length	12 in.
Axles, truck journals, diam. 5½ in.; length	10½ in.
Steam pressure	205 lbs.
Fuel	Anthracite pea
Firebox, width 102 in.; length	120⅛ in.
Water space, front 5 in.; sides and back	3½ in.
Tubes, length 15 ft. 8 in.; diameter	2 in.
Tubes, number	378
Piston rod, diameter	4 in.
Wheels, driving, diameter	68½ in.

The equipment includes the Westinghouse brake on engine and tender, with a 9½ in. pump. The tender has a capacity of 7,500 gallons of water and 12 tons of coal. The valves are of the Richardson balanced type and are set with a travel of 5¾ in. and a lap of 1 in.

Heavy Ten-Wheel Locomotive for the Lehigh Valley.

The Roundel Problem.*

BY DR. WILLIAM CHURCHILL.

Dr. Churchill discusses his subject under four heads: (1) The theory of light and color; (2) conditions encountered; (3) methods of test; (4) results. The paper fills thirty pages of the Proceedings of the association, and is of the nature of a treatise.† Under the theory of light and color he discusses light waves, light analysis, color constants (hue, saturation and intensity), complementary colors, color mixture, color contrast, light and colored glass, and the essentials of the best signal colors. Under the head of conditions, one of the most interesting is that of the quantity of light, which is affected by the type and size of burner, the spherical angle of light received by the lens, the size and design of lens, the type and efficiency of the reflector, the degree of accuracy with which the flame and lens are centered, and other things; but all these are passed by without discussion, though Dr. Churchill says that in many cases due attention to them would double or triple the efficiency of light. Under the head of atmospheric conditions fog is considered. From experiments made by the German Lighthouse Board it is shown that red is the poorest light to show through a fog. The light produced by a kerosene oil flame manifests more penetrative power in a fog than other kinds of artificial light. The German government tried powerful arc lights in a lighthouse, but they proved of far shorter range in fog than the oil lamp of less power, and were accordingly soon discarded. Other tests made by the German Lighthouse Board showed that the reduction of the power of lights in rainy weather was 30 per cent. Under the head of alinement of the semaphore lamp, Dr. Churchill discusses the size of the flame. The flame of the long-time burner is usually not over ¼ in. wide. [Mr. Rosenberg's experiments showed that it gives an efficient signal when it is only ⅞ in. high. In this connection, we understand that a long-time burner has been designed which will materially broaden the flame.—Editor.] Dr. Churchill finds that all colored roundels placed in front of a semaphore lamp shift in hue toward the red end of the spectrum as the observer recedes from the light. He speaks of the effect of smoke and the liability to mistake one light for another. A glass has lately been made at Corning which, with an oil flame, gives a "lunar white" light, and this is rather close in color to an arc light. But Dr. Churchill says that the impression produced by a semaphore lens, with its parallel beam, is so different from that received from the diverging light of the arc lamp that confusion probably would never arise.

Ten per cent. of the total light of a lamp, leaking through a

*Abstract of a paper read before the Railway Signal Association at its annual meeting at Niagara Falls, Oct. 11.

†Dr. Churchill confines the term "roundel" to the glasses in semaphore spectacles which usually are flat and colored.

crack in a colored roundel, may easily produce the effect of a "white" light.

Dr. Churchill describes his method of tests in great detail. He uses spectrophotometric analysis, photometric tests, tests by reducing lenses, and to confirm these, a range test; and, finally, a reaction-time test. In the latter, he measures the time required to recognize and name a signal. Averaging 100 experiments it is found that a certain observer required to distinguish and name a red signal 0.308 sec.; green, 0.335; yellow (amber), 0.358 sec.; yellow (light), 0.360 sec.; "white," 0.352 sec. The time was measured by a chronoscope, the observer calling off the color against a diaphragm which, by impact of the air, closed an electric circuit. Response by pressing a key required a longer time.

Under the head of results Dr. Churchill gives data from elaborate spectrophotometric tests of red, yellow, green, blue and purple glasses, and also of "lunar white" which has in it enough blue to make it white like an arc light, when used with a kerosene flame, while at the same time there is not so much blue but that the light will be visible as far away as the ordinary red or green light, say 2½ miles. With this glass, lights are found to be distinct in color as far as visible, whereas yellow, while it may be seen a considerable distance, is distinctive only a short distance. If a red glass should break, the pale yellow of the uncolored flame would be so different from the lunar white that it would not be mistaken for it, and the breakage would be discovered. The lunar white never becomes reddish, even in fog or smoke. It can perhaps be confused with an arc light; but it is believed that the effect of the lens in throwing the rays of a signal light in parallel or converging lines makes such a light so different from the ordinary arc light that confusion would never occur in practice. If lunar white were to be used in place of yellow, green signal lights might be made more yellowish than now.

In his closing paragraphs Dr. Churchill discusses, with favorable comment, the advantages of using two lights in signals. With yellow and red shown side by side the red looks deeper in hue than before. If yellow and green are shown together the hue of both seems intensified. An auxiliary light six or eight feet below a semaphore arm would increase the distinctiveness of the color displayed at the arm. The use of a yellow light is suggested for this auxiliary; and with this the indications would be red and yellow for stop, green and yellow for caution, lunar white and yellow for clear.

Loading Locomotives on the Equated Tonnage Basis.*

The proper method of rating and loading locomotives has been given more thought, study and demonstration in the past few years than perhaps any other one feature of railroad operation, and justly so, as it is the one important and difficult problem yet to be solved. Officers in the mechanical department have, after making hundreds of thorough and practical tests, with and without the aid of the dynamometer-car, given us the result of their efforts, from a strictly technical standpoint, and have demonstrated beyond a doubt the accurateness of the conclusions arrived at by them. The methods used in arriving at their conclusions vary, but the result obtained and the recommendations made all point to the one fact: that train resistance, or drawbar-pull, in lieu of gross tonnage is the only fair and economical basis for loading locomotives.

The mechanical department, having worked out and solved the problem, turn over the result of their efforts to the operating department, whose duty it is to put them into practice. Several plans are now in use on different railroads: Some provide for allowing an arbitrary five tons on each empty car; others provide for computing the tonnage by reducing it to pounds of drawbar-pull, and, again, others adjust the tonnage on the basis of the total number of cars in the train, for example:

An engine shall haul				2,500	tons	when in		35	cars.
"	"	"	"	2,400	"	"	"	40	"
"	"	"	"	2,250	"	"	"	45	"
"	"	"	"	2,100	"	"	"	50	"
"	"	"	"	2,000	"	"	"	60	"

Under all of these plans a vast amount of clerical work is required, from conductors, yardmasters and yard clerks, who at best are not very accurate in computing train tonnage, and the results obtained are more on an average basis than on handling each individual car and train on its own merit. It is my desire to present the matter from a strictly operating standpoint, avoiding as far as possible all technical formulæ.

Train resistance is made up of gravity and friction: gravity being the number and weight of cars taken as a whole train, causing additional drawbar pull on up grades; friction is made up as follows:

(1) Number of journals and weight carried on them, viz., journal friction.

(2) Number of wheels and weight on them, producing rolling friction with rail head.

(3) Resistance of wheels to change of direction on curves, viz., flange friction.

(4) Atmospheric friction and transverse wind pressure.

(5) Defects of rails, wheels, bearings, brakes, etc.

(6) Wave resistance of rail, varying directly with weight on wheels.

Another feature of train resistance not shown above, and one that to my knowledge has not been brought out in any of the several papers prepared on this subject, is that of improperly making up trains by placing the heavy loaded cars at the rear end of the train instead of at the head end near the engine. I mentioned this fact in discussing the subject at a meeting of the Central & Western Association of Car Service Officers, at Chicago, last year, and have since been advised by a representative of an eastern trunk line, that, after making several tests, they place this additional resistance at 10 per cent. when heavy loads are placed at the rear instead of at the head end of train. This factor is also demonstrated in the hauling capacity of a locomotive in passenger train service: The train has less drawbar-pull when the heavy sleepers are placed at the head end and lighter coaches at the rear. It is also clear that on momentum grades, with the heavy cars at the head end, it gives the engine a decided advantage in obtaining increased momentum to assist it up the ascending grade. It is a fact, also, that in curves, especially in reverse curves, a train with the heavy loads at the rear will bind harder than if they were placed at the head end.

This factor of resistance still further complicates the question of drawbar-pull and makes it necessary to not only take into consideration the gross weight of each car, but, also, its particular location in the train. Hence the true and correct basis to be used in equating or adjusting train tonnage is to consider the drawbar-pull of each individual car at each location in the train.

To adjust the drawbar-pull in this manner, it is necessary to determine by tests the drawbar-pull of each weight of car—for example, take ten 60-ton cars next the engine, then from the eleventh to twentieth car from engine, the same with other weights of cars for trains hauling a given tonnage, using the dynamometer car in making such tests. After determining the drawbar pull of each weight of car at different locations in the train, we then meet the problem of having the yard clerk, switchman, agent, or conductor, compile the tonnage and build up the train on that basis.

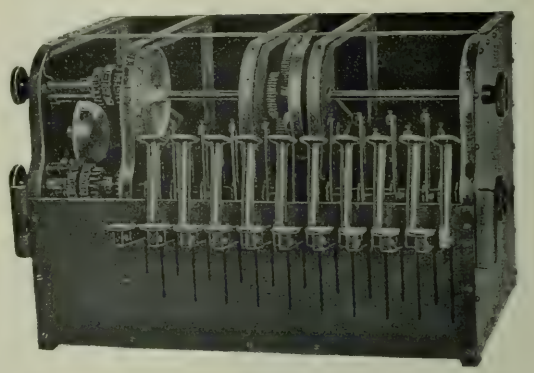


Fig. 1—Tonnage Rating Machine With Cover Removed.

It is customary, as a rule, for the person producing such complicated theories or conditions to also produce at the same time a practical and feasible remedy to overcome them. I have perfected a computing device that automatically registers the number of cars in the train and adjusts the drawbar-pull of each gross weight of car at each location in the train, as outlined in this paper, and permits of computing this drawbar-pull from the billing on a train of 60 cars in 90 seconds, which is 1,800 seconds quicker than under the present practice.

Fig. 1 shows the train tonnage equating machine, which is constructed somewhat similar to a cash register. The case at the top and front is removed, to show the inner mechanism. The keys with numbers 15 to 70, arranged outside the case, represent the gross tons of car and contents, as shown on waybills. The numerals at the lower left-hand corner, represent the number of cars in train, the numerals at the left on top represent the drawbar-pull tonnage, equated from the actual tonnage. The bell at the left side sounds automatically when the limit of cars allowed on one train has been reached.

Fig. 2 is a side view. At the right attached to the large wheel is a clutch that grips the large wheel and causes it to move the distance the key moves down. This wheel causes the numeral wheel 0 to 99 to move sufficient to register the number of tons called for by the key employed. At the right on top is a compounding

*Extracts from a paper by J. M. Daly, Car Accountant, Illinois Central, read at the October meeting of the New York Railroad Club.

wheel on which numbers 0 to 99 are located, and alongside this wheel is a guide yoke with a small adjustable screw at the top, which is attached, and moves with the key in motion. The screw in the guide yoke comes in contact with the irregular face on the small cam wheel immediately under it and causes the key and numeral wheel to stop at a pre-determined point. This cam wheel has the irregular faces so arranged that when the numerals of "cars in train" and "tonnage" are set at "0" before starting to compute the tonnage, the shoulder at the highest point is immediately under the screw in the guide yoke—hence when the key for a car of 60 gross tons next engine is pressed down the guide yoke strikes the cam as set and the register shows 51 tons. A second operation of the same key register would show 102 tons.

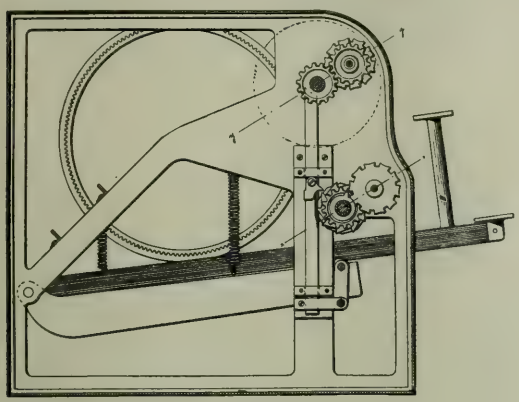


Fig. 2.

Then pressing key 15, it would show 119 tons. When a total of ten cars have been computed, be it the same key ten times, or ten different keys one movement each, the bar on which these cams are attached and carried revolves one-tenth, which causes a shoulder slightly lower than the first to come into position under each key, hence if you operate key 60 for the eleventh to twentieth car it moves a trifle farther before striking the cam and causes the register to show 52 tons instead of 51, and the 15-ton key would now register 18 tons instead of 17, this in order to provide for the additional drawbar-pull caused by distance of the car from the power. The irregular face on the cam wheel is cut or adjusted under each key to control the numeral wheel and cause it to register and record the drawbar-pull of any gross weight of the car at each location of the car in the train, thereby making proper allowance to the engine when heavy cars are placed at the rear and light cars at the head end of the train—in addition to automatically reducing the gross tons to drawbar-pull.

Fig. 3 is an end view showing at the top the tonnage numeral wheels, and at the bottom the wheel which records the total number of cars in the train and changes the position of cams at pre-determined intervals—every tenth or fifth car as desired.

This machine is intended for use in the office of the yardmaster where waybills are kept, and the tonnage to be computed on the machine by the clerk—a machine to be placed at ends of all train districts and at important intermediate filling-out stations, in order to not only adjust correctly the drawbar-pull of trains, but to take away from the trainmen the work of computing their tonnage and avoid all chance for error and light loading, which is invariably the case at present.

This machine also enables us to receive from each station where trains are made up or filled out, a correct statement showing the total number of cars in each train and their equated tonnage, and to detect immediately any failure to properly load engines.

To quickly and accurately adjust the drawbar-pull of a train is a decided advantage in getting trains out of congested terminals promptly after being made up, to say nothing of the advantage of preventing the overloading and underloading of engines, each being equally disastrous to roads—the former by delaying the train and causing it to double hills, possibly delaying other trains, and the latter by losing from 10 to 30 per cent. of the usefulness of the power by permitting it to move over the road light loaded.

The putting of 125 per cent. on one train and 75 per cent. on another is not economical or in line with good practice, even though the average is 100 per cent. This condition exists on a majority of roads that do not provide for equating the tonnage of cars of different gross weight and when engines are not properly rated.

Some roads, when rating locomotives, take a given tonnage, say 2,000 gross tons, if in 65 cars, and the engine used its maximum power to haul it within the time allowed, that then becomes its rating. Now, when that same locomotive has 2,000 gross tons in 30, 40 or 50 cars, it is permitted to move over the road light loaded from 10 per cent. to 35 per cent., and in most cases is a net loss to the road so operating.

It is impossible to build up all trains of equal average weight of cars; it is also impracticable to at all times place the heavy loads next to the engine, hence proper allowance must be made for each weight of car and its location in the train.

The use of block signals has made it even more imperative that locomotives be not overloaded, for the reason that overloaded trains invariably stall on heavy grades, which, in turn, blocks trains following them on the same grade where they should have the benefit of momentum to assist them, but when stopped they frequently are unable to again get their train in motion, resulting in being obliged to double the hill, delaying themselves, and possibly trains of a superior class.

Again, when trains are obliged to cross over or take siding to let others pass or meet, the drawbar-pull should be such as will permit the locomotive to handle its train with reasonable promptness on unfavorable grades or locations. When trains are overloaded to such an extent as to prevent their crossing over or taking siding promptly for trains of a superior class, it creates an element of danger, and it also tends to demoralize the train service.

Enginemen and conductors, after starting on a trip, do their figuring on meeting and passing points, basing their calculations on their train having a reasonable drawbar-pull; but when engines are frequently overloaded and the crews are obliged to double grades and delay other trains in crossing over, they lose confidence in the locomotive, resulting in their frequently laying back when they could and should go ahead and make their meeting point. Again, the confidence of men in charge of superior trains is shaken when obliged to frequently stop on flag signals or slow up for fusee or torpedo signals account of train ahead overloaded and in trouble. When locomotives, especially the large modern type, are overloaded and unable to make more than four or five miles an hour, it increases the tendency to slip, which results in more or less injury to the power.

To offset this condition, the demands constantly made on railroads by state and national legislatures to reduce rates make it imperative that each and every train haul the maximum tons per mile consistent with economic management.

The present plan of compiling statistics of tonnage hauled on a great many roads showing only the average per cent. of the potential hauled is crude and misleading, and does not permit of fair or intelligent analysis or criticism, and the fact that the data is not furnished to the superintendent of machinery, master mechanic, and superintendent, until 60 to 90 days after the service is performed, makes it difficult to locate the cause of failure, and renders it almost worthless.

The yardmaster's office at ends of all train districts and at filling-out points should be responsible to know that every train moving in the direction of heavy traffic is given its full potential tonnage, and that he compile a report each day showing the train number, engine number, time, weather conditions, temperature, rating in tons (drawbar-pull), and tons of drawbar-pull taken, and the cause of failure to take its full rating. A carbon copy of this report to be mailed each day to the division master mechanic, copy to the division superintendent, and a copy to the superintendent of transportation. The division master mechanic to watch for engines failing to take full rating on account of the condition of power, the division superintendent to watch for failure to give engines in proper condition their full tonnage, and the failure to keep a supply of cars at filling-out points to provide tonnage for trains to fill out with, and the superintendent of transportation to give

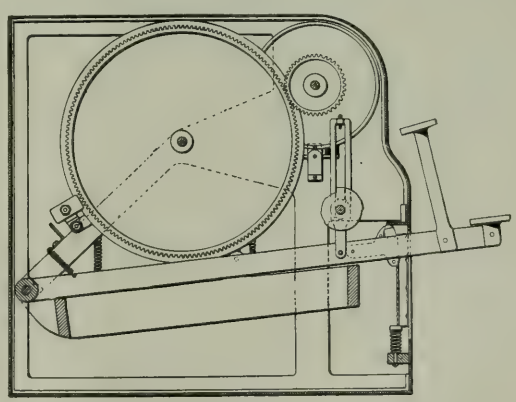


Fig. 3.

it general supervision. A recapitulation of each day's report to be a basis for a weekly report and each week's report to be the basis for a monthly report. In this manner all persons directly responsible will get promptly a daily report of each individual train from each individual filling-out station and the service it performs.

A record of this kind if kept at each point where trains are filled out, would enable the superintendent in charge to know to-day what each of his trains run yesterday hauled, and if any left a terminal with less than their assigned tonnage, then is the available and proper time to investigate it, while the matter is fresh and proper explanation can be made, instead of investigating in April, failures that occurred in February, the result of which is invariably a long list of plausible excuses, such as cold weather, snow, bad condition of power, congested yards, bad water, etc., which may or may not be correct, whereas had the investigation been made the following day, possibly a different result would have been obtained. Promptness in making investigation is very essential.

The tonnage footings on conductors' reports of to-day are very inaccurate. Imagine the average yardmaster or conductor, after taking the initials, numbers and seals, on 50 or 60 cars, also looking the cars over for defects, then go to the office and get his bills, enter the contents and tonnage of each car in his book, then try to foot up his tonnage correctly while standing at the counter along with others, trying to get his running orders and make out reports to the chief despatcher, showing the consist of his train. He has so many things to think about at one time that I am surprised he computes his tonnage as accurately as is done. A conservative estimate is that 70 per cent. of the reports so compiled are inaccurate, and some place it at 85 per cent. Invariably, the tonnage reported is higher than the actual tonnage hauled. What would be the result if we place additional burdens on the conductor by having him carry a chart with him to adjust or reduce from gross weight to drawbar-pull each car in his train? That is difficult for expert clerks to handle, in a comfortable quiet office, where their mind is constantly on the work of adding, but put them out in a yard in rain and snow, with the responsibility of a train on them, and their work in adding would be no better than that of the conductors.

Again, each part of a train district or division should receive independent and complete supervision, in order that the result of the whole may be successful, and the officer in charge should know that all trains moving over any part of his division in the direction of heavy traffic pulled their full rating, and reports of this kind will enable him to dispel any doubts from the minds of his superior officers that he is not moving his maximum tonnage at the minimum of expense. From these figures the officer in charge will have no trouble in determining where it will or will not pay to reduce grades.

I have laid particular stress on the overloading of engines for the reason that the company loses every time an engine is put on the line overloaded, either by delaying itself and others, or in damage to the engine from slipping and dragging over the road, making two trips where it should have made three.

Let us now consider the matter of underloading the power. The road operating over grades of less than 1 per cent. that loads its engines on a gross ton basis, making no allowance for light or heavy cars, loses from 10 per cent. to 25 per cent. in tonnage that should be hauled on at least 50 per cent. of its trains run. I have endeavored to emphasize the importance of full rating in *direction of heavy traffic*, for this reason: Take a district of 100 miles, the preponderance of traffic is eastbound. By failure to equate your tonnage, you lose 10 per cent. of the potential. The result is that on every ten trains run eastbound, you lose service equal to one train 100 miles. Your loss, however, does not stop there. On arrival of these trains at the east end of the district, they are not all required to haul the empty cars westbound, hence this engine and train crew move west, light, and the first failure to properly load trains results in a waste of 200 instead of 100 train miles.

The claim is frequently made, and justly so, that during periods of extreme heavy movement of traffic and during times when freight terminals are badly congested, it is an advantage to reduce the tonnage on trains so as to permit of getting them over the road in less time than if fully loaded. In other words, reduce them 10 per cent. and get five trips out of the engine where only four trips are possible with full tonnage. This, I believe, is the correct basis to work on, but should only be resorted to during times when conditions are as named, but during normal or light seasons the full rating should and can be economically hauled.

The traffic department uses these tonnage figures largely in determining the rates on certain commodities, and in furnishing it such information, care should be taken to show when this reduction is made. If it is not done, then we are deceiving ourselves.

This ratio would not hold good on roads hauling one commodity—such as coal—provided their cars are of about uniform capacity, as their test train would be about an average train; it does, however, hold good on roads handling various commodities, such as grain, lumber, coal, hay, cotton, merchandise and refrigerator-car traffic.

The large capacity car, both coal and box, reduces the cost of operation if properly handled, but so long as light, bulky commodities are shipped, just so long will we have the difference in drawbar-pull on light and heavy cars to contend with even when all cars are of uniform large capacity, and the method of basing on average performance will be as far as ever from securing the results we should obtain, and so long as trains will be made up with light loads at the head end, and heavy loads at the rear, no average plan can make provision for drawbar-pull in such cases, and no proper adjustment can be made unless this factor is taken into consideration.

The matter of adjusting the drawbar-pull of each gross weight of car at each individual location in a train, is made feasible and practicable by the aid of a mechanical device, hence it is not a theory but a condition that we have to contend with, and one that the mechanical and operating departments must join hands in meeting and overcoming.

Investigation of Private-Car Traffic.

At the hearing given in Washington last week, the Interstate Commerce Commission took testimony concerning private cars from Abraham Ellis, an ice manufacturer of Augusta, Ga.; J. H. Kerr, Manager of the American Refrigerator Transit Co.; A. G. Jackson, General Freight Agent of the Georgia Railroad; A. S. Dodge, Third Vice-President of the St. Louis & San Francisco; H. M. Emerson, Traffic Manager of the Atlantic Coast Line, and others. Mr. Ellis said that during this year's fruit season he sold to the Armour Car Lines 3,100 tons of ice at $3.50 a ton. The American Refrigerator Transit is owned by the Wabash, the Missouri Pacific, the Iron Mountain and the Southern railways. It operates 5,300 cars, of which 2,200 are leased. The contract of the refrigerator company with the Iron Mountain was put in evidence. It shows that the mileage paid by the road is one cent a mile and that the refrigerator company receives 12½ per cent. commission on the freight revenue on perishable goods carried in the refrigerator cars. Whether or not this is for services as soliciting agent does not appear. Mr. Kerr cited an example of a car of strawberries from Judsonia, Ark., to St. Louis (292 miles) on which the charge for icing was $50, while the actual cost was $54.75; but the mileage and commissions brought the receipts of the refrigerator company up to $65 a car. His company, he said, had paid no dividends.

Mr. Jackson said that the Georgia road carried in the season about 400 cars of perishable freight. The business was attended to by the Armour Car Lines under a contract. Mr. Dodge (Frisco) said that his contract with the Armour Lines forbade the use of other refrigerator cars on the road. Asked if the meat packers fixed the price of refrigeration as well as the freight charges, Mr. Dodge replied in the negative; that he "did not agree with Mr. Stickney and Mr. Ripley."

Mr. Emerson gave figures showing the reductions in the rates on berries from North Carolina to New York during the past 11 years, one example cited being a reduction from 64 cents to 27 cents. He insisted that the shippers dealt directly with the Armour Lines, the railroad not acting as agent of the car lines. To move the berries originating on the Atlantic Coast Line this year would have required 1,600 refrigerator cars, representing an investment of $2,000,000, which investment would not be productive except in the berry season.

Mr. Bowles, Freight Traffic Manager of the Illinois Central, testified that his road operates 2,458 refrigerator cars and has no agreement with private car lines. North of Cairo the Illinois Central pays one cent a mile for the use of refrigerator cars not owned by railroads. The mileage of refrigerator cars on the I. C. averages 44 cars a day, so that at 7½ mills, which is the rate paid south of Cairo, the hire of these cars is 13 cents a day more than for cars belonging to railroad companies, while north of Cairo the excess is 24 cents. Ten cars of berries shipped from Independence, La., to Chicago, were iced three times on the road and the cost of the ice used was $405.

Mr. Dixon, Freight Traffic Manager of the Pennsylvania Railroad, testified that his road owns 3,100 refrigerator cars.

Mr. Urion, Counsel for the Armour Lines, said that his company had paid out $80,000 on claims for losses suffered by strawberry shippers in North Carolina (presumably during the present year) because of inability to promptly furnish cars, and that claims for $60,000 were still being investigated.

Largely at the instance of the people in the iron and coal regions on the Rhine an express train between Berlin and Antwerp was put on, with through cars. The latter being little used, the leading business men of the coal towns feared that the train might be taken off, and the chambers of commerce united to pay the cost of advertising this train in the newspapers, hotels and otherwise. Imagine the Pittsburg and Philadelphia boards of trade paying for advertisements of a train from New York to Chicago!

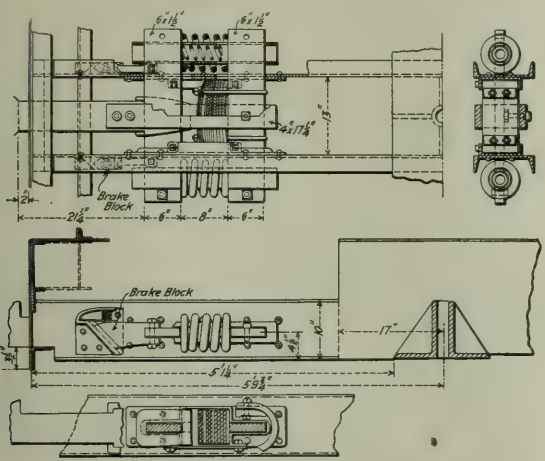
A Combination Spring Draft Gear.

A new design of draft gear brought out by the Bradford Draft Gear Company, Chicago, is shown in the accompanying drawing. It is designed primarily for steel cars, but is intended for use on any equipment where high capacity gears are required, it being possible to furnish the gears up to 300,000 lbs. capacity. It will be seen that the gear has two coil springs outside of the center sills, with transverse follower bars bearing against them front and rear. Between the center sills is a set of leaf springs arranged to come into action serially after the drawbar has traveled 1 in. against the resistance of the coil springs, which is one-half of the total movement of the drawbar. The leaf springs are held in position by U bolts passing around the rear follower. In compression they bear against a center block carried by the forward follower. The travel of the followers is so limited as to prevent breaking the springs or straining them beyond their capacity.

For cars of 100,000 lbs. capacity the builders recommend a spring power of approximately 200,000 lbs., as follows:

2 coil springs,	6¼ in. x 8 in.	38,000 lbs.
4 leaf springs,	¼ in. x 6 in. x 11½ in.	22,400 "
4 leaf springs,	⅜ in. x 6 in. x 11½ in.	49,600 "
4 leaf springs,	½ in. x 6 in. x 11½ in.	92,800 "
Total		202,800 lbs.

For passenger service a spring power of 100,000 lbs. is recommended, consisting of two coil springs of 38,000 lbs. capacity and 11 leaf springs ¼ in. thick with an aggregate capacity of 62,000 lbs. For first-class passenger equipment, placing a cushion between each pair of leaf springs is recommended. It may be of



Bradford Combination Spring Draft Gear.

felt, rubber or leather belting, the same size as the leaves, the object being to produce a noiseless and an easy yielding movement.

When desired, a device to take care of recoil is included with the gear. This is shown best in the side view of the gear. It is mounted on the outer side of each center sill web. These devices are called brake blocks by the designer. One block is rigidly secured to the sill and has on the edge, which is cut at an angle of 45 deg., a V-shaped slot in which moves the corresponding edge of the opposing block. The latter is secured to the front follower and the upward movement of this block against the fixed block is opposed by a single leaf spring and a coil spring above. The device can be applied or removed whenever desired without otherwise affecting the efficiency of the gear.

A Month's Record of Automatic Signals in the Subway.

The New York City Subway of the Interborough Rapid Transit Company has now been in operation one year, and the number of automatic signal movements for the eleventh month (September) was about five millions. The number of signal failures in that month, all on the side of safety, was 11, which is an average of one failure to 464,694 movements. With this enormous movement there was, it will be seen, not a single relay failure. Three of the 11 failures shown were caused by water leaking through the roof, where the road runs beneath the northwest corner of Central Park, the water causing the burning out of fuses at signals. The causes of the failures are shown in the accompanying table. The table is shown complete, from which the reader can see what are the principal kinds of mishaps resulting in signal failures which have been brought to light in the operation of this road. It will be observed that the record includes not only the signals but the automatic stops.

The third section of the table, that devoted to failures of switches, has to do, of course, with the interlocking plants. Of these plants there are 36. The only one of these failures chargeable to the signal department is the last one—water in the sub-station. This was surface water which accidentally got into the intake of one of the air compressors.

This report is a summary of the reports of 13 inspection districts. In each district a repairman is always on duty. The longest district or section is about 1½ miles long. Ten sections report no failures. The whole report represents 55 miles of track. The four-track part of the road, which has a continuous block system on the express tracks, is eight miles long. The number of movements at the interlocking plants is not made a matter of precise record, but at the busiest junction, during the hours of heavy traffic, the number of trains is 125 an hour. This means 250 switch movements an hour; at least 250 signal movements and 125 movements of automatic stops.

Failure Report, Month Ending Sept. 30, 1905.

Causes of failures.	Failures.	Delays.	Causes of failures.	Failures.	Delays.
Signals:			*Automatic stops:*		
A.-C. relay	..	..	Broken wire	1	2
Broken wire	..	..	Frozen valve	..	..
Broken track wire	..	..	Loose wire	..	..
Burned pipe	..	..	Low air pressure	..	..
Broken grid	..	..	Imperfect lubricat'n	..	..
Careless repairman	..	..	Mechanical trouble	..	..
Fuse	3	1	Stones	..	..
Frozen valve	..	..	Ties shifted	1	1
Insulated joint	3	5	Unknown	..	..
Loose wire	..	..	Leaky valves	..	..
Low A.-C.	..	..	Total	2	3
Low D.-C.	..	..	*Switches:*		
Low air pressure	..	..	Broken cylinder	..	..
Lights out	..	..	Broken wire	..	..
Imperfect lubricat'n	..	..	Bad points	..	..
Transformer, short-circuit primary	1	2	Frozen valve	..	..
Train ran by signal	..	..	Loose wire	..	..
11,000-v. main brnd.	..	..	Low air pressure	..	..
Unknown	..	..	Imperfect lubricat'n	..	..
Leaky valves	..	..	Obstruct'n in points	..	..
Poor spring contact:			Out of adjustment	..	..
On machine	1	1	Switch run through	3	4
On home signal	1	..	Indication spring	..	..
			Water in sub-stat'n	1	2
Total	9	9	Total	4	6
			Grand total	15	18

Train Accidents in the United States in September.[1]

unx, 1st, Erie road, Great Notch, N. J., an empty engine running backward was derailed at a switch and fell down a bank. The engineman, fireman and baggageman, the latter riding on the pilot, were injured.

rc, 2d, Maine Central, South Gardiner, Me., a passenger train standing at the station at a time of dense fog, was run into at the rear by a following passenger train and one passenger car was wrecked. Twenty passengers were injured, many of them being scalded by steam from the engine.

unf, 3d, Atchison, Topeka & Santa Fe, Boone, Colo., a passenger train was derailed and 12 passengers were injured.

unx, 3d, Arkansas & Choctaw, Durant, Ind. T., a freight train was derailed at a switch and the engine and five cars were ditched. The fireman was killed and the engineman fatally injured.

†xc, 5th, Chicago, Burlington & Quincy, Brush, Colo., a passenger train was run into by a freight train, the engine of which struck a sleeping car in the side and wrecked it. One passenger and two employees in this car were killed. One other car was wrecked and 15 passengers were injured.

bc, 7th, Pennsylvania road, Wilmington Junction, Pa., butting collision between a regular and an extra passenger train; one engineman and one fireman were killed and many passengers were injured.

bc, 7th, 3 a.m., Illinois Central, Obion, Tenn., butting collision of freight trains, one of which had run past the appointed meeting station. Four trainmen were killed and four injured. The collision occurred on a bridge and both engines and 19 cars fell into Obion river.

bc, 8th, Pere Marquette road, Zeeland, Mich., butting collision between a northbound freight train, running at high speed, and a

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc Rear collisions.
bc Butting collisions.
xc Miscellaneous collisions.
dr Derailments; defects of roadway.
eq Derailments; defects of equipment.
dn Derailments; negligence in operating.
unf Derailments; unforeseen obstruction.
unx Derailments; unexplained.
o Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

southbound train consisting of an engine and a caboose. Both trains were badly wrecked and three trainmen were fatally injured.

rc, 9th, Philadelphia & Reading, Tabor Junction, Pa., a local freight train standing at the station was run into at the rear by a through freight, wrecking the engine, caboose and several cars. The boiler of the locomotive exploded or was in some way ruptured and the engineman was fatally scalded. Two other trainmen were killed.

bc, 9th, 2 a.m., Baltimore & Ohio, Fairmont, W. Va., butting collision of freight trains, both running at full speed; six trainmen were injured.

xc, 12th, Pennsylvania road, Creighton, Pa., passenger train No. 402 ran over a misplaced switch and into the head of a freight train on a side track, damaging both engines; three passengers injured.

unx, 12th, Wiscasset, Waterville & Farmington, Head Tide, Me., the engine of a passenger train was derailed on a curve at an approach to a trestle bridge and, running some distance on the ties, broke through the bridge. Several passengers were slightly injured. The engineman and fireman jumped into the water and escaped.

bc, 13th, Cleveland, Cincinnati, Chicago & St. Louis, Marion, Ind., a gravel train consisting of an engine and 10 cars, with the engine at the rear, running at good speed, collided with a freight train, consisting of a switching engine and 10 cars, making a bad wreck. Two employees were killed and three were injured.

dr, 15th, Southern Indiana, Huntingburg, Ind., passenger train No. 2 was derailed by spreading of rails and two cars were overturned. One passenger and the express messenger were seriously injured and 15 other passengers slightly.

xc, 16th, Baltimore & Ohio, Kimmel, Ind., passenger train No. 14, running at full speed, struck a locomotive standing on a side track, but not clear of the main line, and the first three cars of the passenger train were wrecked. The engineman and baggageman were killed and 20 persons were injured.

unf, 16th, 9 p.m., San Antonio & Aransas Pass, San Antonio, Tex., passenger train No. 4 was derailed by a malicious obstruction; the engine was overturned and the fireman killed. Many passengers jumped out of the windows but all escaped with slight injuries.

unf, 17th, 1 a.m., St. Louis, Iron Mountain & Southern, Ironton, Mo., southbound passenger train No. 5 was derailed at a washout, and two engines and five cars fell into a creek. The engineman and fireman of the second engine were killed and the engineman of the leading engine was fatally injured. Twelve other persons were injured.

unf, 17th, Tombigbee Valley, Fairford, Ala., a freight train consisting of 12 cars of logs and a locomotive, with the locomotive at the rear, was derailed by running over a cow, and the conductor, who was on the leading car, was killed.

unx, 18th, New York Central & Hudson River, Fifty-sixth street and Fourth avenue, New York City, a parlor car in a northbound passenger train of the New York, New Haven & Hartford was derailed and overturned at a switch and eight passengers were injured. The overturned car ran against one of the columns supporting the roof of the tunnel at that point and was badly wrecked. The train was running slowly at the time.

bc, 19th, Southern Pacific, Beowawe, Nev., butting collision of freight trains, wrecking both engines and several cars.

rc, Passenger train No. 3, following the westbound freight, was stopped in consequence of the stoppage of the freight, and a few minutes later was run into at the rear by second No. 3, wrecking the engine and one passenger car. In both accidents one man was killed and 25 other persons were injured.

xc, 19th, Pennsylvania Lines, Ashtabula Harbor, Ohio, collision of freight trains in the yard, wrecking two engines; one engineman killed.

20th, Atchison, Topeka & Santa Fe, Walton, Kan., an eastbound passenger train running at full speed was derailed, and the dining car and one sleeping car were overturned. Four passengers and one employee were injured, the latter probably fatally.

bc, 21st, Philadelphia & Reading, Moor's Mill, Pa., butting collision between a passenger train and a pay car train, making a bad wreck. Five employees were killed and 10 injured, and the express messenger was fatally injured. The men in charge of the pay train miscalculated the time.

bc, 21st, Baltimore & Ohio, Kingsmont, W. Va., butting collision of freight trains, one of which was running at high speed. Both engines and 10 cars were wrecked and five trainmen were injured.

unx, 21st, Nacogdoches & Southeastern, Hayward, Tex., a passenger train was derailed and one man was killed.

unx, 21st, Chesapeake & Ohio, Carkin, W. Va., passenger train No. 35 was derailed at a curve and several cars were wrecked. The express messenger was killed and three passengers were injured.

bc, 22d, New York, Chicago & St. Louis, Sheffield, Ohio, butting collision of freight trains, ditching one of the engines and 30 empty freight cars. Two trainmen were injured.

bc, 22d, Midland Terminal, Victor, Colo., butting collision in the yard between an empty engine and a train consisting of an engine and one platform car. One fireman was killed and two other trainmen were injured.

bc, 23d, Oregon Short Line, Eaton, Idaho, butting collision between a westbound passenger train and an eastbound freight. The fireman of the passenger train was killed and three other trainmen were injured. Both engines were wrecked.

unx, 23d, 1 a.m., Southern Railway, Campton, S. C., passenger train No. 14 was derailed and one passenger car was overturned. Seven passengers were injured.

xc, 24th, Erie, Susquehanna, Pa., passenger train No. 14 collided with a locomotive in the yard and both engines were overturned. The passenger engineman was killed and two other employees were fatally injured.

rc, 25th, 3 p.m., Pennsylvania, Paoli, Pa., an eastbound local passenger train which had just drawn up to the station (empty) to begin its trip to Philadelphia, was run into at the rear by a following express train and the rear car was wrecked. This was the general manager's car, being run on a short trial trip after having been overhauled in the shops, and it was occupied by employees of the shop department and two guests who were interested in new lighting apparatus which had just been put into the car. Three of these employees and one of the guests were killed and 23 persons were injured (of whom two subsequently died), some of them in this car and some of them passengers in the express and local passenger trains. The local train had just passed through crossovers from track No. 4 to track No. 1, and the express train, approaching rapidly on track No. 2, followed the local closely, before the signal man was able to straighten the switches. A few rods back the express train had passed from track No. 1 to track No. 2, this being the usual procedure for running the express train past the local passenger and other trains on track No. 1, and it appears that the engineman of the express mistakenly assumed that the signal which gave him the route from track No. 1 to track No. 2 gave him a clear route through the yard. Having thus assumed, he approached the stop signal, which should have kept him from entering the crossover, at a rate of speed too fast to admit of bringing the train to a stop. This accident was reported in the *Railroad Gazette* of September 29. From the coroner's investigation, held on the day following the collision, it appears that the inability of the signal man to reset the crossover switches after the passage of the local train was due to the presence of the rear car of that train on the detector bar, the train having been stopped too soon. Engineman Broomall, of the express, said that his view of the signal which should have stopped him was cut off by a cloud of steam emitted by a passing freight train. Just as Broomall passed the stop-signal his fireman discovered the error and shouted to him, and at the same moment the whistle on the signal tower was sounded. He then applied the brakes and sanded the rails, but was too late. He says that he was running about 18 miles an hour.

xc, 25th, Woodstock, Ala., a northbound freight train of the Alabama Great Southern ran into the side of a passenger train of the Louisville & Nashville, at the crossing of the two roads. The conductor of the passenger train was killed and 27 passengers were injured.

dr, 26th, Rio Grande Southern, Glencoe, Colo., a mixed train was derailed by spreading of rails and all of the cars were overturned. The train was running at moderate speed. Ten passengers were injured.

unf, 26th, Missouri, Oklahoma & Gulf, Muskogee, Ind. T., a construction train was derailed by running over some cattle, and the engine was overturned. The conductor and the engineman were killed.

unx, 26th, Texas Central, Morgan, Tex., a freight train was derailed and the engine was overturned; engineman killed, fireman and one brakeman injured.

*rc, 27th, Cincinnati, Hamilton & Dayton, Glenwood, Ind., a passenger train ran into the rear of a preceding freight, wrecking the engine, caboose and two freight cars, which took fire and with two passenger-train cars and four cars on the side track were burnt up. A tramp was burnt to death and two trainmen and six passengers were injured.

dr, 28th, International & Great Northern, Navasota, Tex., a passenger train was derailed by spreading of rails, and one passenger car fell down a bank. Six passengers were injured.

rc, 29th, Norfolk & Western, Lurich, Va., a freight train standing at the station was run into at the rear by a following freight, and six cars were wrecked. The engineman was killed and two other trainmen were badly scalded.

rc, 29th, Atlantic & Birmingham, Brunswick, Ga., a local freight train which had stopped to leave some cars was run into at the rear by a through freight train, drawn by two engines, wrecking two engines and several cars. Two trainmen were fatally injured.

bc, 29th, West Virginia Central & Pittsburg, Dodson, W. Va., butting collision between passenger train No. 1 and an empty engine. One engineman killed, two other trainmen injured.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understoud that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 18. FRIDAY, NOVEMBER 3, 1905.

"A plan for doing something," instead of objecting to the proposed legislation for fixing freight rates, is suggested, in a letter in another column, by an eminent gentleman who has had a lifelong close acquaintance with traffic problems. Mr. Stickney indicated a similar idea in a speech last week—but he did not write this letter. Our correspondent is definite, and perhaps too definite, in the details of his plan, for, like a political party platform, each detail finds new objectors and lessens the number of those willing to stand on it. There are more people in this world willing to subscribe to six or eight of the Ten Commandments than to the whole of them. The correspondent wants two commissions, such as President Hadley outlined, an administrative and a judicial one, appointed for life. He thinks that this tenure of office will inspire the President, who evidently wants obedience to the law to become a quite general habit, to consider these appointments seriously, put them on the high plane of the judiciary, and choose only the very best men. He names a definite interval between an order of the commission and the date for its taking effect, which is simply a worthy undertaking to solve what has puzzled many, that is, a translation of the President's most recent substitution of "a reasonable time" for his former word, "immediately." At this point our correspondent seems to go afield. He wants a lot of new United States District Court Judges, spotted over the country at intervals of 500 miles, each with his ear to the telephone, waiting for a hurry call from a shippers' combine, or a railroad, to give a high-speed decision on an appeal from the Commission's findings. It would seem to be enough for the present to have one such judge located midway between Cincinnati, Chicago and St. Louis; for a poultice usually does the most good when covering the center of inflammation. We are inclined to think that our correspondent has made a worthy effort to indicate a course which is at present impracticable. Neither that part of the public which we call the consumers, nor the railroads, have been protected by an enforcement of present laws. Until that is fully done no one is wise enough to say what further legislation is needed to make effective the principle of reasonable freight rates without discrimination in favor of persons, corporations, or localities.

Three hundred and fifty passengers were killed in train accidents in the 12 months ending with last June, as shown in the fourth annual Government bulletin, reprinted in the *Railroad Gazette* today. This is the aggregate of the fatalities to passengers in the eleven great train accidents* which were reported in the *Railroad Gazette*, and in the dozens of less magnitude, which occurred during the year. This number, 350, is an increase of about 30 per cent. over the year before and 113 per cent. over the second year before. The number of passengers killed by other causes (mostly the victims' own fault), 187, has also increased (25 per cent.). This indicates that the increase in traffic throughout the country is in part responsible for the greater number of fatalities; but this fact lightens only a trifle the black record of wrecks, and does not at all blunt the sharpness of the lessons to be derived. It is encouraging to note that there has been a decrease in the number of fatal accidents in coupling cars (from 278 to 243), which is equal to 13 per cent. As the commission pointed out in one of the earlier bulletins, there occur in the thousands of coupling operations which have to be carried on every month a good many accidents, the causes and frequency of which are little, if at all, affected by the style of coupler. Whether it is automatic or non-automatic makes no difference. Where couplers are out of order and the men have to go between the cars to repair or adjust them, and where men who are in a hurry prefer to take the risk of running backwards in advance of a moving car to adjust a coupler rather than to take the safe course required by the rules, the accidents occur now precisely the same as they did before the automatic coupler was thought of; and it may probably be said that we now have the measure of the saving of life and limb which was to be effected by the vertical plane coupler. There is also a decrease in the number of fatalities from falling off cars, which, it seems likely, may be due in great measure to the increased use of air brakes, diminishing the necessity of riding on the tops of cars.

The present bulletin, like its predecessors, gives authentic details of the causes of a number of butting collisions, bringing these

**Prominent Train Accidents—July, 1904-June, 1905—with number of persons killed and injured (passengers, employees and other persons), as reported in the Railroad Gazette:*

		Killed.	Injured.
July.	Litchfield, Ill.	24	45
July.	Midvale, N. J.	16	69
July.	Glenwood, Ill.	18	25
Aug.	Eden, Colo.	94	3
Sept.	Hodges, Tenn. (Newmarket)	59	100
Oct.	Warrensburg, Mo.	30	60
Nov.	Azusa, Wyoming	13	20
March.	Clifton, Pa.	8	35
May.	Lochiel, Pa.	23	109
June.	Patapsco, Md.	26	20
June.	Mentor, Ohio.	19	15
	Total	330	501

out in a way which, we are free to say, was not often possible when the *Railroad Gazette* was the only reporter of American railroad accidents. These statements of details set forth an interminable variety of causes which, apparently, no man can cope with. Thus month after month the bulletins go on increasing the mass of evidence which goes to show that nothing short of the space-interval principle will cure this sore on the American railroad system. Perhaps the culminating instance is to be found in that paragraph of the present bulletin which describes the butting collision on the Western Maryland of June 17, when 26 persons were killed, including *six* who should have prevented the error which caused the collision. Concerning the Mentor disaster, which occurred in the quarter now under review, the government gives no material facts not already known. An inquirer for information as to how the switch came to be misplaced is left just where he was three months ago. The Interstate Commerce Commission has no power (and, indeed, we are sorry that such power is not given it) to investigate accidents, and so the Federal as well as the State and county authorities leave the main question in the dark. According to the preposterous and apparently irresponsible statements made by the coroner of Cuyahoga County, the night operator at Mentor misplaced the switch, but the coroner of Lake County and the State Commissioner of Railroads appear to have been satisfied to let the question go by default. If the operator has been cross-questioned, or if any energetic effort has been made to clearly show all that can be shown as to his relation to the accident, the tribunal which has taken this action has omitted to tell the public anything about it.

WHERE GOVERNMENT CONTROL OF RAILROADS IS NEEDED.

The railroads of this country need new legislation, Government control and interference with their unabated killing and wounding of people on trains. Some of it is inevitable, much of it is avoidable by a prompt judicial determination of the cause and the remedy. In comparison with the train accidents in other countries our work is shameful. Throughout the whole civilized world we have earned a reputation for recklessness. Nevertheless, some of our companies have employed a writer who, by distorting facts and juggling with ratios of killed to not-killed passengers, has made foolish apology for this recklessness. The money paid for that work has been ill spent, for the Government bulletins and *Railroad Gazette* records show that the railroads need something more than defense in this matter—they need control.

The Government Accident Bulletin shows that 1,148 persons (passengers and employees) were killed, and 13,550 wounded in train accidents during the year ending June 30, 1905. Bad and record-breaking as that killing was, we have been approaching it in the three months since July; and bear in mind that these are summer months. The quarterly official bulletin for July-September is not yet issued, but the *Railroad Gazette's* incomplete detailed reports of persons killed and injured in train accidents are summarized as follows: July, killed 56, wounded 266; August, killed 69, wounded 244; September, killed 55, wounded 263. In three months we have killed 180 persons and wounded 753. But the errors in these figures are errors of omission. We get statistics of passengers killed with reasonable accuracy, but the compulsory official reports indicate that we get voluntary information of only about one-quarter of the employees killed and injured in train accidents. It is safe to say that the rate of killing and wounding has not decreased during the past three months.

Most of the lives so lost, and the injuries, have to be paid for. Contributory negligence lightens the burdens in some cases, but jury awards and private settlements show that the value of a life may be quoted at anywhere between $5,000 and $100,000. The larger sum has been paid in only a few cases, but the tendency is upward in these days, when the earning power of men is rapidly growing. What would a railroad company have to pay for killing an insurance company president, with a salary of $150,000 a year and a considerable "expectation of life?" Substantially all injuries cost the company something, and they are apt to cost more than killings. Railroad attorneys fear to face a jury in a damage suit rather more than for a death claim. The injured man hobbles painfully to the witness chair, and the wife is conspicuously pitiful, but brave. Some of the law and all of the evidence of the defence is swept from the juryman's mind in a wave of gallant sympathy.

We have tried to abstain from preaching, believing that a publication of the facts would be effective, and for 32 years we have published each month a brief account of all serious train accidents, and the causes so far as known. Until four years ago this was the only record. This has not produced the results which might have been expected, but it is not a necessary inference from failure that railroad officers, generally, are to be blamed. Their ardor in determining the responsibility for a train accident and frankness in making it public are often tempered by their loyalty to the company which has to pay the claims based on it. No man should be his own judge. Nevertheless, almost any railroad officer is better than most coroners. The powers and the work of State Railroad Commissioners vary so much in efficiency, from nothing to something, that they may be ignored in this discussion.

We are, therefore, apparently driven to resort to that General Government legislation and control which is lawful for interstate railroads—which under judicial decisions include nearly all roads. In this, happily, we have an excellent model; we do not need to experiment, for the British system of investigating the causes of accidents and making recommendations for future precautions has worked without friction for many years, and with splendid results. It would seem to need only adaptation to American laws and American conditions.

The Board of Trade is a department of the British Government which has, among other duties, that of regulating the relations between the railroads and the public. Its inspectors are experienced men of position and judicial quality. They are so carefully chosen that no lack of honesty of purpose or fairness has ever been charged against any one of them. When a train accident occurs an inspector gets to the spot as quickly as possible and makes an examination. Then he summons every officer and employee who has had anything to do with the case, and examines them under oath. He has full power and learns to be skilful, expert in determining whether or not, or to what extent a witness is lying. It is rare indeed for the inspector to fail in discovering the cause and fixing the responsibility. He consults freely with the officers and makes his report and recommendation. No railroad officer hesitates to carry out a recommendation made by such a man. They like it. The public is protected and likes it. There are comparatively few train accidents —one year in which no passenger was killed—although their dense fogs are a menace to safety, and their transportation is swift.

Considering the cost and the pity of killing and maiming so many, and the reasonable assurance, based on experience, that an expert, judicial and quick investigation and recommendation would reduce it, it seems to be clearly a subject for Congressional enactment, a better subject, this saving of human life in car-load lots, than making arbitrary freight rates.

COMPETITIVE RAILROAD BUILDING.

Mr. Harriman on his return from the Orient enlivened the railroad world and incidentally knocked a point or two out of the stock market by announcing that we seem likely to be running into an era of competitive railroad building just as we have lately passed through an era of competitive railroad buying. Although Mr. Hill, who happened to reach New York on the same day as Mr. Harriman, said that this view of the situation had not presented itself to him, the market at once assumed that there was soon to be an open revival of the Hill-Harriman strife so recently brought to a close forever, if the daily newspapers were to be believed, by a simple agreement between the two interests to build a joint line through the long disputed Clearwater country in northern Idaho.

At the same time with Mr. Harriman's statement, came news of a contest between the Union Pacific and the Burlington, each of which has discovered the desirability of building a line along the north branch of the Platte river, in Nebraska, and has secured an injunction restraining the other from doing the same thing. This is, of course, a comparatively insignificant dispute, but may be suggestive of present relations between the two great railroad powers of the northwest. This North Platte line of the Burlington is reported to be only a preliminary step to a more ambitious plan—an extension from Guernsey, the present terminus of one of its most western branches, west some 500 miles through Wyoming to Salt Lake City. Such an extension would parallel the main line of the Union Pacific through Wyoming. Mr. Hill, refers to this report as a fable. Nevertheless, the story does not down. It is known that some years ago the survey for such an extension was made and that a practicable line was located through the undeveloped territory north of the Union Pacific.

The present situation of the Burlington is an argument for such an extension. Mr. Hill's choice for a Chicago connection was the St. Paul. With its, at that time, nearly 7,000 miles of line

almost all of it north and northwest of Chicago, the St. Paul would have most effectively filled out the eastern end of the Great Northern's territory. It proved, however, to be out of reach, and the Burlington, nine-tenths of whose nearly 8,000 miles of road was south of the parallel of Chicago, was bought for the sake of its 450 mile St. Paul-Chicago line. The bulk of the Burlington system—the network of main and branch lines in Illinois, southern Iowa, northern Missouri, and southern Nebraska—is separated by hundreds of miles from the Great Northern and the Northern Pacific. Through this territory the Burlington is a direct competitor of the Chicago & North-Western to Omaha, and of the Union Pacific from Omaha to Cheyenne and Denver. These two roads have close traffic alliance. The Union Pacific controls the coast connection. Is it likely that the Burlington gets any large share of through traffic? If not, its purchase by Mr. Hill has resulted in making of fifteen-sixteenths of the Chicago, Burlington & Quincy, a local railroad. It is not characteristic of Mr. Hill to be satisfied with such a result. It gives him another reason, in addition to the tremendous traffic importance of San Francisco, for desiring a share in trans-continental traffic west, as distinguished from northwest, from Chicago. The circumstantial stories which come from the west, of a Burlington extension to Ogden and Salt Lake are no doubt premature, but that such a purpose will ultimately be carried out seems in view of these facts not at all improbable. If this be the case, there is the possibility that the Western Pacific from Salt Lake City to San Francisco will be found, when completed, to be as serviceable to the Hill as to the Gould roads.

At any rate, whether or not the Burlington plans to strike at the Union Pacific, the Hill roads are overturning a Harriman monopoly in Oregon by a new line now under construction down the north bank of the Columbia river to Portland, paralleling the Oregon Railroad & Navigation Company's line on the south bank. This will give the Great Northern its own line into Portland instead of having to use the O., R. & N. line from Spokane as at present. This, however, can hardly have been enough to call forth Mr. Harriman's remark or to denote bitter Hill-Harriman warfare; yet even leaving Hill and Harriman out of the account, northwestern territory has plenty of extensions and new lines by other companies, either already under way or the subject of constant rumor to justify the prediction of the Union Pacific's President.

Perhaps the most persistent of the rumors is that the Chicago, Milwaukee & St. Paul will extend to the coast, which has repeatedly been reported as an assured fact and as often denied by the highest officers of the road. The incorporation of the Pacific Railroad, which has made extensive purchases of terminal property in Tacoma and Seattle and which plans to build east 250 miles from the coast, has been taken as strong circumstantial evidence of the truth of this report, although it is denied that it has any connection with the St. Paul company. The President of this new company is Mr. H. R. Williams, who recently, and with no explained reason, resigned as General Manager of the St. Paul, and the Chief Engineer is Mr. W. L. Darling, late Chief Engineer of the Chicago, Rock Island & Pacific. Men of this stamp are not likely to be connected with a 250-mile road without cause. But this is no proof, of course, that it is necessarily the St. Paul which will ultimately get the road, although it looks as if that would be its ultimate disposition.

The reason given for a Pacific extension is that the St. Paul as at present situated is merely a local line and must, to be continuously prosperous, have a share of trans-continental traffic. The Chicago & North-Western, except for its more favorable relations with the Union Pacific, is in precisely the same situation, and there have even been reports that it would build to the coast. Neither of these companies may have any thought of the Pacific, but it is common knowledge that the St. Paul is building west from Chamberlain, S. Dak., the terminus of one of its farthest western branches, to Rapid City, in the Black Hills, and also that the North-Western is building west from Casper, Wyo., to Lander, in the Wind River Indian Reservation. Both companies seem to feel that it does no harm to open up new territory in the direction of the coast.

Other new lines which carry out Mr. Harriman's assertion are the Spokane International, which is to be a Canadian Pacific connection into Spokane, the Western Pacific, already mentioned, and the Denver, North-Western & Pacific—the Moffat road—from Denver to Salt Lake, which will, when completed, give a new through line 200 miles shorter, and with the completion of a long tunnel through the Continental divide, possessing better grades than any existing line between those two points. Such a road could not fail to be a severe competitor to the Denver & Rio Grande. It is possible, of course, that the Burlington may be planning to reach Salt Lake over this now independent line.

The $100,000,000 preferred stock authorized this year by the Union Pacific for acquisitions and extensions is still unissued. It is one of the strongest factors to be reckoned with if there should be a new Hill-Harriman contest. The Great Northern has within the past month announced a new stock issue of $25,000,000. The St. Paul, too, has an issue of $25,000,000 common stock authorized but unissued, which would go a long way toward paying for a Pacific connection. These three companies at least, have ammunition available. It may not be that the large extension plans which are just now so widely rumored are ever to be carried out, but surely these years of great prosperity for northwestern railroads are being used in strengthening and extending control of their respective territories. Mr. Harriman could hardly have meant to compare the era of competitive building which he predicts with the construction craze in the late '80s; yet that period of reckless and speculative expansion taught certain lessons which might well be applied to the present situation. While it is as certain as anything can be that no company is going to build so extensively that it will on that account have to face receivership or a dividend reduction on the first let-up of prosperity, the experience of a road like the Alton, which did not join in the expansion mania of 1885-1889, and whose earnings fell off sharply in the recovery from the panic of 1893 on account of loss of business to the extensions of its competitors, has not, apparently, been forgotten.

The full official report of the Russian railroads for 1902 has but recently been published. Perhaps the most interesting facts shown by it are those concerning traffic and rates. The latter are certainly the lowest in Europe and only in British India, if there even, are lower ones to be found, taking freight and passengers together. The average received per passenger-mile was 0.689 cent, being 0.72 cent in European Russia and 0.441 cent on the Asiatic lines. Per ton per mile the receipts were 0.855 cent in Europe and nearly the same (0.858 cent) in Asia. The Asiatic traffic is extremely light, and at these rates it is not surprising that the earnings did not equal the working expenses. The Asiatic Midland (Caspian Sea to Tashkend), which is comparatively an old line, was, it is true, worked for 80 per cent. of its earnings, and yielded $930 net per mile, but on the Siberian Railroad west of Lake Baikal the working expenses were 110 per cent. of the earnings, on the Ussuri Railroad (from Vladivostok to the Amoor River) 172 per cent., and on the Trans-Baikal line 180 per cent. The whole Siberian Railroad (but not including the Chinese Eastern) earned gross $15,714,427, while it cost $20,280,757 to work it. There is nothing surprising in this, considering the rates and the extremely thin population on the line. The object of the railroad was chiefly to develop this country, and this will take time. These lines had cost at the time a little more than $173,000,000.

That those physicians who discuss the matter have been rather too strenuous in their denunciation of the upholstery of cars as promoters of the spread of tuberculosis has long been the feeling of a good many observers. Not that the layman finds any glaring fault in the theories propounded by the doctors, but he is constantly oppressed by the fact that no conclusive evidence is produced to show that the alarming conditions assumed by the theorists do actually prevail. One may readily admit that the bacillus is of active disposition and persevering, but that he meets with success in the manner claimed remains to be shown. How many consumptives have caught the disease in either sleeping or day cars? This, as we say, has long been the feeling of many observers; but now Dr. Charles B. Dudley, Chemist of the Pennsylvania Railroad, has studied and formulates the facts on which the feeling is based, and he has presented his conclusions to the American Public Health Association, in a paper which was read at the annual meeting of that body in Boston last month. The principal claim concerning tuberculosis is that the sputum of those sick with the disease becomes dry, and that this, in the form of dust, floats in the air and so gets into the mouth or nostrils of other persons. Dr. Dudley shows that as a general rule "prolonged exposure" is necessary to infection. The sputum is extremely difficult to dry, and when dry is with difficulty pulverized, and even if dry and pulverized is so heavy that it readily falls to the ground. Two days of strong light or five days of diffused light will sterilize it. Dr. Dudley names the authorities on which he bases these statements. He shows from the census that railroad employees suffer far less from consumption than the average of the community. The Pullman Company has no statistics, but officers of the company say that they have never known of either a conductor or a porter acquiring any disease in a car except one case of smallpox. Interviews with many of the oldest conductors fail to find one who has known of a porter who had consumption. The records of the Pennsylvania Relief Fund

show that freight conductors and brakemen are more subject to tuberculosis than are passenger conductors and brakemen. Dr. J. J. Kinyoun, in the New York Medical News, July 29 last, writing on the bacterial content of the passenger car, says that in 14 examinations of dust from the carpets of cars, many of which were known to have carried tuberculous people, none showed the presence of the tubercle bacillus. Out of 64 examinations of dust collected by swabs from the interior surfaces of cars only one might have been bacillus tuberculosis, and this was doubtful; out of 96 examinations of air from similar cars, only one, and out of 21 drinking cups, none. To inform himself as to the relative danger of textile fabrics and smooth surfaces, Dr. Dudley made experiments with pieces of plush, carpet and glass, putting equal quantities of salted paste on the different specimens, allowing them to dry and then passing over them a heavy iron roller to simulate the conditions of grinding up tuberculous sputum under the foot. After driving away as much as possible of the pulverized material by compressed air, he found that on the glass about one-third of the material remained, while on the plush and on the carpet seven-eighths of it stayed behind, indicating that the danger of infection from upholstery fabrics is much less than from naked surfaces.

Mexican Central.

The Mexican Central, with its 3,155 miles of line, is the largest railroad in Mexico and has a monopoly of the country's largest port in point of tonnage, Tampico. Its main line runs from Mexico City to the United States boundary line at El Paso, Tex., thus carrying it through the western part of northern Mexico and making a longer route to the eastern part of the United States than that of the Mexican National lines, by way of the Eagle Pass or Laredo gateways. Nevertheless, the Mexican Central obtains a very substantial share of international traffic.

The fall in the price of silver during the past 20 years and the fluctuating value of the Mexican dollar have been serious handicaps to all industrial undertakings in Mexico. The railroads in particular have suffered. Not only has the prosperity of the country, and therefore the volume of traffic, been greatly lessened by the depreciation and uncertainty of the standard of value, but, more particularly, the railroads have received their income in Mexican currency, while all of their fixed charges and a large part of their material and supplies have had to be paid on a gold basis. Monetary reform provisions went into effect on May 1 and appear to have been successful in steadying the rate of exchange. The value of the Mexican dollar during the Mexican Central's whole fiscal year ending June 30 fluctuated 3.44 cents between a high and a low price, while in the two months of the year after the passage of the act, the fluctuation in value of the silver dollar was only nine one-hundredths of a cent. A continuance of this stability of exchange cannot fail to be a factor in increasing the prosperity of Mexico, and therefore of Mexican railroads.

Gross earnings of the Mexican Central last year were $26,097,700 (Mex.), a slight increase over the corresponding 12 months previous. Owing to the impossibility, without further facts than those in the report, of working out an exact corresponding figure in United States currency, most of the operating results are given in Mexican dollars. The average price received during the year for Mexican dollars was 48.41 cents, against 45.13 cents in 1904. As a result, the increase in gross earnings on a gold basis was much larger than in Mexican currency. Operating expenses were cut down $2,000,000, leaving net earnings of $8,498,523, an increase of $2,116,193 (33 per cent.) over 1904.

This large increase in net earnings was brought about by decreases of $370,187 in maintenance of way expenses, $907,361 in maintenance of equipment, $566,354 in conducting transportation, and $176,794 in general expenses. There was also a decrease of $284,049 (Mex.) in the expense account, caused by the average lower rate of exchange used in converting into Mexican currency purchases and other expenditures made in the United States and Europe. The decrease in operating expenses appears to have been largely brought about by the improvements of recent years. Especially is this true of the large decrease of over $900,000 in maintenance of equipment. In December, 1903, the large shops at Aguascalientes were put in operation, enabling the company to transfer most of the shop work at four other smaller and less economical shops to these, the main shops for the system, which are operated by thoroughly modern methods, including steam turbine motive power for the generation of electricity. Besides this, during the spring of 1904, 80 new locomotives, which raised the average tractive weight of the company's locomotive equipment from 101,305 lbs. to 113,670 lbs., and 1,933 freight cars, which raised the total tonnage capacity of the freight equipment from 153,515 tons to 216,875 tons and the average car capacity from 26.91 tons to 28.40 tons, were added to the Mexican Central's equipment list. Maintenance of equipment works out at $1,844 (U. S.) per locomotive, $423 (U. S.) per passenger car and $95 (U. S.) per freight car. The freight car allowance seems large, the others about normal. Maintenance of way decreased $52 per mile, from $524 in 1904 to $472 in 1905, both U. S. currency. This decrease is attributed to new bridges and heavier rails, but seems a rather small roadway maintenance charge. There was, however, in addition, charged against income for betterments and improvements to the line, $554,071 (Mex.), or $270,510 in U. S. currency, which brings up roadway expenditures nearer a normal figure.

The report is most incomplete in traffic statistics. The number of tons of freight carried one mile is not given, but including company freight it decreased 11,942,663 ton miles, or about 1 per cent. The freight train mileage decreased 636,225 miles, or over 12 per cent. The better handling of freight trains thus shown is held to be accountable for at least one-third of the decreased operating expenses. Forest products were 11 per cent. of the total freight traffic—whether this means in tonnage or earnings is not stated—agricultural products 22 per cent.; live stock and animal products 4 per cent.; ores 26 per cent.; other mineral products 27 per cent., and merchandise and miscellaneous 9 per cent.

Like many other railroads, the Mexican Central suffered severely last year from floods. For twenty days from September 7, 1904, the main line was cut in two and all through traffic had to be abandoned as a result of the washing away of a six-span 900-ft. steel bridge at Ortiz, just south of the city of Chihuahua. Moreover, the road suffered from the effects of washouts on two of its connections in the United States, the Santa Fe and the Rock Island. Traffic through the El Paso gateway was interrupted on this account for nearly a month in October and November when the normal movement would have been very heavy.

A departure in the motive power department of the road is the decision to use oil burning locomotives. Under a contract with the Mexican Petroleum Company, which has extensive oil wells near Tampico, 40 locomotives are now being equipped to burn oil.

The income account for the year (all in U. S. currency) shows, after borrowing $750,000 from the subsidy trust fund, which represents the Mexican government's subsidy payments on different parts of the road, a final deficit of $210,710. In the face of an increase of $1,231,327 (U. S.) in net earnings, a deficit is unexpected. It is largely due to a payment of $800,000 to bankers for cancellation of an option on $16,000,000 consolidated mortgage 4 per cent. bonds. This option, which was given July 1, 1904, must have been a most unsatisfactory arrangement, to make the company willing to endure so large a direct loss in order to cancel the agreement. Had it not been for this payment, and $181,400 charged off as "accounts and balances," the showing of the company for the year would not have been a bad one. Operating results, except for the small increase in gross earnings, were fairly satisfactory.

The financial situation of the road is somewhat involved, as over $97,000,000 of obligations must be refunded within the next six years.

Several new lines are and have been for some years projected. The one nearest of attainment is a line to the Pacific coast. With the completion of a gap of 40 miles between Tuxpan, the present southern terminus of the Zapotlan branch, and Colima, the northern terminus of the Mexican National Construction Company's line, recently purchased, the Mexican Central will have a line from Tampico and the City of Mexico to the Pacific coast at Manzanillo, and will be the first Mexican railroad north of the Isthmus of Tehuantepec to cross the continent.

The principal statistics of operation follow, first in Mexican currency and second in United States currency at the average price of a Mexican dollar in each of the two years:

	1905.	1904.
Mileage worked	3,155	3,026
MEXICAN CURRENCY.		
Freight earnings	$20,238,211	$20,372,083
Passenger earnings	4,330,462	4,303,811
Gross earnings	26,097,699	26,002,202
Maint. of way and structures	3,008,792	3,378,979
Maintenance of equipment	3,309,721	4,217,081
Transp. and traffic expenses	9,792,048	10,358,402
General expenses	1,488,615	1,665,409
Operating expenses	17,599,176	19,619,872
Net earnings	8,498,523	6,382,330
UNITED STATES CURRENCY.		
Freight earnings	$9,797,318	$9,193,891
Passenger earnings	2,193,197	1,942,310
Gross earnings	12,633,896	11,734,794
Maint. of way and structures	1,456,556	1,524,933
Maintenance of equipment	1,602,236	1,903,169
Transp. and traffic expenses	4,740,331	4,673,747
General expenses	720,639	751,599
Operating expenses	8,519,761	8,854,448
Net earnings	4,118,173	2,886,846
Deficit	210,710	.....

NEW PUBLICATIONS.

Practical Planer Kinks for Planer Hands. By Carroll Ashley. The Hill Publishing Company, New York, 1905. Cloth, 4½ in. x 7½ in.; 80 pages, 32 illustrations. Price, $1.00.

This work, as its title implies, is essentially practical. The first pages are devoted to a detailed description of the planer itself, which is clearly written and which is accompanied by an excellent halftone illustration of a modern planer on which the parts are marked with their proper names. The remainder of the book is devoted to

describing and illustrating planer equipment, such as tools and their care, including gang tools, special jigs, various handy methods of doing special jobs, such as circle planing, grinding, slotting, cutting spiral grooves, planing large cylinders, etc. The illustrations are good and the text is clearly written. The journeyman as well as the apprentice will find this work of value inasmuch as many new and valuable suggestions are given which, if followed, will no doubt enable both to do more and better work.

Proceedings of the Sixth Annual Convention of the American Railway Engineering and Maintenance of Way Association. Published by the Committee on Publications, L. C. Fritch, Secretary. Chicago, Ill. Paper, 872 pages.

Volume 6 of the *Proceedings* of this association is a larger book than any which have been issued previously and contains a great amount of data and information on subjects covered by the engineering departments of railroads. The committee reports are reprinted in full with the oral and written discussions and the excellent index makes reference work easy. Some of the committee reports were as follows: Wooden bridges and trestles; roadway; iron and steel structures; signaling and interlocking; yards and terminals; water service; records, reports, and accounts; buildings; masonry; uniform rules; ballasting; track; ties. The book also contains a list of members' names and addresses.

TRADE CATALOGUES.

Paint.—The Standard Paint Company, New York, sends its October issue of the *Exchange*. It is full of interesting reading matter pertaining to this company's products, such as "Ruberoid" roofing "S. P. C." non-inflammable paint, "Ruberoid" damp course, etc. A half-tone illustration of the company's American works at Bound Brook, New Jersey, is shown, and a detailed drawing showing the Standard Paint Company's system of damp-proofing with Ruberoid built-up damp-course is given, as well as a set of approved architect's specifications for damp-proofing outside walls and foundations and cellar floors.

Rotary Converters.—The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., sends a 67 page pamphlet in which is described and illustrated the characteristics and construction of its rotary converters. Instruction for their erection, operation and care are also given. Illustrations of a number of large Westinghouse rotary converter installations are also shown. Notable among these is one of four 1,500-k.w. machines installed in substation No. 8, of the Manhattan Railway Company, New York City.

Pneumatic Hammers.—The Dayton Pneumatic Tool Co., Dayton, Ohio, has a new catalogue on "Green" pneumatic hammers. A description and view of each class of hammer made is given with essential details. There are also views of "Green" hammers in service, fac-simile reproductions of testimonial letters and a view of Thebes bridge, on which these hammers were used. Sectional drawings show the construction, accompanied by a list of repair parts.

Panel Back Chairs.—The Richards Chair-Panel Co., Chicago, is distributing a folder showing two views of Richards "fit-the-back" chairs, and presenting a number of testimonials from users of these chairs regarding their comfort and other good qualities. There is also attached a slip on which is printed an extract from the description of the new "Alton Limited" train in the *Railroad Gazette* of September 1 mentioning the use of these chairs in the chair car.

Agricultural Bulletins.—Agricultural bulletins Nos. 52 and 53 of the passenger department of the Union Pacific give respectively the crop yields by counties of Nebraska and Kansas for 1905. There is also a summary of the acreage and total yields of crops for the year. All agricultural bulletins issued by the road to date may be had on application to the passenger department.

The Allis-Chalmers Company, Milwaukee, Wis., sends copies of its new publications, entitled, Saw Mill Carriages and Accessory Machinery; Allis-Chalmers Steam Shovel; The Hancock Jig; McDougall Roasting Furnace; High Duty Pumping Engines, and Single-Stage Centrifugal Pumps. All of the above publications are generously illustrated and contain clearly written descriptions of the devices to which they pertain.

Pressure Recorders.—The Crosby Steam Gage & Valve Company, Boston, Mass., sends a folder descriptive of its pressure recorders and gages.

Special Machine Tools.—The United Engineering & Foundry Company, Pittsburg, Pa., is distributing a neat catalogue in which illustrations of a number of specially designed tools made by the company are shown. The illustrations include half tones of pipe straightening presses, cutting-off machines, welding rolls, testing machines, multiple spindle tapping machines, plate shears, straightening and bending machines, etc.

Ratchet Drills.—The Billings & Spencer Company, Hartford, Conn., sends an illustrated folder and price list of its "Packer" and "Boiler' ratchet drills as well as of the Billings double acting ratchet drills. All of the above ratchets are drop forged from the best material, and are made to take Morse taper shanks, twist drills and sockets.

Steam Engine Economy.—The American Blower Co., Detroit, Mich., sends a small pamphlet entitled "Will 100 Per Cent. on Investment Interest You?" For two engines, each costing $250, the pamphlet shows a difference in cost of operation of $234 a year, the economical engine being the "A B C" Type A of this company.

Electric Drills.—Circular No. 52 of the Chicago Pneumatic Tool Co., Chicago, Ill., describes several types of air-cooled Duntley electric drills which are adapted for any form of portable drilling. A number of tests showing the capacity of the different sizes of drills in working steel and cast-iron are given.

CONTRIBUTIONS

Honeycombing Flue Sheets.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest the editorial note in your issue of October 27 regarding the formation of honeycomb on flue sheets of locomotives equipped with automatic stokers. I have experienced considerable trouble with honeycomb forming on the flue sheets of locomotive fireboxes with hand firing, and have tried lime-stone, oil and sand blast to overcome the difficulty, but almost invariably the difficulty was overcome by making absolutely tight joints in the steam pipes and exhaust pipe in the front end and making the flues tight in the flue sheet in the firebox. Wherever honeycomb occurs, it demonstrates that there is more or less mineral and sulphur in the coal, and it is absolutely necessary that this pass into the flues before it becomes chilled, and insufficient draft caused by leaky steam pipes, exhaust pipes or flues is liable to cause more or less of a honeycomb on the flue sheet. In my judgment if the steam and exhaust pipe joints are made absolutely tight in the front end and with good broad ground fit surfaces, not less than ⅝-in. on the steam pipe joints, and the flues and seams are made absolutely tight in the firebox end, so that there is not even a simmer of steam escaping, then the majority of the trouble due to honeycomb will be avoided.

S. M. P.

New York, Oct. 27, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The experience with honeycombing mentioned in the editorial note in the *Railroad Gazette* October 27 is not entirely an uncommon one, and the conditions obtained on the western railroad noted are not confined to the use of Illinois and Iowa coal, as roads east of Buffalo and Pittsburg that burn Pennsylvania coal have similar experiences under certain conditions.

From the experience I have had, I should be inclined to believe that coal taken from the same cars as that used with the automatic stoker, would have shown similar results if the firing had been done by hand. Careful investigation in several cases that came under my own observation where the flue sheets and firebox ends of flues on locomotives were covered to the depth of considerably over an inch in a run of less than 150 miles showed three adverse conditions existing.

First.—The special loads of coal which were at the foundation of the difficulty were very dirty, and contained considerable quantity of sulphur.

Second.—Analysis showed that the deposit on the flues contained quite an amount of iron which was traced to its source and showed that the cars in which the coal was loaded had previously been loaded with iron ore, and a considerable quantity of the ore had either frozen to the bottom of the cars and had not been removed, or else the cars had not been properly unloaded. When the carloads of coal were dumped the fine iron ore was mixed all through the coal.

Third.—From some source or other, either due to leakage in the firebox or to excessive wetting of the coal, enough moisture existed at the time of combustion of coal to mix with a peculiar vapor arising from the sulphur and iron causing the formation of this peculiarly honeycomb deposit. Steps were at once taken to trace the coal, and it was found that it was being mined from a peculiarly dirty vein. Shipments for locomotive use from the mines furnishing from this vein were stopped. Special precautions were taken to prevent the loading of locomotive coal in cars which had formerly carried iron ore, unless the bottoms of the cars were thoroughly clean and the ore removed. Precautions were also

taken to see that better care was taken at the roundhouse to prevent allowing locomotives to go on the road with leaks on the inside of the firebox; and also firemen were cautioned against excessive wetting of coal.

As the trouble suddenly stopped after the above precautionary measures were taken, I have always assumed that one or all of the three causes noted above were at the bottom of the unfortunate honeycomb of the flue-sheet and flues. This experience may prove of value to your readers in locating the cause of similar troubles on other roads.

A. M. WAITT.

To the Editor of the Railroad Gazette:

The honeycombing of flue sheets on locomotives is a very common occurrence with Illinois coal, regardless of how the locomotive is fired, whether by hand or with a stoker. It is probably safe to say that all roads using this coal carry a scraper on the tank for the purpose of dislodging honeycomb when it forms on the flue sheet. I have seen all kinds of experiments such as wiping the flue sheet off with crude oil, cylinder oil, etc., but none of them seem to have any effect. Any means of preventing this will be gratefully received by motive power officers in the middle west.

MECHANICAL ENGINEER.

Fond du Lac, Wis., Oct. 28, 1905.

To the Editor of the Railroad Gazette:

I am very much interested in the matter of "honey-combing" referred to in an editorial note in your issue of October 27, as we have quite a little trouble with it. The editorial gives the impression that honey-combing is a new trouble which has come with the advent of the locomotive stoker. That trouble has existed for years and exists to-day where Illinois coal is used and on roads that have not yet tried the stoker. Last year we burned West Virginia coal and we had practically no trouble with honey-combing. We are now burning Illinois coal and are annoyed a great deal by it. We find it comparatively easy to clean the flue sheets with a scraper or clinker hook when the fires have been cooled down but without having to pull the fires. With a stoker, as suggested, this is a more difficult problem.

It is my opinion that the honey-combing does not come as a result of the method of firing, but that the same trouble has been more easily overcome where the stoker is not used. I have no doubt that this trouble has not arisen on roads using higher grade fuels.

I know of no successful means of preventing honey-combing, but I have often seen it knocked off by throwing lumps of coal at the sheet. This is more effectively done when the fire is quieted down. I should think that automatic stokers might be made to discharge coal against the flue sheet when necessary to remove the honeycombing.

Alfred R. Kipp,
Master Mechanic, Wisconsin Central Railway.

New York, Oct. 30, 1905.

To the Editor of the Railroad Gazette:

Referring to the editorial note in your issue of October 27 regarding the honeycombing of flue sheets where Illinois and Iowa coal is used with automatic stokers, it is barely possible that it may result from causes similar to those that have produced the same thing in connection with the use of coke in the locomotive firebox. It has been found that coke of a certain character can be successfully used on short local runs where the firebox is frequently opened; but on long express runs its use is unsatisfactory. The reason is that in burning this fuel a heavy bed is necessary and the resultant firebox temperature is very high. With this high temperature the ash of the fuel is volatilized. The ash will again solidify at a comparatively high temperature so that as soon as the volatile gases strike the relatively cool flue sheet they solidify and clog the tubes with a honeycomb. It is quite possible that the even distribution of the coal by the automatic stoker creates such uniform conditions of combustion that the ash is volatilized and then resolidified at the entrance to the tubes which are quickly honeycombed.

It is, of course, quite impossible to accurately diagnose the case or prescribe a remedy without a more thorough investigation of all the attendant conditions than is possible from a mere perusal of your note. It may be suggested, however, that a possible remedy might be found in the use of the brick arch. In burning pulverized fuel it has been found that where it is thrown directly into the firebox the waste is excessive and the formation of the honeycomb on the sheets very annoying. By using a firebrick furnace, however, and confining the whole of the work of combustion within its limits and taking out only the direct products of the union of the fuel with the oxygen to the furnace, honeycombing and coating are avoided. On the other hand the volatilized ash is liquefied as it comes in contact with the brickwork and, trickling down the sides, is collected at the bottom in a closed ashpan. There is, thus, an automatic separation of the volatilized ash from the products of combustion proper.

Whether this will remedy the locomotive difficulty or not is a matter upon which an opinion could not be safely hazarded without a careful and thorough investigation of all of the conditions that obtain in the particular case under consideration.

F.

Car-Service Burden on Terminal Roads.

New York, New Haven & Hartford Railroad,
New Haven, Conn., Oct. 30, 1905.

To the Editor of the Railroad Gazette:

The article about the recommendation of the Car Service Committee of the American Railway Association on page 382 of the *Railroad Gazette* for October 27 is not complete as to the penalty rate. The penalty rate is to be $1, but it does not commence to accrue until after a car has been held beyond 40 days on a road of 2,000 miles or more. On a road of less than 2,000 miles the penalty rate commences after a car has been on the road 30 days.

Twenty cents is not unquestionably below the average cost of the service of a car for a day, unless you consider all the cars owned by a road to have cost as much as we are now paying for new cars, which is not a fair proposition; and, furthermore, according to the figures of the committee the average value of cars is about $472. The committee's figures as to the cost of maintenance per car per year vary from $6 to $93. This wide difference is rather peculiar, to say the least.

If the New York, New Haven & Hartford, and other terminal roads, are to suffer for the general good, why does the committee recommend relief for the long roads in the way of ten additional days before the penalty rate takes effect? By this action the committee recognizes that, doing the best they can, the long roads cannot move foreign cars without incurring excessive penalty. The committee knows from personal observation that the New England roads are doing the best that they can to return foreign cars promptly, working as we are under a 96-hour law for loading and unloading. The committee may have diplomatic ability and grit, but in showing consideration to the long roads about the penalty rate and declining to give any consideration to the New England or other terminal roads as to the per diem rate, the committee is not consistent.

Your recommendation is a readjustment of rates and making consignees pay for unreasonable detention of cars. The rates were not readjusted when we changed from mileage to per diem, although per diem increased our operating expenses about $700,000 per annum. We can do nothing about charging for detentions to cars until after 96 hours, not counting Sundays or holidays; therefore your remedy cannot be very effective. Under these circumstances we do not feel inclined to acquiesce, either gracefully or otherwise, in the will of the majority, inasmuch as we have done more than our share of suffering for the general good.

S. Higgins,
General Manager.

Government Should Control Railroad Rates.

To the Editor of the Railroad Gazette:

In discussing President Roosevelt's message last winter, you wisely advised the railroads to abandon their campaign of obstruction and criticism and to adopt a constructive policy; to lay down a plan for doing something, instead of so vociferously claiming that it was impossible to do anything (a claim which may soon be proved false). If those who are familiar with the subject do not produce a plan, more and perhaps worse plans will be forthcoming from men who are ignorant. President Roosevelt's recent utterances, as noted in your issue of October 27, again indicate that this constructive plan is now past due. The time has come to tell Congress what is needed. In less than three weeks Senator Elkins will have brought his committee together and will be drafting measures to be laid before Congress. In spite of the best intentions of the more rational minded members of the committee. these measures are quite likely to be colored much more by political considerations than by those of economy and business wisdom.

At least the skeleton of a plan should be quite easily constructed, though there will be plenty of room for differences of opinion about details. A considerable expenditure of money will be required. Any plan to meet the demands of the shippers, even half way, will require the establishment of courts, or tribunals of some sort in at least a half dozen different sections of the country. We can never think of adjudicating all complaints at Washington.

1. The first point is to continue the Interstate Commerce Commission as an investigating and recommending body. Every competent observer knows that there should be two tribunals: An administrative body to thrash out the facts and report conclusions, and a judicial body to keep this lower body from swinging away from the principles of true conservatism.

2. Perpetuating the Interstate Commerce Commission does not, however, mean the retention of retired western politicians as com-

missioners. It is of the utmost importance to have men of knowledge, strength and experience, and to insure tenure of office. This idea was brought out by Mr. Henry Fink and was emphasized in your editorial on his book. I do not know of any way to make sure that the President will appoint to the commission, as he does to seats on the judicial bench, the highest class men that he can find, unless it be to have the appointments made for life. In a matter which is somewhat experimental this is objectionable. Perhaps the only thing to do is to exert the utmost possible missionary influence on the President by personal interview. May not eminent railroad officers well go and ask the President to appoint the most intelligent, public spirited and impartial men that he can find?

3. The commission should be declared by statute to be what the Massachusetts State Commission is in fact; a recommending body whose recommendations are accepted by the railroads. It is a pity that we have not had during the past 18 years what Massachusetts has had for 36 years, a commission whose recommendations are so wise and moderate and convincing that in the great majority of cases the parties affected by them have feared to disregard them. By referring to this Massachusetts example I mean to bring out the idea that the Federal commission should pursue the methods of a friendly adviser to the railroads, and not those of a critical opponent. A friend is not necessarily one who grants vicious indulgences. The commission must, of course, recommend affirmatively, not negatively, as now. It should say what ought to be done in the future. At the same time, a rate recommendation should be in the shape of a maximum rate. There will be no practical benefit in trying to establish minimum rates. With five or seven strong and discreet men at its head the commission may safely be authorized to appoint district officers at three or four western cities to hear complaints and advise complainants. These men would be something like the Commissioners of the Federal Courts.

4. A rate recommendation of the commission should take effect in 60 days after issue, unless both parties to the controversy agree upon a shorter period. This last proviso implies that the two sides of the question are well defined and are represented by responsible bodies. In the case of a question which could not be represented by a board of trade or other public body, or by one or a very few shippers, and in cases where it could not be foreseen just what railroads would be affected, or how much they would be affected, the 60 day or some fixed term would have to be applied without modification.

5. An order should be made to run one year, at least, with possibly a proviso for extending it through a second year, if both parties were agreed on such extension. It is significant that Secretary Taft brought out this point in his Ohio speech. It will be recalled that the President of the Pennsylvania Railroad approved this idea a year ago, though in quite guarded language.

6. Enough judges must be added to the United States District Courts to enable those courts to sit in any state on a week's notice. Possibly in the more thinly settled states this may be modified by requiring cases to be tried some distance from the places where they arise, but, ordinarily, the limit should be 500 miles, or a night's journey. It must be possible for aggrieved railroads to air their grievances very promptly; say within a month, or less than a month, if possible. This addition to our judicial machinery will, of course, be somewhat costly. In some districts the cost to the government very likely may be many times the amount saved to the public. I need not explain, however, that the directly measurable saving or loss in money is not the only thing to be considered. As was truly said on the first page of your issue of September 15, nothing but free access to some government tribunal for complaints will satisfy the public. To put a stop to rebates and trickery will not be enough.

7. The courts must be empowered to make such rules that ordinary cases will not be going up continually to the Supreme Court of the United States. Only the gravest questions must be allowed to cumber the docket of that court. Perhaps the ideal arrangement may prove to be a special court made up of two of the justices of the Supreme Court, to be designated by the Chief Justice, to sit, with one transportation expert, as a special court. This special court of three should have power to refer questions to the full Supreme Court whenever the three should unanimously so decide.

What do you think of this? Conservative people will object to such an enlargement of the courts; but I am a conservative myself, and it seems to me that, if we could blow away the dust of conflict, it would be seen that any reasonable expenditure made to cure the law's delays not only is wise but is much to be desired in all matters which the courts deal with, not railroad rates alone.

I have to admit that I do not own or manage a railroad. Also that Mr. Cassatt, as quoted above, is the only railroad man who, so far as I know, has been brave enough to openly avow sympathy with such a course as I recommend—one so liberal toward the public. But it is to be hoped that some of the timid ones will soon be made to look at the situation in its true light, and to see the need of doing something; and the *Railroad Gazette* is the only power that I know of which can awaken them. Do not for a moment lose sight of paragraph No. 2—a vital preliminary to those which follow it. AMICUS CURIAE.

Poor's Statistics for 1904.

Advance sheets of Poor's Manual for 1905 contain the usual summary of statistics of the railroads of the United States for the fiscal years of the companies ending in 1904.

The total length of all railroads completed on Dec. 31, 1904, is given as 212,349 miles, an increase for the year of 5,014 miles. For the previous year these figures were 207,335 miles completed Dec. 31, 1903, an increase of 4,397 miles over 1902. The heaviest construction of the year was in the southwestern group of states, in which 1,716 miles were built, divided as follows: Missouri, 418 miles; Texas, 318 miles; Oklahoma Territory, 279 miles; Arkansas, 262 miles; Indian Territory, 260 miles; Colorado, 147 miles; Kansas, 31 miles, and New Mexico, 0.62 miles.

The following table gives the totals of the principal statistics for the two years:

	1904.	1903.
	Miles.	Miles.
Mileage of railroads	211,074.39	206,885.99
Second track, sidings, etc.	82,863.03	79,376.03
Total track	293,937.42	286,262.02
Steel rails in track	282,229.35	271,012.70
Iron rails in track	11,708.07	15,249.32
	Number.	Number.
Locomotives	48,658	44,529
Cars—Passenger	31,034	28,648
Baggage, mail, etc.	10,947	10,182
Freight	1,728,903	1,624,150
Total revenue cars	1,770,884	1,662,980
	Liabilities.	
Capital stock	$6,447,045,374	$6,355,207,335
Bonded debt*	7,475,840,203	6,722,216,517
Unfunded debt	172,619,537	448,199,448
Current accounts	516,404,178	648,434,976
Sinking and other funds	190,213,456	115,201,683
Total liabilities	$14,802,122,748	$14,289,259,959
Excess of assets	620,750,567	572,851,585
Total	$15,422,873,315	$14,862,111,544
	Assets.	
Cost of railroad and equipmt	$11,664,191,134	$11,233,311,285
Other investments	2,712,445,967	2,653,851,625
Sundry assets	408,808,136	552,036,399
Current accounts	637,328,078	422,912,235
Total assets	$15,422,873,315	$14,862,111,544
	Miles.	Miles.
Miles of railroad operated	213,828.02	205,237.12
Revenue train-mileage:		
Passenger	441,156,014	431,314,116
Freight	543,532,369	546,380,595
Mixed	28,069,524	22,288,855
Total	1,012,751,907	999,983,566
Passengers carried	716,244,858	696,949,925
Passenger mileage	22,174,139,991	20,895,606,421
Tons of freight moved	1,277,771,573	1,288,628,858
Freight mileage	173,628,034,040	171,292,198,079
Traffic earnings—Passenger.	$456,342,380	$429,705,287
Freight	1,374,102,275	1,344,150,719
Miscellaneous	147,194,058	135,001,820
Total	$1,977,638,713	$1,908,857,826
Net earnings	639,240,027	592,508,512
Other receipts	81,357,891	89,485,484
Total available revenue.	$720,597,918	$681,993,996
	Payments.	
Interest on bonds	$242,992,755	$239,426,707
Other interest	13,851,590	8,680,451
Dividends on stock	188,386,093	164,549,147
Miscellaneous	54,557,670	61,336,614
Rentals: Interest	32,807,445	38,675,121
Dividends	23,136,073	26,125,268
Miscellaneous	18,120,396	21,320,600
Taxes	54,325,856	.....
Total payments	$627,977,878	$560,113,908
Surplus	92,620,020	121,880,088

*Including in 1904 real estate, mortgages, equipment trust obligations, etc., previously included in the item "unfunded debt."

Total receipts increased 69 millions, or about 3 per cent., against an increase of 188 millions, or about 10 per cent. in 1903; freight earnings, 29 millions, as against 147 millions in the preceding year, and passenger earnings 26 millions as against 33 millions in 1903.

The following table shows the average mileage operated, capital per mile and bonded debt per mile of all steam railroads in the United States for the past five years:

	Mileage worked.	Capital stock, per mile.	Bonded debt, per mile.
1900	192,162	$30,205	$29,967
1901	195,887	30,521	30,811
1902	199,685	30,439	32,377
1903	206,876	30,719	32,494
1904	211,074	30,686	35,418

Gross earnings per mile of road in operation in 1904 amounted to $9,248, and net earnings to $2,989, as compared with $9,301 and

$2.887 per mile in 1903. The average ton-mile rate was 7.87 mills as against 7.81 mills in 1903 and 7.64 mills in 1902. This average shows a steady increase since 1899, when rates touched the lowest point with a ton-mile rate of 7.26 mills. The average revenue per freight train mile was $2.52 against $2.45 in 1903 and $2.36 in 1902. Earnings per freight train mile have steadily increased since 1894, when the average revenue was $1.47, clearly reflecting the development of the modern large train load. The average receipts per passenger mile in 1904, 1903 and 1902 were respectively 2.053 cents, 2.052 cents and 2.012 cents. The low point in passenger receipts was in 1898 when the average revenue per passenger mile was 1,994 cents. The average rate paid on the total bonded debt was 3.98 per cent. in 1904, 4.13 per cent. in 1903, and 4.09 per cent. in 1902, while the average dividend rate paid on the total share capital was 3.28 per cent. in 1904, as compared with 3.00 per cent. in 1903 and 2.93 per cent. in 1902. The ratio of operating expenses to earnings in 1904 was 67.68 per cent. as against 68.96 per cent. in 1903, which was the highest figure since 1897, when the operating ratio was 69.74 per cent.

The Electrification of the Long Island Railroad.

The Western Division of the Long Island Railroad consists of numerous lines within the limits of the city of New York, and while the main terminus of the road is in Long Island City, opposite Thirty-fourth street in the Borough of Manhattan, the road has another important terminus at the intersection of Atlantic and Flatbush avenues in the Borough of Brooklyn. The line to the latter terminus is four-tracked from Jamaica to East New York, thence double-tracked through Atlantic avenue to Flatbush avenue. By reference to the map, it will be seen that the Flatbush terminal is in the heart of Brooklyn and connects at that point with the Brooklyn Rapid Transit elevated lines leading to the Brooklyn Bridge and to the Broadway Ferries; it will also soon connect with the Subway being built by the Interborough Rapid Transit Company from the Battery, under the East River, and thence to Flatbush and Atlantic avenues. When the Subway is completed, passengers arriving at the Flatbush avenue terminal, from points on Long Island, will have a short and direct route to the lower business section of Manhattan by either the Subway or by elevated lines over the Brooklyn Bridge. Direct connection is also to be established by the elevated lines over the new Williamsburg bridge.

The regular service on the Atlantic avenue line consists not only of suburban trains carrying passengers from towns on the south and north shores of the island, but also heavy local business from Flatbush avenue out to Jamaica, and heavy excursion business to Rockaway beach and three different race tracks, located at Aqueduct, Metropolitan and Belmont Park respectively.

Extent of Electrification.

Considering the complicated train service above referred to, it was obviously impossible to adopt an electrification plan which contemplated electric traction for part of the journey and steam traction for the remainder of the journey to the suburban stations, beaches and race tracks, inasmuch as transfer of passengers en route to these points would occasion much confusion and delay. It was therefore determined, in spite of the fact that immediate return on the very heavy outlay could not be expected, to electrify all lines leading out of the Flatbush avenue terminal which carried heavy suburban or excursion traffic. This resulted in the electrification of practically the entire road south of Atlantic avenue and the main line out to Queens, and as far east on the Montauk Division as Valley Stream. It was not found necessary to electrify the line north of this dividing line as no through traffic from Flatbush avenue to the terminal in Long Island City at present exists. When the tunnel lines to the Borough of Manhattan, now being built by the Pennsylvania Railroad, are completed, new conditions will be introduced which will require considerable extension of the electric service, and will probably include at that time all the lines for 25 miles out of both terminals.

The diverse character of the train service and its fluctuating loading at different seasons of the year, due to character of excursion business, formed a condition the reverse of favorable for economical electric traction, for the reason that the load factor on any of the fixed portions of the complete system such as power house and transmission lines, would necessarily be low throughout most of the year. In spite of this handicap, which meant a heavy initial expenditure, the railroad company determined to provide complete electric service at the outset, believing that the improved facilities afforded would result in the growth of the territory adjacent to their line, and in the end afford a fair return on the investment. For the present, however, and probably for some time to come, the expensive pioneering done will result chiefly in increased convenience to passengers rather than in enlarged net revenues.

Under normal conditions the load on the power plant and sub-stations will be comparatively light, but in order to take care of the heavy race track and excursion movement a power capacity has been installed sufficient to move simultaneously the following service:

Flatbush Avenue to Belmont Park:
15 6-car trains per hour in each direction.
Flatbush Avenue to Rockaway Park:
3 6-car trains per hour in each direction.
Valley Stream to Hammels:
2 4-car trains per hour in each direction.

In addition to the above, power is supplied for the trolley-car service between Rockaway Park and Jamaica.

System Adopted.

In deciding on the character of the equipment and the electrical apparatus the possibility of connecting with the lines of neighboring companies, including the Brooklyn Rapid Transit Company, the Interborough Rapid Transit Company and the Pennsylvania Railroad tunnels was taken into consideration, as well as the physical character of the lines of the Long Island Railroad itself. Operation over elevated lines, in subways, on the surface and also in the Pennsylvania Railroad Terminal and tunnels had to be harmonized. It was decided to adopt for the car equipment a type and dimensions of car which would permit, if necessary, of through operation over connecting lines. It was also decided to adopt a system of electric distribution which was standard on connecting lines, namely: third-rail contact and direct current at 600 volts for the propulsion current, and alternating current transmission at 11,000 volts for conversion at sub-stations.

Electrified Lines of the Long Island Railroad.

General Layout.

Current for the entire system will be generated at the large power house, now nearly completed at Long Island City. This power house will eventually be one of the largest in the world and is entirely equipped with steam turbines. There are at present installed three Westinghouse-Parsons turbine units, of 5,500 k.w. capacity each, and the engine room provides facilities for three more such units. The power house is in the center of the electrified district at present, but the Long Island electrification forms only a part of the general scheme for the operation of the Pennsylvania Railroad Terminal and the North and East

river tunnels. When these are in complete operation and when the Western Division of the Long Island Railroad is entirely electrified, Long Island City will be in about the center of distribution.

The three-phase alternating current, generated at the power house, is carried in conduits through Long Island City as far out as the railroad yards. From here the cables are brought overhead and carried on a specially designed lattice steel pole line. The poles are of strong construction and are mounted on concrete foundations. Wherever the transmission lines cross telegraph or telephone wires, the latter are led underneath the high tension wires. The substantial character of the heavy cables prevents any danger from their breaking and falling across the telegraph wires. A further precaution is taken by placing the poles closer together at such points.

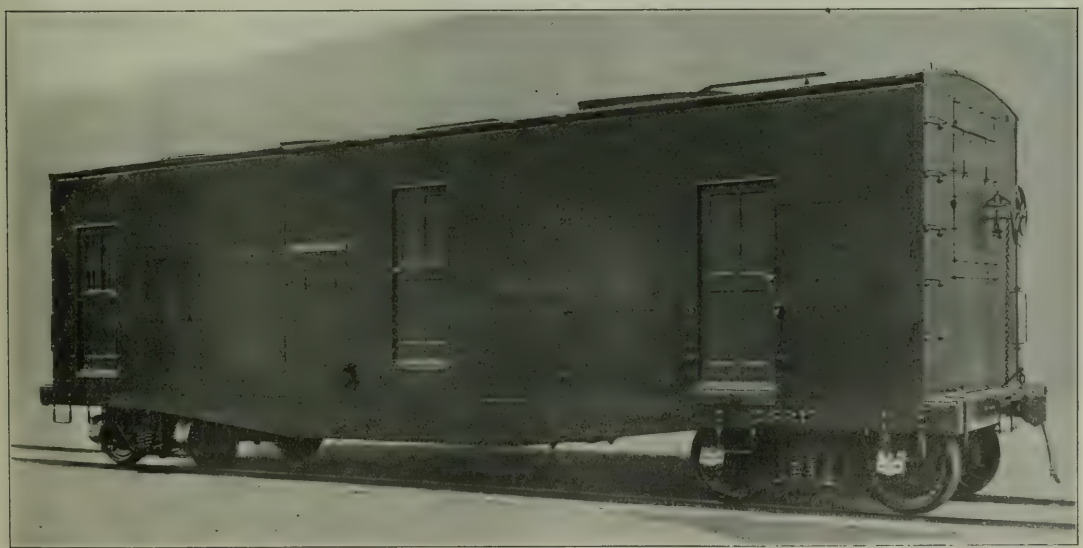
This pole line follows the railroad tracks to Winfield, from which place it is led across country on a private right of way to Glendale Junction, where it again follows the railroad to the sub-station at Woodhaven Junction. At this point the lines branch off in the direction of the different sub-stations. The danger from lightning has been guarded against by placing lightning arresters in all sub-stations and special arrester and cut-out houses have been erected at all places where the transmission wires are led from overhead and carried in underground or submarine conduits and vice versa.

The sub-stations are five in number and are located at the following places: No. 1.—Grand and Atlantic avenues, Brooklyn. No. 2.—East New York. No. 3.—Woodhaven Junction. No. 4.—Near Rockaway Junction. No. 5.—Hammel.

As far as possible sub-stations have been located at junction points, where the heavy loads occur. Such locations also make it possible and convenient for the arrangement of transfer switches for the high tension circuit.

The sub-station at Woodhaven Junction is the largest of all, being provided with an initial equipment of three 1,500-k.w. rotary converters and nine static transformers of 550-k.w. capacity. Ultimately this station will be equipped with six 1,500-k.w. rotary converters with a corresponding increase in the number of static transformers. The Grand Avenue sub-station is provided with an initial equipment of three 1,000-k.w. rotary converters and nine static transformers of 375-k.w. capacity. The ultimate capacity, however, will include four 1,500-k.w. rotary converters, with a corresponding increase in transformer capacity. The Rockaway Junction sub-station is provided at present with an initial equipment of two 1,000-k.w. rotary converters and six static transformers of 375-k.w. capacity. The ultimate equipment will include four 1,500-k.w. rotary converters and the proper number of static transformers. The East New York sub-station has an equipment of three 1,000-k.w. rotary converters with nine 375-k.w. transformers, while the ultimate equipment will consist of four 1,500-k.w. rotary converters and the corresponding number of transformers. The sub-station at Hammel is equipped with two 1,000-k.w. rotary converters and six 375-k.w. transformers. Ultimately, however, it

Steel Car for Long Island Railroad's Electric Suburban Service.



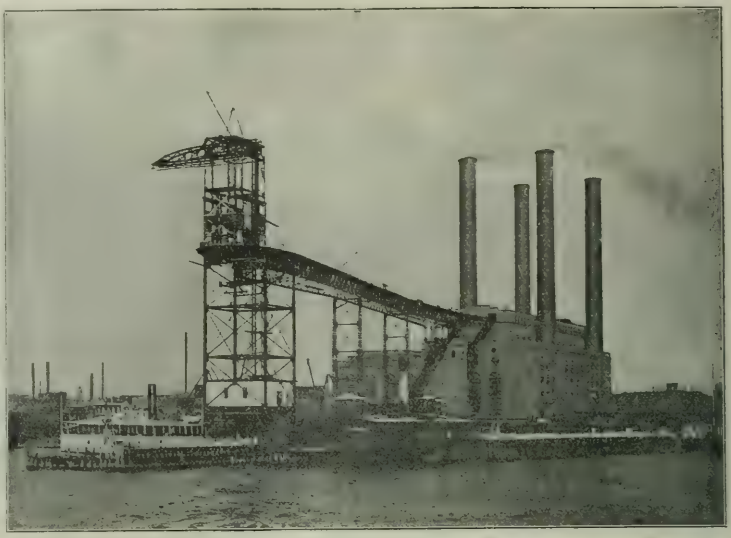
Steel Portable Sub-Station Car.

will contain six 1,500-k.w. rotary converters with a corresponding increase in transformer capacity. In addition to the above, this sub-station is provided with a storage battery of 2,000-k.w.-hours' capacity, making it the largest storage battery in the world in use for electric railway work. Its installation was deemed expedient owing to the fact that the Hammel sub-station is the farthest from the power station and the transmission line is exposed to an unusual extent, being carried over Jamaica Bay for four miles. Furthermore the load at Hammel is very light during the winter and the large battery capacity makes it practicable to shut down the rotary equipment for much of the time during the winter months.

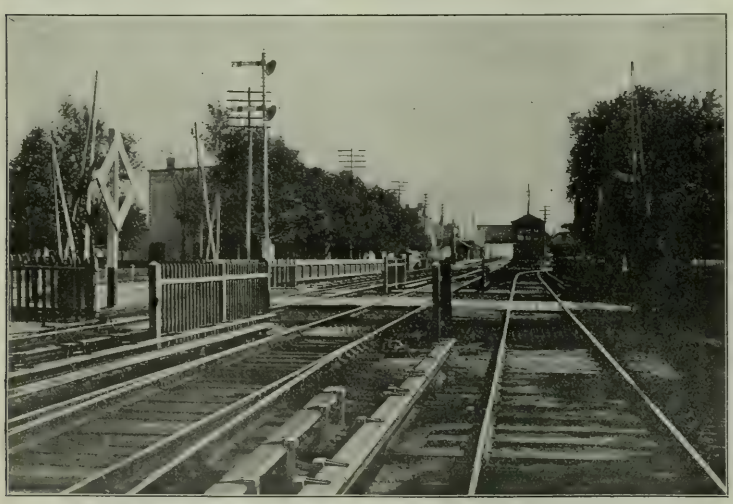
All the sub-stations which are now equipped with 1,000-k.w. rotary converters, are provided with foundations of sufficient size to accommodate converters of 1,500-k.w. capacity. By the time the present sub-stations reach their maximum capacity with 1,000-k.w. converters, the sections of the road, electrically equipped, will have extended far enough to warrant the building of more sub-stations further out on Long Island. It will therefore be possible to move the 1,000-k.w. converters from their present stations to the outlying ones and erect in their place converters of 1,500-k.w. capacity.

In external appearance all these sub-stations resemble each other closely, being built of brick and steel and of fireproof construction throughout. They also conform closely in interior arrangement, the rotaries and transformers being set up on the first floor while the main switch-board is placed in a gallery on one side of the building from which the operators have an uninterrupted view of all the machinery under their control. The high tension cables are led to a carefully insulated board on the other side of the building facing the main switch-board.

All of the sub-stations are provided with the means of augmenting their capacity in an emergency, to the extent of 1,000-k.w. through the use of portable sub-stations. These consist of steel cars each carrying a 1,000-k.w. rotary converter and three static transformers. Two such portable sub-stations have been built. They were designed primarily, not only to reinforce the permanent sub-stations, but to maintain the potential at any points where traction might, temporarily, be very heavy. Such conditions would be met at the different race tracks, and therefore buildings have been provided at Belmont Park race track and at Springfield Junction, near the Metropolitan race track, where these portable sub-stations may be housed and connected up. While the use of portable sub-stations is not new, yet they are being used on a larger scale in this installation than has ever before been attempted. One reason for their extensive use is found in the fact that no feeders are used for supplying the third rail, the high conductivity of these rails making it unnecessary to use feeders for all ordinary conditions of traffic.



Long Island City Power House.



Typical Road Crossing at Grade near Woodhaven Junction.

Third Rail.

Direct current, at a potential of 600 volts, is led directly to the third-rail from the different sub-stations. The third-rail is laid at the standard distance from the track rail adopted by this road, the Pennsylvania Railroad and the Interborough Rapid Transit Company, namely, 27 inches from the gage-line of the track to the center-line of the third-rail and with top of rail 3½ inches above the top of the track rail. Placing the third-rail in this position will allow interchange of equipment between these three railroads and will permit of proper clearances for steam equipment, especially the steel hopper cars now in general use.

The third-rail is supported by insulators made of vitrified clay which rest on extension ties laid at intervals in the track. It is covered throughout its entire length by a wooden sheathing held in place in the following manner: Brackets of steel attached to the rail are firmly bolted to wooden uprights outside the rail, and to these, by separate bolts, are attached a second set of strong brackets supporting a plank 2 in. thick and at a height of about 4 in. above the rail. Wherever the rail is led in front of stations, a special side sheathing is attached to both sides, making it practically impossible for pedestrians to come in contact with it. Another safeguard to protect passengers at stations is a running-board, similar to the one covering the third-rail, which is led along the outside edge of the platform and effectually prevents passengers from coming in contact with the collector shoes of the motor cars.

At either side of a grade crossing, the third-rail terminates in a broad sloping shoe, similar to that at switches and crossings in the Subway and on the Manhattan Elevated. This is inside the line of protecting fences which enclose the entire right of way and a heavy insulated wire cable connects it with the continuation of the third-rail, beyond the break. The cable passes underground in a concrete duct at a depth not likely to be interfered with by crossing repairs.

The total mileage of third-rail installation reduced to single track basis is 97½ miles. This is divided as follows: Miles of main line equipped, 42; main line single track mileage equipped, 90; sidings, 7.5.

Trains.

The trains at present are made up of five cars in the ratio of three motor cars to two trailers, the motor cars being cars 1, 3 and 5. An eight-car train will consist of five motor cars and three trail cars, the motor cars being 1, 3, 5, 6 and 8, or else 1, 3, 4, 6 and 8. By this arrangement, it is possible to make up three-car trains consisting of two motor cars with a trail car

between them, by simply taking off two cars from either end of a five-car train.

All the cars are equipped with the Westinghouse pneumatic multiple-unit system of control and each motor car has two propelling motors, of 200-h.p. each, both of which are carried on the same truck. Each motor car has a motor truck at one end carrying two motors, one geared to each axle, while the truck at the other end of the car is a "trailer" and carries no motive power.

Steel-Concrete Shelter for Two Portable Sub-Station Cars at Belmont Park.

Both the cars and the trucks were designed by George Gibbs, Chief Engineer of Electric Traction for the Pennsylvania, New York and Long Island Railroad and for the Long Island Railroad. The cars were built by the American Car and Foundry Company and the trucks by the Baldwin Locomotive Works. These cars are quite similar in appearance to the steel cars in use by the New York Subway, which were also designed by Mr. Gibbs, being constructed throughout of steel and finished in aluminum. For a more extended description of these cars the reader is referred to the *Railroad Gazette*, June 16, 1905.

These cars are receiving their equipment at the shops of the Long Island Railroad, between Locust avenue and Springfield, on the cut-off line to Valley Stream. The shops have a capacity for the equipment of about ten cars per week, which are received from the builders in an entirely completed condition as regards exterior and interior finish, but are bare of any electrical apparatus. After receiving their electrical equipment they are given trial runs before being placed in active service. Each motor car weighs 83,000 lbs. and is capable of maintaining a maximum speed of 55 miles an hour and a schedule speed, including stops 1.6 miles apart, of 25 miles an hour. One hundred and fifty are now ready for service.

A noticeable feature of their operation is that, although attaining their maximum speed under short headway, there is no jerk or jar, acceleration being accomplished smoothly and evenly. The trains are brought to a stop in the same even manner, being equipped with specially designed air-brakes controlled by the new Westinghouse graduated-release triple-valve.

Inspection Sheds.

Large car-inspection sheds have been built at Rockaway Park, Dunton, and at the Morris Park shops. The shed at Rockaway Park is 100 x 30 ft., the Dunton shed 200 x 50 ft., and the shed at Morris Park 200 x 75 ft. These sheds are large enough to accommodate trains of eight cars and are fitted with all necessary tools and appliances, the pits being fitted with compressed air pipes in order that pneumatic tools may be used under the cars.

Organization.

When it was decided, three years ago, to electrify the system Messrs. Westinghouse, Church, Kerr & Company were engaged to act as engineers and builders of the road, the entire work being under the direction of Mr. George Gibbs, who acted first as Electrical Engineer of the road and First Vice-President of Westinghouse, Church, Kerr & Company, and afterwards as Chief Engineer of Electric Traction for the road, the general features of the work being under the supervision of the Electrical Committee of the road. The construction work was under the supervision of George B. Caldwell, who acted as Superintendent of that department.

Work was begun on the various sections as follows: Power house, September 15, 1903, the first engine being put in operation January 6, 1905, and regular operation was commenced July 26, 1905. Work on the sub-stations was begun May 24, 1904, and completed July 7, 1905, the sub-stations being put into operation July 26, 1905. The transmission system was started November 30, 1904, and finished May 27, 1905, while work on the third-rail and the bonding of the tracks was begun October 6, 1904, finished August 31, 1905, and put into operation July 26, 1905.

Transmission Pole Line Between Long Island City and Woodhaven Junction.

Alliance Against Accident Frauds.

An organization with this name and for the purpose indicated was formed at a meeting held in New York City last week, Wednesday, at which were represented a large number of railroad and insurance companies, among which were the Interborough Rapid Transit Co., the New York Central, the Delaware, Lackawanna & Western, the Chicago & North-Western and the Boston Elevated; the Hudson River Day Line; the New York City Railway and the street railroad companies of Baltimore, Washington and other cities; the Travelers' Insurance Co., and other companies insuring against accident, and the Fuller Construction Co. A committee was appointed to confer with the American Bar Association and with the American Medical Association. The following officers were chosen:

President, Robert B. Armstrong, President of the Casualty Company of America; First Vice-President, James R. Pratt, of the United

Railways and Electric Company of Baltimore; Second Vice-President, R. C. Richards, of the Chicago & North-Western; Secretary-Treasurer, Chauncey S. S. Miller. The first annual meeting will be held January 19.

The officers of the alliance are expected to defend its members against fraudulent claims and prosecute all persons engaged in presenting or promoting such claims; to collect and disseminate information to its members concerning fake claimants, shyster lawyers, unprincipled physicians, ambulance chasers, false witnesses, and others engaged in such practices and methods, and to insist upon fair dealing with honest claimants.

Accident Bulletin No. 16.*

The Interstate Commerce Commission has issued Accident Bulletin No. 16, summarizing the records of railroad accidents in the United States during the three months and for the full year ending June 30 last. The number of persons killed in train accidents during the quarter was 262, and of injured 2,764. Accidents of other kinds bring the total number of casualties to passengers and employees up to 14,669 (886 killed and 13,783 injured).

Table No. 1.—Casualties to Persons—April, May, and June, 1905.

	Passengers— Killed.	Injured.	Employees— Killed.	Injured.
Collisions	5	549	102	626
Derailments	36	680	94	564
Miscellaneous train accidents	..	24	25	321
Total train accidents	41	1,253	221	1,511
Coupling and uncoupling	..	.....	49	766
While doing other work about trains	..	.....	72	3,328
In contact with overhead bridges, etc.	..	7	26	285
Getting on or falling off, cars or engs.	51	446	152	2,172
Other causes	10	457	284	3,558
Total, other than train accidents	41	910	583	10,109
Total all classes	82	2,163	804	11,620

In train accidents the total number of fatalities this quarter, both to passengers and to employees, is decidedly larger than in the last quarter or in this quarter a year ago. The tables for the whole year (below) show the unprecedented total of 350 passengers killed in train accidents. The number of employees killed in the 12 months, while very large, is less than in the year preceding, both by train accidents (collisions and derailments) and by other causes.

Table No. 2.—Collisions and Derailments.

	No.	Loss.	Persons— Killed.	Injured.
Collisions, rear	234	$219,971	16	304
" butting	120	212,212	63	338
" trains separating	193	103,008	1	77
" malicious obstruction track, etc	26	48,913	23	75
Total	1,231	$885,179	107	1,175
Derailments:				
Due to defects of roadway, etc	256	$173,624	8	257
" defects of equipment	711	567,592	11	198
" neg. trainmen, signalmen, etc.	100	66,804	9	128
" unforeseen obstruct'n track, etc	99	378,608	42	255
" malicious obstruction track, &c.	26	48,913	23	75
" to miscellaneous causes	343	289,951	37	331
Total	1,535	$1,525,492	130	1,214
Total collisions and derailmts.	2,766	$2,410,671	237	2,419

Causes of Thirty-one Prominent Train Accidents.

[NOTE.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engs., cars & roadway.	Reference to record.	Cause.
			COLLISIONS.				
1	R.	F. & F.	1	1	$2,233	46	Engineman forgot an order fixing a meeting point; conductor asleep. See note in text below.
2	R.	F. & F.	0	1	3,500	18	Engineman, 39 years old, in service 2 years, had fallen asleep; was under influence of intoxicating liquor.
3	M.	P. & F.	0	4	3,675	51	Occurred at crossing, in fog, 4 a.m.; freight at approached crossing at uncontrollable speed and ran into side of passenger train.
4	B.	P. & F.	5	4	4,350	4	Freight train ran past meeting point in consequence of engineman's watch being too slow; watch some time before had stopped and engineman had wound it without discovering that it had run down; conductor tried to stop the train, but failed. These men on duty many hours. See note in text below.
5	R.	F. & F.	1	1	5,000	16	Runaway on steep grade; both of the two enginemen of train held responsible for having failed to test air brakes at head of grade.
6	M.	P. & F.	3	17	5,000	52	Crossing collision; engineman of passenger train (who was killed) neglected to stop before passing over crossing, and his train was struck by a freight train.
7	B.	F. & F.	0	4	6,000	20	Train despatcher, 18 months' experience, gave conflicting orders to two empty engines, both of them running as extra trains.
8	B.	P. & F.	1	38	6,100	3	Engineman of passenger train continued on his way after having heard torpedoes and shut off steam; he was killed and his action is inexplicable. See note in text below.
9	R.	F. & P.	4	24	6,125	41	Passenger train, unexpectedly stopped by automatic application of air brakes, run into at rear by following freight train, which had disregarded 10-minute time interval. See note in text below.
10	B.	F. & F.	6	4	6,800	19	Conductor made mistake of 1 hour in calculating time of delayed opposing train. See note in text below.
11	B.	F. & F.	1	6	7,000	48	Despatcher gave conflicting orders to extra freight trains.
12	B.	F. & F.	1	4	10,000	49	Conductor and engineman of westbound train forgot about eastbound train.
13	M.	F.	1	2	11,800	24	Coal train became uncontrollable on descending grade of 3½ per cent.; only 18 cars out of 40 air-braked; hose ruptured and air leaked off, but did not thereby apply brakes sufficiently to reveal the leak.
14	B.	P. & P.	2	31	16,910	42	Engineman misread telegraphic meeting order; engineman, conductor and fireman had neglected to read order aloud, as required by rules.
15	R.	P. & P.	1	36	20,000	1	Passenger train, standing at station, run into at the rear by following passenger train, which approached at uncontrollable speed. Engineman held responsible for running too fast and flagman for not going back; also for not having given fusee signals.
16	B.	P. & F.	26	11	25,000	43	Freight train waiting on side track to be passed by four trains was started out after the passing of the third. All of the men responsible for this error were killed in the collision. See note in text below.
17	M.	P. & F.	1	11	52,400	9	Extra passenger train, in disobedience of rule, entered yard at uncontrollable speed, and collided with yard train. Damage caused largely by fire from overturned stove in dining car and from explosion of gas tanks.
Total			54	199	$191,893		
			DERAILMENTS.				
1	D.	P.	1	10	$1,000	37	Malicious removal of rail fastenings.
2	D.	F.	5	0	3,475	57	Work-train derailed at washout, 5 p.m. Crew had been on duty 14 hours 20 minutes.
3	D.	F.	0	0	6,000	26	Car of blasting powder in long freight train derailed by running in of slack when brakes were applied. See note in text below.
4	D.	P.	2	39	7,390	53	Track distorted by solar heat.
5	D.	P.	0	7	10,500	65	Cause undiscovered; speed of train 45 miles an hour.
6	D.	P.	19	8	12,000	59	Misplaced facing-point switch, turning train into a sidetrack; 14 passengers killed. See note in text below.
7	D.	P.	3	29	12,400	64	Cause undiscovered; speed 45 miles an hour on straight line; injuries to 28 passengers reported as slight.
8	D.	P.	2	0	13,610	15	Malicious obstruction; rock on track.
9	D.	F.	1	5	15,000	63	Cause undiscovered; speed 25 miles an hour.
10	D.	P.	0	5	15,000	14	Train broke through burning trestle bridge; speed 40 miles an hour; engineman had view of bridge for only 225 ft. before reaching it.
11	D.	F.	1	1	25,000	62	Train of empty passenger cars running 25 miles an hour; cause undiscovered. The engine was running with the tender first.
12	D.	P.	0	9	28,859	33	Train broke through trestle bridge which had been weakened by heavy rains.
13	D.	P.	2	13	29,100	31	Some part of engine or tender or first car became detached and fell on track; wreck partly destroyed by fire.
14	D.	P.	23	110	200,000	27	Westbound passenger train ran into wreck of eastbound freight, in which was a carload of blasting powder; whole train destroyed by explosion or fire. See note in text below.
Total			59	236	$279,334		
Grand total			113	435	$471,227		

Collision No. 1.—This occurred at 5 a.m., two freight trains running toward each other collided with sufficient force to cause the damage stated and to cause the fatal scalding of one of the firemen. The collision was due to the failure of the men on the eastbound train to keep in mind a despatcher's order to meet the westbound train at B; and in consequence of this lapse of memory the train ran two miles beyond B. The meeting order was delivered to the conductor of the eastbound train at A, but it appears that he was asleep or drowsy when it was given to him. The flagman, who claims that he had awakened the conductor, was told by the latter to go to the telegraph office and get the meeting order which was waiting, and he did so, signing the conductor's name. The engineman made no objection to this improper action of the flagman. The telegraph operator was a new man and did not know that the man signing for the order was not the conductor. Returning to the caboose, the flagman did not deliver the order into the

*Four of the items in the list of prominent accidents may be identified with the accounts of the accidents which were published in the *Railroad Gazette*, as follows:

Collision No. 4	Branchville, S. C.	April 2.	Reported, May 26, p. 573.
Collision No. 16	Patapsco, Md.	June 17.	Reported, July 21, p. 51.
Derailment No. 4	Lochiel, Pa.	May 11.	Reported, July 7, p. 3.
Derailment No. 6	Mentor, Ohio.	June 21.	Reported, July 21, p. 51.

hands of the conductor, who was in the cupola, but put it under the edge of a water bucket, expecting the conductor to take it when he got down from the cupola; but the flagman claims that he told the conductor the contents of the order—to meet the opposing train at B. The conductor claims to have no recollection of these things. On arrival at B the train was stopped by the train-order signal. The conductor alighted from the caboose, and, with the engineman, went to the telegraph office, but as the signal was displayed for some other train, and as the operator had no order for this train, he gave clearance cards and the train proceeded; the engineman having forgotten the meeting order received at A and the conductor knowing nothing about it. The flagman made no protest against passing B, assuming that the conductor and engineman had received (at B) a new order changing the meeting point to some place beyond B.

This collision occurred at 5 a.m. The conductor was a man of 12 years' experience. The flagman had had three years' experience. The engineman who forgot the order failed to show it to the fireman (who was killed), but claims that he had told him the substance of it. This engineman was making his first trip as a road engineman. He had had three and one-half years' experience as fireman and four months as engineman of a switching engine. All of these men had been on duty 12 hours after 18 hours or more of rest.

Collision No. 4.—This is a case where the men at fault had been on duty irregularly for many hours. The train began its trip at A at 3 p.m. of Friday and continued its run until 3.30 a.m. of Saturday. At this point (B) a stop of seven and one-half hours was made. Starting from B at 11 a.m. Saturday the run was continued until 5.05 p.m. the same day, where there was another wait (C) until 11.30 p.m. (6 hours, 25 minutes). The trip was resumed from C at 11.30 and continued until the collision occurred (at D) at 4.40 Sunday morning, 37 hours and 10 minutes from the time of starting.

Collision No. 8.—This occurred at 2 a.m., and was due to the inexplicable negligence of an engineman, who was killed. An eastbound freight had set off part of its cars on a side track and the engine had been run back some distance for the remainder of the train. The flagman, who had been sent forward to stop the passenger train, was not seen by the engineman of the passenger, though the torpedoes which had been placed on the rail were exploded and the engineman shut off steam; but he soon again put on steam and did not shut it off until he saw the headlight of the freight train, when it was too late to avoid the collision. The fireman heard the torpedoes and noticed the slackening of speed, but presumed that the subsequent increase of speed (after the train had passed the flagman) was in response to an "all-right" signal. The engineman was one of long experience. He may have been deceived by the part of the freight train which was on the side track.

Collision No. 9.—A freight train ran into the rear of a stalled passenger train. Two passenger cars and a dining car were wrecked, and the smallness of the number of passengers killed (four) is due to the fact that the conductor was able to warn most of the people on the train in time to enable them to jump off. Many of the injuries were caused by jumping off. The passenger train had passed the freight train at A, had gone on to D (six miles), and was stopped a half mile beyond D by an unexplained defect in the air-brake apparatus, causing the brakes to apply on one of the cars. The freight train left A in from two to five minutes after the passenger train, in violation of the rule which requires an interval of ten minutes in such cases. Besides this irregularity, the engineman and fireman of the freight appear also to have become confused when they came in sight of the passenger train on a descending grade, and to have neglected to use the means at their command for reducing speed; and their train was running at 25 miles an hour when it struck the passenger train. The accident occurred in the daytime and the signal at station D, which was against the freight train, was visible for 1,100 ft. before reaching it. The crew of the passenger train had succeeded, in spite of the difficulty with the air-brakes, in getting their train started before the collision occurred, but not in attaining sufficient speed to materially mitigate the severity of the shock. The engineman and fireman of the freight had jumped off their engine some distance before reaching the point of collision. The conductor of the freight, who shares the responsibility for this improper running, had been in the service only six months, though he is reported as having had experience on other roads. The fireman had been in the service nine months and the engineman four years.

Collision No. 10 was caused by the conductor of the eastbound train making a mistake of one hour in calculating the time that an opposing train would be due; this opposing train was 4 hours 40 minutes late and was so described in a despatcher's order. The conductor counted the hours on his fingers and claims that his engineman (who was killed in the collision) had counted in the same way and had reached the same result. Another clause in the despatcher's order would have shown the conductor his error if he had compared it carefully with the clause with which he was dealing, but he did not make any such comparison. The conductor's calculations were also somewhat confused by the presence of a passenger train on that part of the road which was 1 hour 30 minutes late. The fireman and one brakeman had read the order on which the miscalculation was made, but did not detect the conductor's error. The conductor re-read the order after passing another station, but still failed to discover his mistake. All of the men at fault were experienced, except the brakeman, who was not familiar with the handling of train orders.

Collision No. 16.—An extra freight train, southbound, drawn by two engines, running without right on the time of northbound passenger train No. 1, collided with it, causing the death of both enginemen, both firemen, the conductor, and one other man on the freight train, and the engineman, fireman and 18 laborers (riding in or on the baggage car) on the passenger train. The men in charge of the freight train were all experienced employees. Their train had waited on a siding at A, five miles back, about an hour for one southbound train and two northbound, and should have waited for one more northbound (the one with which it collided); but for some reason, which a rigid investigation failed to develop, the men in charge started their train out after the passage of the last of the other three trains. The train at fault, being a freight train, had no right to the road whatever as against the opposing passenger train.

The only surviving members of the freight-train crew, two brakemen and a learner, state that while lying at A the conductor and the two enginemen consulted their time cards very carefully and talked about train No. 1, giving evidence that they had not forgotten the train. They ate their luncheons out of buckets at the same time. Just before train No. 2 came the enginemen of one of the engines discovered a broken bolt in his engine which it was necessary to replace. While they were hunting for one to replace it No. 2 passed, and while the bolt was being put in the conductor said to one of the brakemen, "This sticks us here an hour and ten minutes," evidently figuring at that time to remain at A for No. 1. At this time the rear brakeman went for a second bucket of water, and while at the spring, which is a short distance south of the side track on which they were lying, train No. 3 passed, and the freight train started to pull out of the siding. He got back to the switch about the time the engines reached it, and, being on the fireman's side, called to him, asking him where they were going, to which the fireman replied, "To B." The brakeman said something about No. 1 not having passed, to which the fireman replied, jokingly, that his (the brakeman's) watch must be stopped. At this point the stories conflict a little, one story being to the effect that the conductor called to the front brakeman and said, "You had better get on unless you want to get left and have us come back to-morrow and get you." The brakeman, having the bucket in his hand, did not like to get on the head end of the train on account of the difficulty of carrying the bucket over the train, and he was stunned with the idea that he must be wrong about the time and the right to the road. He waited for the caboose, put the bucket of water on it, and then closed the switch. Immediately on getting into the caboose he looked up his time card, examined his watch, and found that there was no question but what they were on the time of No. 1. He states that he then thought there must be something the matter with his watch and unscrewed the back of it, but, so far as he could judge, it was running at its normal rate. It then occurred to him to go over the three rear cars, which were not equipped with air, and set the brake on the cars immediately ahead, but, thinking that he would break the train in two, he did not do this; and he then concluded he would go to the head end and question the men there about what they were going to do for No. 1. He started to make this move, although, as he says, he "figured that the head end was a dangerous place to be on about that time," and almost at once the trains struck.

As the conductor and both enginemen and both firemen were killed, it is impossible to determine whether they forgot No. 1, whether they figured No. 1 had passed, or whether they were making a close run against No. 1. They were running their own train at a very moderate rate of speed, and the last supposition is deemed by the officers of the road improbable.

The company has a rigid watch inspection and the watches of the men were all good and had been keeping excellent time.

The men were men of good habits, and the two enginemen had been off duty 13 hours and the conductor 15 hours before starting on this trip, and they had been on duty less than nine hours when the accident occurred.

Derailment No. 14.—In this case a passenger train running at high speed struck a freight car, which had been derailed and pushed upon the track from a train on an adjoining track, in consequence of another accident, which had occurred a few seconds before (derailment No. 3). The first derailment was that of the 35th car in a freight train of 68 cars. This train, moving at about six miles an hour, was signaled to stop, on account of the presence of another train on the line ahead. On sighting the stop signal the engineman applied the brakes by reducing the train-line air pressure about 5 lbs. per sq. in. The grade of the road was level, or very slightly descending, but the air-brakes were in operation on

only half of the cars of the train (34), and the pressure of the other 34 cars, not air-braked and therefore not retarded, against the forward half of the train was so severe that the 35th car was derailed and, with the 36th car, was pushed to one side. It does not appear that these cars were badly crushed or their contents much broken. The engine of the passenger train, striking these cars, was wrecked, and the fire in its firebox was scattered about the wreck. This fire ignited illuminating gas escaping from ruptured tanks of the passenger cars, and the fire, either from the coals or from the gas, exploded a large quantity of blasting powder, which was in the 36th car of the freight train, and this explosion created great havoc throughout the wreck and the adjacent cars of both the passenger train and the freight. Twenty passengers, two trainmen, and one other employee were killed, and 103 passengers and seven employees were injured. Those cars of the passenger train which were not wrecked by the explosion were consumed by the fire, and many of the freight cars were destroyed in the same way.

It will be observed from this abstract of the railroad company's report that this distressing accident was due to the lack of power brakes on the rear half of the train. This main cause may or may not have been re-enforced by excessive slack between the cars, or by putting together in the same train cars of different degrees of stiffness and strength. It is not, however, deemed important to further analyze the cause of this accident, as it is very generally agreed that the only safe rule for the management of very long freight trains, as regards this question, is to require a large percentage of the cars to be power-braked, to keep the cars in the best possible condition as regards slack in the draft gear, and to avoid putting light or weak cars in front of heavy cars in the same train.

It is to be noted that this accident to the freight train was a great danger to the passenger train, regardless of the presence or absence of explosives, and that, therefore, the foregoing statement embraces the main body of facts to be considered in connection with the accident.

In regard to explosives, it is universally recognized that their presence in large quantities in a railroad train is an imperative reason for exercising extreme care in the management of such train. The railroad company on whose line this disaster occurred and one or more other companies have now adopted regulations containing elaborate rules forbidding the transportation of explosives in large quantities except in trains of not over 30 cars, two-thirds air-braked. The explosives must be near the middle of the train and not within 10 cars of the front end, and must be in cars with steel underframes and air-brakes, and which are known to be sound, by special inspection.

Derailment No. 6 was of a fast passenger train, made up of a heavy locomotive and five cars. The car next to the engine was a combination baggage and passenger (smoking) car, and it was in this car that nearly all of the fatalities occurred. The accident occurred at night, and the train appears to have run over the misplaced switch at unabated speed—about 60 miles an hour—and it was derailed in consequence of the curve of the side track being too sharp for the speed. The engine, after running off the track, ran against a building and was turned around. The first car took fire from the coals in the engine, and the passengers in this car were burned by the fire and also scalded by steam escaping from the engine. It is believed that the steam caused many of the deaths. The engineman was killed, so that the evidence concerning the signal light attached to the switch is not clear. The switch is known to have been in proper position 34 minutes before the accident. The fireman, who survived, said that this light and that on another switch 175 ft. away, indicated white (all right), and that the engineman and himself confirmed each other in this view, on approaching the station, while some distance away, the fireman calling out "Right," and the engineman responding; but when within about 300 ft. of the fatal switch the fireman was startled by a shout from the engineman, "Jump!" He at once got down behind the boiler-head and did not again see the switch light. It is not known, therefore, what had occurred to cause the engineman to give the alarm of danger; whether the light had been turned to red (stop) or had been extinguished, or whether he had seen the wrong position of the rails by the light of his headlight.

Immediately after the derailment the conductor of the train and other persons examined the switch and found it set for the side track and locked; the switch lamp was in proper position (to show red), but was not burning. It was afterwards relighted without turning up the wick. The switch had not been damaged in any way. Extended inquiries were made by the railroad company for the purpose of discovering how the switch came to be misplaced, but the report says that these inquiries have not had any useful result.

This derailment occurred opposite a station. The agent or telegraph operator in charge of the station at night is required to inspect the switch signals immediately before the time at which a fast passenger train is due. In this case, the agent says that he stepped out of his office about three minutes before the arrival of this train, saw the signal lights of the switches, and of the train order or block signal, all showing "All right"; also saw the headlight of the train approaching, two or three miles away; and then he returned to his office. A person who came into the station just as the derailment occurred testifies to having seen the agent taking his seat at his desk after turning the semaphore signal to the stop position, as is done, in the regular routine, immediately after the arrival or passage of a train.

A young man who is employed by the railroad company, though not in the operating department, had driven across the railroad at a crossing near the fatal switch about 10 minutes before the accident and testifies that at that time the switch light, as well as the other switch light near by, showed white ("All right").

The station agent in question is 23 years old and had been in the service of the company 18 months. The fireman of the train, whose testimony is referred to above, is 30 years old, and had been in the service of the company six years.

Tables 3, 3A and 4 are given in the same form as in the last preceding bulletin.

YEARLY TABLES.

*Table A.—Casualties to Persons, Year Ending June 30, 1905.**

	Passengers		Trainmen		Yard trainmen.		Other employees.		Total employees.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Collisions	198	3,493	308	2,726	38	366	64	526	410	3,618
Derailments	151	2,891	246	1,495	27	206	32	246	305	1,947
Miscellaneous train accidents	1	114	66	1,267	6	129	11	91	83	1,487
Train accidents	350	6,498	620	5,488	71	701	107	863	798	7,052
Coupl'g & uncoupl'g	...	.....	138	1,566	97	1,457	8	87	243	3,110
Other wrk abt trns.	..	.....	116	8,069	55	2,132	87	2,397	258	12,598
In contact with overhead bridges, etc.	8	38	77	821	12	311	3	53	92	1,185
Getting on or falling off cars or engines.	134	1,732	362	5,554	162	2,527	109	1,156	633	9,237
Other causes	45	1,772	228	832	96	280	913	11,132	1,237	12,244
Other accidents	187	3,542	921	16,842	422	6,707	1,120	14,825	2,463	38,374
Total, all classes.	537	10,040	1,541	22,330	493	7,408	1,227	15,688	3,261	45,426

*This table includes the following statistics which did not appear in the quartely bulletins, the reports from which they are taken having been received after the bulletins were printed: One passenger and 19 employees killed and 13 passengers and 39 employees injured; damage to railroad companies' property, $6,582. The totals of these yearly tables are not comparable with those given in the Commission's Annual Statistical Reports, for the reason that the monthly reports deal only with accidents to passengers and to employees while actually on duty.

Table B.—Casualties for Three Years.

	Year ending June 30, 1905		1904		1903.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Passengers: In train accidents	350	6,498	270	4,945	164	4,424
Other causes	187	3,542	150	3,132	157	2,549
Total	537	10,040	420	8,077	321	6,973
Employees: In train accidents	798	7,052	844	6,990	895	6,440
In coupling accidents	243	3,110	278	3,441	253	2,788
Overhead obstruction, etc.	92	1,185	116	1,210	93	992
Falling from cars, etc.	633	9,237	700	9,371	678	8,025
Other causes	1,495	24,842	1,429	22,254	1,314	20,759
Total	3,261	45,426	3,367	43,266	3,233	39,004
Total passengers & employees	3,798	55,466	3,787	51,343	3,554	45,977

Table C.—Collisions and Derailments, Year Ending June 30, 1905.

	No.	Loss.	Persons—Killed.	Persons—Injured.
Collisions, rear	1,493	$1,463,012	152	2,085
" butting	707	1,451,906	304	2,453
" trains separating	972	440,495	11	369
" miscellaneous	3,052	1,493,641	141	2,204
Total	6,224	$4,849,054	608	7,111
Derailments, due to defects of roadway, &c.	1,007	$777,433	50	1,446
" " " defects of equipment	2,605	2,068,620	40	798
" " " negligence.	341	272,254	40	418
" " " unforeseen obstructions	372	676,901	177	646
" " " malicious obstructions	76	142,761	34	196
" " " miscellaneous causes.	1,010	925,533	115	1,334
Total	5,371	$4,862,602	456	4,838
Total collisions and derailments	11,595	$9,711,656	1,064	11,949

A Combination Stock and Drop-Bottom Dump Car.

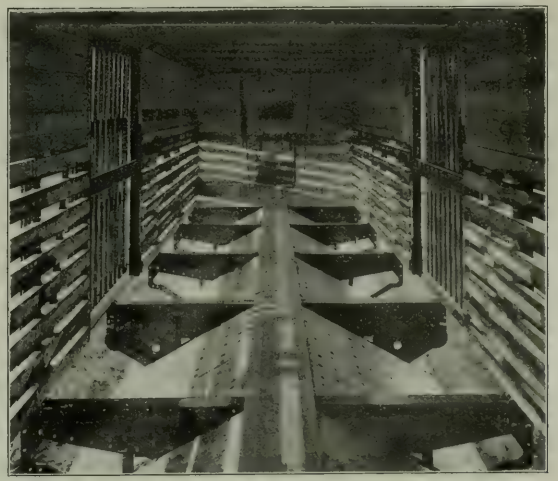
The Chicago, Rock Island & Pacific has recently placed in service a new type of 80,000-lb. stock car, illustrations of which are shown herewith. The object of the design was to produce a car that could be applied to other service than stock carrying, thus enabling it to be used at all seasons and thereby making it a paying investment, in contrast with the plain stock car. The car shown herewith is intended primarily for coal or coke service when not carrying stock.

The design and method of operation are quite clearly shown by the engravings. It is a combination stock and drop-bottom dump car. The bottom is formed of 12 doors, six on each side, which are operated in sets of three by hand wheels on top of the car at each end. By simultaneous movement of the hand wheels, two or more sets may be operated in unison, dumping all of the load

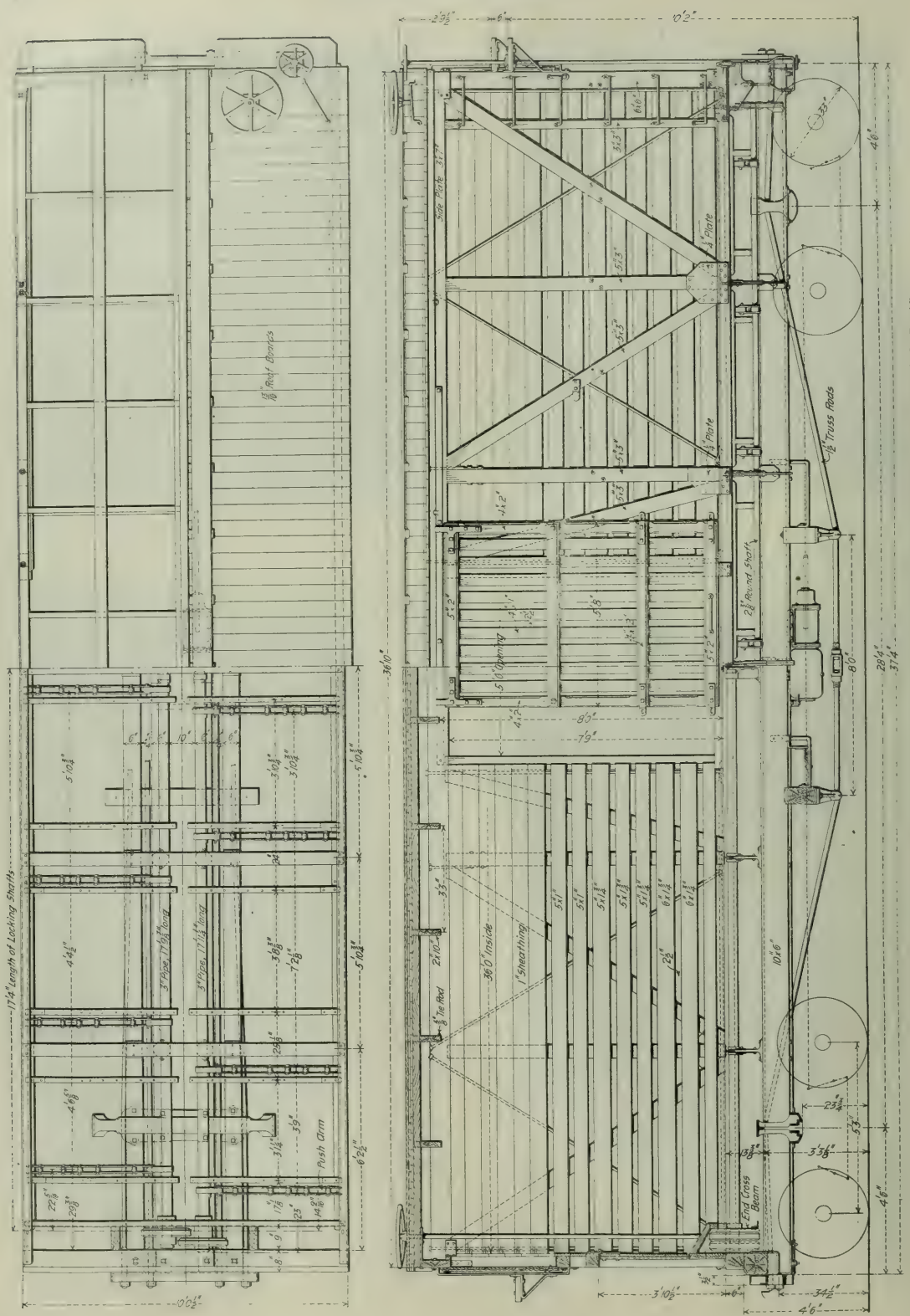
Combination Stock and Drop Bottom Car with Doors Up.

Interior View with Doors Up Ready for Carrying Stock.

Combination Stock and Drop Bottom Car with Doors Dropped.



Interior View with Doors Dropped for Dumping.

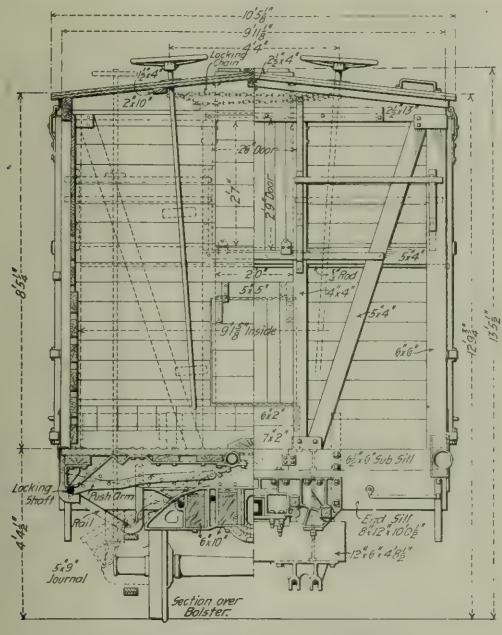


Plan and Side Elevation of Combination Stock and Drop Bottom Car—Chicago, Rock Island & Pacific

at one time if desired. The car is self-cleaning, no dumpable material remaining after all of the doors have been lowered.

The superstructure differs in some details from the standard construction of the Rock Island. The side sill is a 4-in. x 3-in. x ⅜-in. angle, the posts being bolted to plates riveted to the angle. The posts next to the door posts on each side are I-beams, and metal carlins tie the structure across at the top. The superstructure rests on a series of steel cross beams which are fish-belly girders. These cross beams rest on four 6-in. x 10-in. longitudinal timber sills, spaced as shown in the plan, the beams being riveted to a special form of malleable iron support bolted to the sills. A special form of body bolster is required, shortened to provide for the lowered position of the doors and designed to embrace the four longitudinal sills. It is cast-steel, the form being shown in the drawing.

Each set of doors is hinged to a longitudinal 3-in. pipe shaft above the center sills. The hinge pieces, which are ⅝-in. x 2-in. iron, are extended along its bottom to the outward end of the door, and are bent to a special contour, as shown in the half cross-section. The doors are supported at their outer ends on a 2⅜-in. longitudinal shaft carried on brackets depending from the cross beams. Riveted to the bottom of the latter and also to the cross beams are inclined rails, down which the shaft slides as the doors are opened. The shaft is moved by two push arms under each



Part End Elevation and Cross-Section.

door which are attached to short crank arms secured to the pipe shaft. The latter is moved from the hand wheel by means of a worm and gear wheel. The position of the lowered door and its supporting shaft are shown by dotted lines in the half-cross section.

Ease of cleaning is one of the special advantages claimed for this design in stock service, it being claimed that this can be done in less than half the time usually required and at half the cost. The dumping doors can be locked and sealed in their closed position to insure safety. The design provides for traps in the roof, when desired, for loading coal or coke from the top. It is claimed that coal can be unloaded for half a cent a ton. The car was designed by Mr. Spencer Otis, President of the National Coal Dump Car Company, Chicago, and was built by that company.

Socialist deputies in the Belgian Parliament urged recently an increase of 20 per cent. in wages for State railroad employees, and a reduction of hours, etc., which would make necessary an increase of about 20 per cent. in the number of employees. The Railroad Minister rose in his wrath and declared that these deputies did not themselves believe in the practicability of such measures, and if they were responsible ministers would never accept them; and had only made such proposals to gain favor with the ignorant. It would increase the expenses by an amount which the State financiers could not possibly bear. To which the reply was that railroad men would not be content forever and ever with average wages of 46 cents a day.

The Cost of Locomotive Operation.

XIV.

BY GEORGE R. HENDERSON.

ENGINEMEN.

(*Continued from page 319.*)

The effect of enginemen's wages upon the cost of transportation is exceedingly irregular and uncertain in that it bears little, if any, direct ratio to the work accomplished. It is true that the pay is in a measure according to the work performed, as for instance, a rate per mile, which varies at times for different types and classes of engines, the larger locomotives obtaining the higher rates for operation, but at the same time light engine mileage, which produces no direct transportation; overtime, caused generally by side track delays; reporting for duty; constructive mileage, and similar unremunerative (for the company) methods, bring about the fact above stated, that the pay bears little ratio to the work accomplished, if by such "work" we understand the production of useful transportation, or "revenue service," as it might be termed. Strictly speaking, the haulage of empties is not a "revenue service," in that ordinarily no payments are earned by the railroad, yet in this case the engine may do just as much work as in hauling a fully loaded train, and all the locomotive expenses are justly apportioned to such mileage, regardless of the nature of the train. We must therefore discriminate in such matters ,and as far as the locomotive expenses are concerned, consider that work done by the tender drawbar is a legitimate credit to such expenses, whether any revenue freight is hauled or not.

SCHEDULES.

The arrangement by which enginemen's wages are computed vary greatly throughout the country, and are generally more or less complicated. In many cases the men are paid a standard rate for a run of 100 miles or less, so that if the run were but 70 or 80 miles, the pay would be the same as for 100 miles, except that special provisions are usually made to cover "turn-around" trips. In addition to this, if the run be over 100 miles, the additional mileage is usually allowed at the same rate.

As examples of these methods, several locomotive enginemen's pay schedules are here reproduced.

SCHEDULE 1.—COMPENSATION OF ENGINEMEN IN PASSENGER SERVICE.
Rate per 100 Miles or Less per Day.

	Districts— A.	B.	C.	D.
Eight-wheel locomotives	$3.50	$3.85	$3.75	$3.65
Ten-wheel, less than 50 tons on drivers	3.50	3.85	3.75	3.65
Ten-wheel, more than 50 tons on drivers	3.65	3.85	3.90	3.80
Prairie	3.75	4.00	4.00	3.90
Mogul	3.75	3.85	3.90	3.80
Consolidation	3.75	4.40	4.00	3.90

Over 100 miles will be paid pro rata.

Here we notice several peculiar features. It might be considered logical enough that more pay should be given for a consolidation locomotive than for a light wheel engine, on the basis that it will do more work (haul more cars), but as far as the engineman is concerned the increase in labor is merely oiling and watching the additional bearings. The same argument will not hold good, however, for the various rates which apply to the same engines when used in different localities. Districts B and C have very much steeper grades, being directly in the Rocky Mountains, and this more dangerous service (claimed by the men), and the fact that the territory is more costly for living, with fewer advantages, has always received a higher rate of compensation. While a locomotive will not work any harder (bearing in mind the many miles of drifting) on a hilly road than on a level, yet the descent of steep grades requires greater attention and carefulness on the part of the men, and may justify an increased remuneration. District D lies in the same general territory as district C, but the grades are lighter, and the rates are less on that account. From schedule 1 we see that the size of engine, rate of grade, and conditions existing in the particular locality are all reflected in the wages paid to the enginemen.

The freight schedule for the same road (lying mostly west of the Missouri river) shows still greater vagaries.

SCHEDULE 2.
Rate per 100 Miles or Less per Day.

	Districts— A.	B.	C.	D.	E.	F.	G.
Eight-wheel locomotives	$4.00	$4.00	$4.33	$4.15	$4.15	$4.25	$4.00
Ten-wheel:							
Less than 50 tons on drivers	4.00	4.00	4.33	4.15	4.30	4.25	4.00
More than 50 tons on drivers	4.15	4.15	4.48	4.30	4.30	4.25	4.00
Prairie	4.25	4.75	4.75	4.60	4.60	4.25	4.00
Mogul	4.25	4.75	4.75	4.60	4.60	4.25	4.00
Consolidation	4.25	4.75	4.75	4.60	4.60	4.25	4.00

Over 100 miles will be paid pro rata.

There are perhaps no logical reasons by which these various rates could be justified, but they are brought about in several ways. Sometimes a large road absorbs smaller lines adjacent to its territory. These small roads may have had different rates of pay entirely from the larger line—very often such rates will be greater. On becoming part of the absorbing system, the men naturally strive to prevent a reduction in their pay—the large road certainly does

not wish to raise the rates of their many enginemen, and so two rates will exist for years in territories that are interwoven.

Again, rates of pay are usually adjusted at regular conferences between the railroad officials and the representatives of the men; the former strive to keep down such rates, while the latter endeavor to advance them—the result is generally a compromise; some rates are raised as a concession, in order to dispose of the question amicably, or at times to reward some individual engineman who has held a specific run for a long term of years, and so the schedule is formed, to be readjusted whenever the men find it possible to obtain another increase. Under such circumstances a logical or rational disposition cannot be expected.

In addition to the above tables, a specific allowance of 25 cents per 100 miles above the regular rate is made for way freight trains. Helper enginemen were paid $4.75 for 12 consecutive hours or less, with over-time at 47½ cents per hour. If, however, over 100 miles are made within the first 12 hours, an additional payment of 4¾ cents per mile is made. These rates applied to mountain territory—on the plains—the helper rate was $3.75 per 12 hours, with the same ratio of extras as above. Thus if a helper engine made only one trip of 20 or 30 miles in 12 hours, the full pay would be due, so that the rate per ton-mile of train handled would be greatly above the normal, as far as that district was concerned.

Switching enginemen receive from $2.90 to $4 per day of 10 hours or less, depending upon the locality. If an engineman be called and not used on account of the train being abandoned, he is paid for 33⅓ miles as per the class of service for which he was called. Light engines call for passenger rates of pay.

Another road in the central west has a complete schedule for practically every run, passenger and freight, graded to heavy, medium and light engines, also for junior enginemen as well as for those entitled to full pay. For extra and special passenger trains the rate is 3.5 cents per mile for full rate enginemen and 3.15 cents for juniors, this term signifying men during the first year of their employment as enginemen. Work train service is entitled to 3.75 and 3.4 cents per mile for seniors and juniors respectively. An important line operating in the northwest gives a schedule as follows:

Schedule 3.—*Road Service.*

Class of engine.	Passenger.	Freight.	Way Frt.
Eight-wheel, 18-in. cylinder and under	$3.80	$3.80	$4.10
Eight-wheel, 19 and 21-in. cylinder	3.80	3.80	4.10
Atlantic Type	3.90	3.90	4.20
Ten-wheel, 18 and 19-in. cylinders	4.10	4.15	4.45
Ten-wheel, 20-in. cylinders	4.10	4.25	4.55

These rates are for 100 miles or less. For the first year of service the rates are 80 per cent. of those given above. Switching is paid $2.95 and $3.10 for 10 hours or less. All regularly assigned men are guaranteed not less than 2,600 miles per month, except where they may lose time on their own account. Extra men are not guaranteed any definite amount, but catch what they can. This schedule (No. 3) is quite regular, and makes no change in the rate for different parts of the road; only the type of engine and class of service affect the pay.

Schedule 4 shows the rates in force in the State of California.

Schedule 4.

	Passenger.			Freight		
	Districts					
	Mountain.	Undulating.	Level.	Mountain.	Undulating.	Level.
Eight-wheel locomotive	$3.65	$3.50	$3.55	$4.15	$4.00	$4.05
Ten-wheel:						
Less than 50 tons on drivers	3.75	3.75	3.75	4.50	4.30	4.30
More than 50 tons on drivers	3.90	3.80	3.80	4.60	4.35	4.35
Prairie	4.00	3.85	3.85	4.80	4.35	4.35
Consolidation:						
Less than 85 tons on drivers	4.00	3.90	3.90	4.95	4.50	4.50
More than 85 tons on drivers	4.00	3.90	3.90	4.95	4.50	4.50

These rates are for 100 miles or less per day; all mileage over 100 to be paid for pro rata.

Here will be noted the higher rates paid for mountain lines than for level. The former have some grades of 140 ft. to the mile, while the level run has little over 20 ft. to the mile. The passenger rates are lower than those given in schedule 3, but the freight rates are considerably higher.

Schedule 5.

	Engines, weighing, on drivers		
	Less than 50 tons.	More than 50 tons or less than 60.	More than 60 tons.
Passenger service	$3.65	$3.75	....
Freight service	4.15	4.25	$4.45

These rates are for 100 miles or less; over 100 miles paid proportionately, and represent the schedule of a line in the far south. Switch enginemen receive $2.90 to $3.10 per day of 10 hours.

All of the eastern roads pay as follows:

Schedule 6. *Rates per Mile in Cents.*

Passenger service	3.41 cents.
Through freight	4.25 "
Local freight	4.50 "

For runs of less than 100 miles the company has given a regular list of the compensation for each such run. It also states that when not so provided, runs of less than 50 miles will be paid at overtime rates, based on 37 cents an hour in passenger service, and 42.5 cents in freight service. For runs of 50 miles or over, but less than 100 miles, 100 miles at regular rates will be allowed. This is one of the simplest schedules, in that no allowance is made for different classes of engines. Most of the freight power on this road consists of consolidation locomotives, which probably accounts for the uniform rate in freight service.

By comparing these various tables we find that the passenger enginemen receive between 3½ and 4 cents a mile quite generally, but four exceptions to this being found: The freight rates vary more, being generally between 3¾ and 4¾ cents per mile, with a few cases even outside of those limits. The farther west the higher is the rate paid, as a general proposition, although there are exceptions to this, as seen in passenger rates in schedules 3 and 4.

The practice generally in vogue of paying for 100 miles, even if only 60 or 70 miles be run, has the effect of placing a variable value upon this item of operating expense. It is evident that if many such short runs are made in a month, the actual cost of this service will be greatly increased by the natural operation of the schedule, although no change in the established rates will be actually made. These points require careful watching, and many ingenious arrangements are made locally by the division master mechanics to combine such short runs as will enable the men to make good wages, and at the same time permit them to give a full return to the company. In making any study of train costs, it is obviously quite necessary to be familiar with the situation, so that these various irregularities may receive due consideration.

OVERTIME.

The charges made against overtime are often so large as to very seriously affect this item of transportation costs. It is an item that maintains this specific cost at nearly full value, while no work is being accomplished, as occurs in delays either on main or side tracks. When an engine goes into a siding for a length of time that may run from 10 minutes into hours, the consumption of fuel and water drops to the amount required to make up for radiation and leaks, the supply of oil can be reduced to zero, the wear and tear on the machinery ceases altogether, but the pay of the engineman proceeds at full rate—that is, at the overtime rate, assuming, of course, that the time allowed for the run would be occupied without the delay which we are considering. If it be of such short duration that the train can still make its terminal within the limit for paying overtime, this would not increase the pay of the enginemen, but if the run be extended beyond the time limit, all delays must be paid for at practically full rates.

In connection with schedule 1, we find this rule: "Eight hours shall constitute a day's work for enginemen in passenger service, and no overtime will be allowed until these hours are exceeded. When the schedule for any train exceeds eight hours, all delays, if more than 59 minutes beyond the schedule time, will be paid for pro rata."

In passenger service overtime is not so likely to occur, as these trains are given the preference throughout their journey, to the detriment of the freight trains. In freight service the following rule applies: "Ten hours shall constitute a day's work for enginemen in freight service and no overtime will be allowed until these hours are exceeded. Ten miles per hour shall be considered the running time of all freight trains, and overtime will be paid only on trips the average speed of which does not reach 10 miles per hour."

From this it is apparent that the hourly rate is one-tenth that given in schedule 2; as under ordinary circumstances 100 miles are allowed, even for shorter runs, there would be no overtime allowed until 10 hours had been occupied, as this would allow a rate of 10 miles an hour, or one-tenth of the schedule rates. Many freight trains, however, are so heavily loaded that they can do little better than 10 miles an hour when running, and therefore every delay must be paid for at full rates under this arrangement. If the trip be made at a greater speed than 10 miles an hour, the engineer obtains the benefit and is paid by the mile or run.

Another road in the central west pays 36 cents per hour for full-rate enginemen, and 32½ cents for junior enginemen, in freight service to accrue only when the average speed is less than 10 miles an hour. In connection with schedule 3, an overtime rate is allowed at 10 miles an hour, as per basis of rate and classification by the schedule. The same applies to schedule 4. Schedule 5 is accompanied by an overtime arrangement which gives passenger enginemen an allowance of 10 miles an hour on the basis of the 100 mile rate for all delays of one hour or more over the schedule time, when the run is over 100 miles. On runs of 100 miles or less, overtime in excess of schedule is allowed when delayed two hours or more over the schedule time. This is quite a liberal provision. One of the runs on this road is 99 miles between terminals and the schedule time about four hours. If a delay of two hours should occur the engineman would receive pay for 100 miles and the overtime would amount to the proportion of 20 miles, or 1⅕ the regular rate for six hours of time, whereas we found for schedule 1 that no overtime was allowed until 8 hours had elapsed. In freight service overtime is paid at proportionate rate for all time used to complete trip in excess of an average speed of 10 miles per hour.

The eastern road shown in schedule 6 has a uniform over-

time rate of 37 cents per hour for passenger enginemen and 42½ cents for freight men. Overtime for through runs begins after being on duty 61 minutes over the running time, when one hour is allowed up to 1 hour and 31 minutes; over this two hours are allowed, and so on. It will be noticed that there are as many idiosyncrasies in the payment of overtime as in the regular schedule, and most of them have been brought about in a similar manner.

Now, what does this overtime amount to in the way of operating costs? This is a question which will have to be answered by each division for itself. At the last Master Mechanics' Convention (1905) there was presented a report on "Time Service of Locomotives." The time was taken of one engine for one month in freight service, in which the distribution showed as follows:

Time at and in roundhouse	28 per cent.
Running time	29 "
Delays on road and in yards	43 "
	100 per cent.

From this it appears that this particular engine was only in motion hauling its train for 40 per cent. of the time that it was out on the road, and as the men must be paid for time lost, only about 40 per cent. of the enginemen's wages were really applicable to transportation benefits. This case may not be an average sample of what is taking place daily, but we all know from experience that there is usually a great deal of overtime paid, and that it ordinarily represents no benefit whatever to the railroad company. Of course, much of this cannot, possibly, be avoided, due to track and traffic conditions, nevertheless it is unremunerative, and must be considered in the question of costs. A train loaded down by excess tonnage may lose so much time that the overtime for the engine and train crews will be a very serious charge against its operation, and in considering what is an economical loading, the question of overtime cannot be lost sight of if any accuracy be desired.

DELAYED TIME.

This operates in much the same way as overtime, but the term is generally applied to delays in starting or getting away, whereas overtime refers mostly to delays that occur after leaving the starting point. Some roads allow overtime rules to cover all delays by simply stating that the enginemen's time will commence at the time of departure of train, as designated in caller's book. Another road states that when an engine crew is on the road between terminals for a time not exceeding in hours the mileage of the run divided by 10, they shall be allowed delayed time for all time that they are delayed at initial terminal, provided that time is one hour or more. If the crew shall be on the road for a time exceeding in hours the mileage of the run divided by 10, then their time shall be figured from the time that the crew leaves the initial terminal to their arrival at destination, 29 minutes or less not being counted, while 30 minutes or more is counted as one hour. By this it will be seen that an engineer cannot claim both delayed time and overtime on the same run; if the overtime is greater, that is, delays during the trip amount to more than the time lost in starting, he will naturally take the overtime, but if the run be accomplished without delay, he can claim delayed time if it occurs, although the trip may have been completed at a much higher rate of speed than 10 miles per hour. The first rule given, it is apparent, does not permit such an arrangement, and seems the simplest and fairest all around.

Still another road allows hourly rates for the full delay, whether it occurs in starting or upon arriving at a terminal, provided that it amounts to one hour or more. This is still more liberal, as even if a good run be made, well within the speed limit, a man can obtain in addition overtime or delayed time at both ends of the trip if it occurs.

These delays have nothing to do in general with the weight of the train, but are chiefly concerned in the yard arrangements for making up trains for departure and for putting them away on arrival; however, they must be considered, as they increase the pay-roll without enlarging the ton mileage.

The rate of pay for delayed time is usually the same as for overtime, and there is no reason why it cannot be considered strictly as a species of overtime, and estimated accordingly.

British Railroad Rates.*

Mr. Edwin A. Pratt, who is not unknown in the United States, has just published "Railways and Their Rates" in defence of British railroad rates and practice. There is in England a considerable section of railroad stockholders who claim that if the English railroads were subjected to what is known as the "Americanising" process, dividends would be considerably enhanced. Mr. Pratt's object is to prove that English methods are best suited to the conditions obtaining in the British Isles. In this he fails, but his book sets forth in an interesting manner the differences between English and foreign railroad conditions. He points to the outstanding feature of English freight-traffic, "small consignments and short hauls." American readers will appreciate the importance of this situation when they bear in mind that while in the United States the average freight-haul is something like 125 miles, in England it is only about 30 miles, and in the case of many companies considerably less. As an example of the small average weight of consignments, too, the following figures speak for themselves: Of 10,705 consignments forwarded from the London & North Western's two principal London depots on a single day, 1,246 weighed less than 28 lbs. and only 136 were in excess of a ton. He fails to note that, for example, the city of New York's consignments are quite like this, if express packages were included. An English shipper in an industrial center expects the railroad company to collect freight consignments from his warehouse at 4 p.m. and to deliver them to his customer, hundreds of miles away, it may be, at 10 a.m. on the following day. As a matter of fact, so promptly is freight forwarded that retailers in the provincial towns do not trouble to stock large quantities of the commodities in which they deal. A sixpenny telegram sent after lunch to the manufacturer ensures the arrival of the required goods in time for the next day's trade.

This difference in the conception of the treatment to be accorded to freight traffic is of itself a sufficient cause for the large measure of variance between English and American methods. Whether, economically speaking, the English railroad companies are not the ultimate losers by the methods which they have adopted, or which circumstances have forced upon them, is a question that may be left to debating societies for discussion. The matter is one which has its roots in the geographical situation of the British Isles, in the density of population, and in the very mode of life of the nation.

State regulation of railroad rates is a topic that comes in for very thorough discussion in Mr. Pratt's book. American readers may find much that is instructive in the progress which this movement has not made in England. The general supervision of railroads there began with Acts of Parliament passed in 1840-1842, which gave certain powers to the Board of Trade. In 1847 the railroad companies united to form the Railway Clearing House. In those days, except for certain maxima specified in the companies' respective charters, no attempt on the part of the state was made to regulate rates. The principle, in fact, was eyed askance; for in 1845 we find a Parliamentary Committee, appointed to inquire into the subject, reporting that

"it did not consider that it would be expedient, even if it were practicable, to adopt any legislation which would abolish the freedom the railway companies enjoyed of charging what sum they deemed expedient within their maximum rates."

In 1873, government supervision of railroads was vested in a Railway and Canal Commission under the Board of Trade; and in 1881 a Select Committee of the House of Commons was appointed to inquire into the working of the existing laws bearing on the subject. Public demand for rate regulation was meantime increasing in vehemence, and, at length, in 1888 an act was passed requiring the railroads to submit to the Board of Trade for revision lists of their maximum rates. The Act of 1888 also legalized "differential" rates, sanctioned the grouping of numbers of towns in the same area for the purpose of rate-making, and empowered the Board of Trade to adjust disputes as to rates between railroad companies and shippers. Needless to say, the revised schedules of rates presented to the Board of Trade were hailed with an universal howl of execration. Some 4,000 objections were received from 1,500 objectors. The report of the committee appointed to consider these objections pointed out that "evidence was abundantly forthcoming to show that the chief object of a large section of the traders was *not* to revise statutory powers to charge, but to obtain a reduction in actual rates." More convincing proof of this could not be given than the following letter, which the committee included in their report as a "characteristic" objection. It was from a fish dealer at Berwick, and read:

"What we want is to have our fish carried at *half* present rates. We don't care a ——— whether it pays the railway company or not. Railways should be made to carry for the good of the country, or they should be taken over by the government. That is what all traders want, and mean to try and get."

The result of the legislation of 1888-90 was the entire reform of British railroad rates. The basis of the new system was "for the first 20 miles, so much, for the next 30 miles a certain less rate, for the next 50 miles a still further reduction," and so on. The magnitude of the task involved in the transition from the old system to the new may be imagined when it is pointed out that on the Great Northern alone there were some thirteen million rates in operation. And the railroads were allowed by the Board of Trade five months in which to prepare new rate-books and bring them into use.

To-day the railroads of Great Britain stand in very much the same position with regard to the state as they did after the passing of the laws of 1890. One anomaly, however, which has an important influence with managers with some disposition to reduce certain rates is worthy of attention. About 75 per cent. of British freight traffic is carried at rates which are lower than the statutory maxima authorized by the Board of Trade. But before any rate

*"Railways and Their Rates." By Edwin A. Pratt. London: John Murray. 5 shillings.

can be increased (even to a point which is still within the legal maximum), the railroad company must justify the increase before the Railway Commission, which will hear objectors to the proposed increase in rate, and sanction or veto it. Mr. Acworth, when he testified before the Senate Committee on Rate Regulation a short time ago, gave evidence of the effect of this restriction, which makes managers think twice before making a speculative rate-reduction with a view to a possible increase in traffic. Incidentally, it renders the possibility of rate-wars very remote.

Not the least interesting part of Mr. Pratt's work is the series of sketches of the history of railroad progress in various Continental states. He finds abundant justification for any alleged differences in favor of foreign rates as compared with English rates, in the striking circumstance that the British railroads have never received state-aid in any shape or form (the cost of construction and capital outlay stood in 1900 at about $270,000 per mile, as against $125,000 for the rest of Europe, and $65,000 for the United States [1902]; in the excessive local taxation to which British railroads are subject; in the smallness of the average British consignment; in the rapid handling of British freight; and in the circumstance that British rates include, as a rule, cartage and delivery, as well as storage.

Most diverting of all the histories is that of the railroads of Holland. There the national waterways had the monopoly of freight traffic, and the railroads in their early days were only saved from bankruptcy by the brilliant idea of some of the English railroad men who had been brought over to manage the system. They resolved to carry Westphalian coal at a cut-rate, and encouraged station agents and other employees to act as coal dealers in their respective localities. The advantages to the consumer were obvious, and the railroad agent received a liberal commission on his sales; and the railroads succeeded by this means in capturing a large proportion of the coal-carrying trade.

Americans who are striving to vest the ownership of all transportation lines, in the state, will derive small comfort from the case of the Prussian State lines. They yield a profit of over one hundred million dollars annually (most of which is expended on the army, or devoted to other unproductive purposes), and the political pressure brought to bear by the various sections of the country is so great that no reductions in rates can be brought about; any concession in favor of one district being hailed as an injustice by competing districts. Mr. Pratt calls attention to the articles on the subject by Mr. Meyer in the *Railway Age* for 1903, which will no doubt be familiar to many readers.

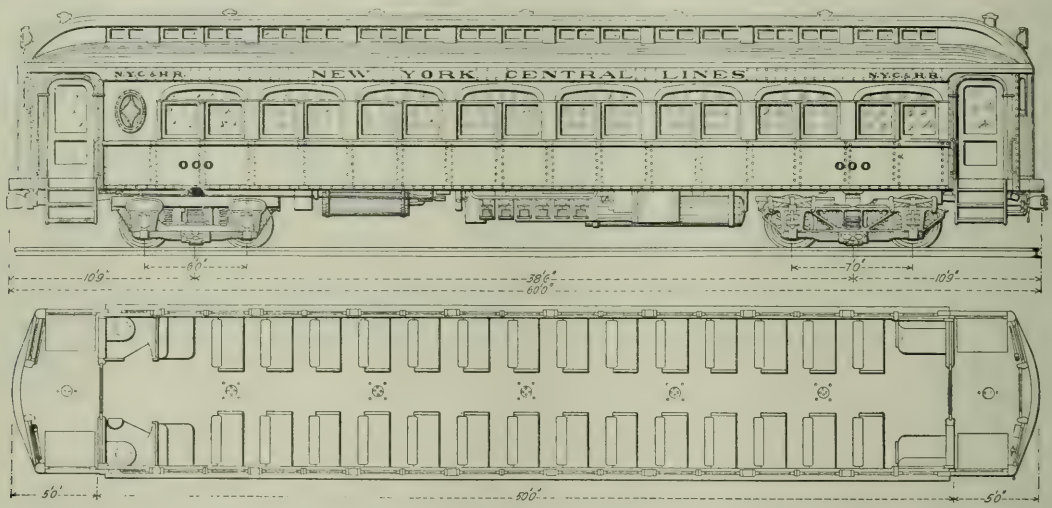
Mr. Pratt has small difficulty in disposing of the arguments advanced by the supporters of "equal mileage" rates. Not out of his own mouth alone is condemnation forthcoming. Nothing could be more scathing than the following extract quoted from the report of the 1882 Parliamentary Select Committee on Railroads:

> In short, to impose equal mileage on the companies would be to deprive the public of the benefit of that competition which now exists or has existed; to raise the charges on the public in many cases where the companies now find it to their interest to lower them; and to perpetuate monopolies in carriage, trade and manufacture in favor of those rates and places which were nearest and least expensive, where the varying charges of the companies now create competition; and it will be found that the supporters of equal mileage, when pressed, often really mean not that the freight-rates they pay themselves are too high, but that the rates that others pay are too low. Pressed on these difficulties, the proposers of equal mileage have admitted that there must be numerous exceptions; *e. g.*, where there is sea competition (*i. e.*, at about three-fifths of the railway-stations of the United Kingdom), where low rates for long distances will bring a profit, or where the article carried at low rates is a necessity, such as coal. It is scarcely necessary to observe that such exceptions as these, whilst inadequate to meet all the various cases, destroy the value of equal mileage as a principle, or the possibility of applying it as a general rule."

In an appendix on the English canal problem, Mr. Pratt discusses the present state of disuse into which these waterways have fallen. As is well known, most of the English canals belong to the railroad companies; and it is generally argued that the latter are responsible for the extinction of canal-borne traffic. That this cannot be altogether the case is evident from a table given by Mr. Pratt showing the number of locks on the various trunk canal-routes of England. Between London and Liverpool there are 252 locks in 244 miles; between London and Birmingham 155 locks in 147 miles; between Worcester and Birmingham 58 locks in 16 miles, including a "flight" of 30 within three miles. In the face of such engineering difficulties, it is a wonder that the canals were ever built at all.

Steel Cars for the New York Central's Electric Suburban Service.

Not the least important detail of the New York Central's electrification plans has been the design of the cars to be used in the suburban service. It was early decided that in order to maintain the required schedule speed and to provide the necessary flexibility in the train service, motor car trains with multiple-unit control were essential. The problem then to be met was to develop a type of car that would meet all of the requirements not only of the final service but those of the transition period during which the electrification of the outlying districts would be carried on. In the early stages of the work it was contemplated to run the suburban trains on to the Interborough Rapid Transit Subway tracks at Forty-second street and on down to the Battery, but this plan was later abandoned for a number of reasons, the principal one being the limited clearances of the Subway which would prevent running cars of the railroad company's standard dimensions. Inasmuch as these cars will be run from the Grand Central Station to Croton, 34 miles, it was necessary to provide every comfort and convenience of the standard coach, including toilet facilities, and to do this nothing less than the standard clearance dimensions could well be employed. After more than two years work the general design has been approved and contracts have been let for 125 of the cars and the electrical equipment which will be mounted on them.



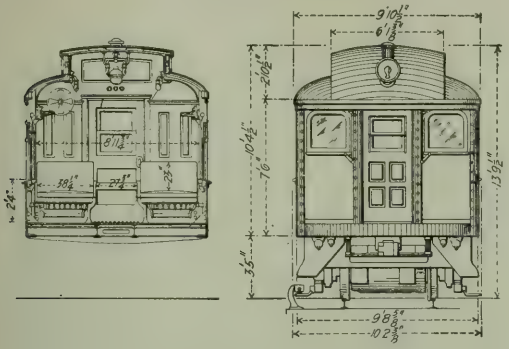
Plan and Side Elevation of Steel Motor Car for New York Central Suburban Service.

The accompanying drawings show the exterior appearance of the cars and their interior arrangement. They are entirely of steel, practically the only other material used being the rattan seat coverings, which will be impregnated with a fire-proofing compound. As will be seen from the illustration, they are almost identical in exterior appearance with the standard wooden coaches now in use. They are 60 ft. long over platforms, 50 ft. long over body end sheathing, and have monitor decks and double arched windows of leaded green cathedral glass. The width over eaves fascia plates is 9 ft. 10½ in. and the height from top of rail to top of deck is 13 ft. 9½ in. The interior of the car is 8 ft. 11¾ in. wide with a central aisle 27¾ in. wide. There are 30 cross seats 38¼ in. wide with backs 23 in.

high, and two longitudinal seats at one end of the car. The corresponding space at the other end is taken up by two toilet rooms, one for men and one for women. The seats have steel frames and are covered with fireproof rattan. On the outside the cars will be painted and lettered to New York Central standards with dark olive body color and gold lettering. The interior will be painted the color of mahogany to match the finish of the wooden coaches now in use.

The end platforms are 5 ft. long and are completely enclosed as in the Interborough cars. The side doors slide in pockets formed in the car sides and the end doors in the car slide in pockets formed in the end bulkhead. The door in the end of the platform is a swinging door and is intended to be kept closed. During the transition period the cars will be provided with dropped steps and the opening in the platform floor will be covered by a steel trap door. When all of the suburban station platforms have been rebuilt and raised to the level of the car floors these steps will be removed. The motorman's control apparatus and brake valve will be mounted against the end of the platform. The cars will have M. C. B. couplers and the draft gear will be designed to enable them to pass around the sharp curves of the loop in the Grand Central Station.

Provision has been made for heating and lighting the cars during the transition period with Pintsch gas and steam heat as well as electric lights and heaters. Gas tanks will be mounted under the cars and five deck lamps will be put in together with lamps in each vestibule. The steam pipes will be carried along the footboard with an expansion loop under the center seat on each side. The system of heating and lighting by electricity has been carefully worked out. There will be six two-light chandeliers under the deck roof and single lamps over each seat. These fixtures are of special design in statuary bronze. All other fittings and hardware in the car, including the continuous basket racks, will be of this same finish. An electric heater will be mounted under each seat. An-



End Elevation and Cross-Section of Motor Car.

other small feature, but one conducive to the comfort of the passengers, is the window opening which has been provided. A full opening of 20 in. will be given the windows, which will have balanced sash. This will make the car cool and airy in summer and will not obstruct the passenger's view. No outside window guards will be put on as these are considered unnecessary owing to the clearances allowed.

The structural details of the car-body framing have not yet been given out so that no extended description can be given here. The cars will have I-beam center sills with angle side sills and plate girder sides extending up to the bottom of the windows. In the details of the construction, however, a number of new features have been introduced and these will be more fully described at a later date.

The cars are mounted on a motor truck and a trailer truck, each car having two motors only, mounted on the motor truck at one end. It is the intention at first to run trains made up partly of motor cars and partly of trail cars, the latter being motor car bodies mounted on two trailer trucks. As the electrification is extended these trail cars will be converted into motor cars by mounting a motor truck under one end and eventually all of the suburban cars will be motor cars. It was not thought to be advisable or safe to convert any of the standard wooden coaches into temporary trailers on account of the expense of wiring and the danger from fire from possible short circuits.

The motor trucks are a special design made by the American Locomotive Company. They have bar side frames and in the unique system of spring suspension they resemble somewhat the equalizing system under a locomotive. They will carry two G.E. 200-h.p. railroad motors with nose suspension, and to admit these the wheel-base has been spread to 7 ft. The wheels on the motor trucks are 36-in., steel-tired, and the axles are 7 in. in diameter at the center with 5½-in. x 10-in. journals.

The trailer trucks have a 6-ft. wheel base and are also to be made by the American Locomotive Company. They are made entirely of steel and have the M. C. B. type of suspension. The wheels under these trucks will be 33 in. in diameter, and the axles will be M. C. B. standard for 5-in. x 9-in. journals.

Each truck will carry a collector shoe on each side, making four shoes in all. The Sprague-General Electric system of multiple-unit control will be used and all wiring will be carried in steel pipe conduits outside of the car body. As a protection against fire from short-circuits under the car, the steel plate floor will be covered with a cement composition over which the car floor will be laid.

An order has been given to the American Car & Foundry Co. for 125 of these cars, to be built at its Berwick, Pa., works. It is expected that 40 cars will be ready for delivery by next March. The trucks will be shipped by the American Locomotive Company to the car works, and the cars will be completely wired and all electrical apparatus applied there by the railroad company's own forces. In addition to this order it is expected that 50 more cars will be needed, part of which will be used as temporary trailer cars. The order for this lot has not yet been placed.

The following tables of weights of these cars and of standard steam car trains are of interest:

Weights of N. Y. C. Steel Motor Cars.

Weight, light	102,600 lbs.
" loaded	111,560 "
" light, per passenger	1,603.1"
" of car body	53,000 "
" of trucks	27,800 motor, 11,800 trailer.
" per wheel, loaded	16,195 motor, 11,695 trailer.

These weights are divided as follows:

Motor trucks, without motors	15,400 lbs.
Trailer trucks	11,800 "
Car body	53,000 "
Equipment, motor end	6,000 "
Equipment, trailer end	4,000 "
Motors	12,400 "

Comparison of Weights of Average Six-Car Steam and Electric Trains.

Steam.	Weight.	Electric.	Weight.
Locomotive (avg. suburban type)	275,600 lbs.	4 motor cars	446,240 lbs.
6 cars (standard type, loaded)	424,560 "	2 trailers	175,120 "
Total weight	700,160 lbs.	Total weight	621,360 lbs.
	Or, 350.1 tons.		Or, 310.7 tons.

Difference in favor of electric trains having same seating capacity..39.4 tons.

The cars were designed under the supervision of Mr. W. J. Wilgus, Vice-President, Mr. Edwin B. Katte, Electrical Engineer, having had direct charge of the work. We are indebted to Mr. Wilgus for the drawings and information.

Electric Equipment of the Mexico City Shops of the Mexican Central Railway.

The Mexican Central Railway has installed electric motors in its Mexico City shops to replace the boilers and engine that have been used to drive the machinery. The railroad company does not generate its own current, but buys it from the Mexican Light and Power Company, which furnishes all the light and power in Mexico City. When the main shops of the system were established at Aguascalientes, most of the machinery was moved away from the Mexico City shops, but enough was retained to require about 150 h.p., and owing to the high cost of fuel it was found that considerable saving would result from the installation of electric motors. The current furnished is 50 cycle three-phase alternating, which for motors of 30 h.p. and upwards is 3,000 volts. For motors under 30 h.p. it is stepped down to 220 volts. A 45-h.p. motor drives all the metal-working machinery, which consists of a 79-in. driving wheel lathe, an hydraulic wheel press, an axle lathe, a coach-wheel lathe, a car-wheel borer, a 42-in. lathe, two 16-in. lathes, a 24-in. bed planer, an 18-in. shaper, a 1½-in. bolt cutter, a flue cutter, a 36-in. drill press, a 48-in. grindstone, a No. 5 Sturtevant blower, and a 150-lb. spring hammer. The wood-working machinery is driven by a 30-h.p. motor and consists of a 24-in. surfacer, a 16-in. rip saw, a 42-in. cut-off saw, a band saw and a small boring machine. Both of the above motors are placed on concrete foundations 6 ft. high and have oil-insulated switches. A 14-in. x 18-in. Ingersoll-Sergeant class A straight line air compressor is driven by a 65-h.p. motor. The steam cylinder was removed, and a 96-in. cast-iron split band wheel was mounted on the fly-wheel shaft where the two eccentrics had been, the end of the compressor frame being cut away to permit the spokes of the wheel to pass. The motor was belted to this 96-in. wheel and operates the compressor at 120 r.p.m. This compressor not only furnishes air for such pneumatic tools as are used for coach cleaning and testing air brakes, but also for pumping, by the Pohle air-lift system, all the water required. It is run almost continuously day and night.

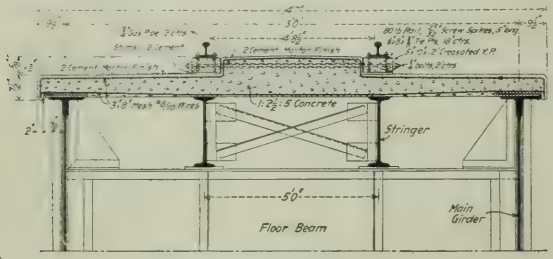
In addition to the shops, power is required to run the two gas compressors of a four-retort Pintsch gas plant which the railroad company owns and operates to furnish gas for its own equipment and for the Pullman cars that are run not only on its own line but also on the Mexican Railway and the National Railway. The fly-wheels of these two compressors are belted to a countershaft, which is driven by a 15-h.p. motor. A clutch in the center of the countershaft permits the running of either one or two compressors at the same time. For the sake of reducing the internal friction of the

compressors, the steam piston and rod are removed and the valve disconnected All of the motors are of Siemens & Halske make and the installation was done by a local firm.

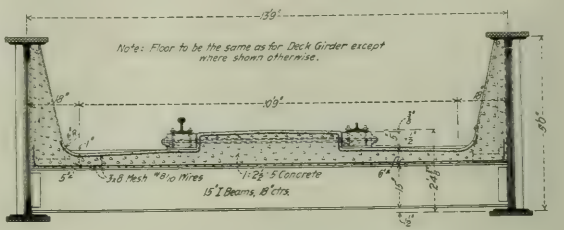
Concrete Floors Without Ballast for Bridges and Roadway.

The accompanying designs of concrete floors without ballast for deck and through plate girder spans and for the roadway were prepared by Mr. J. W. Schaub, M. Am. Soc. C. E., Chicago. Several years ago Mr. Schaub proposed a design of permanent way for steam roads similar to the one shown herewith and the idea received considerable discussion. The need of preparing some such design of floor for a long viaduct recently arose and the idea previously proposed was utilized to that end.

As will be seen, all ballast is done away with, the track rails resting on longitudinal timbers bolted to the concrete floor. This



Deck Plate Girder Floor.


Note: Floor to be the same as for Deck Girder except where shown otherwise.
10'9"
3'8" Mesh #8 & #10 Wires
1:2½:5 Concrete
15" I Beams, 18" Ctrs.

Through Plate Girder Floor.

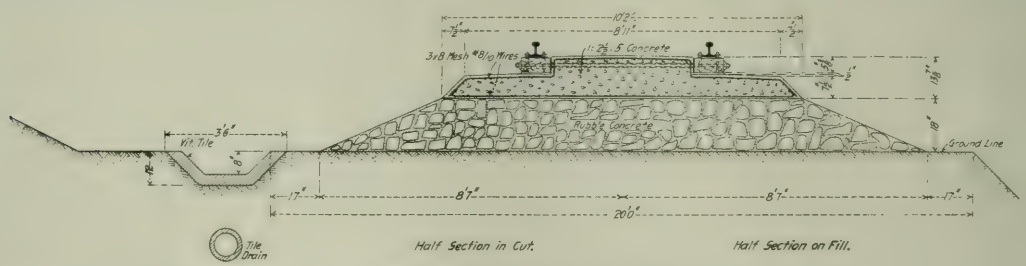
floor—the deck girder design—is 14 ft. 7 in. wide outside, is made of 1:2½:5 concrete reinforced with wire netting of 3-in. x 8-in. mesh, formed of No. 8 and No. 10 wire respectively. The top and edges of the slabs are given a 1:2 cement mortar finish. In the high portion of the floor, between rails, pieces of ¾-in. gas pipe 4 ft. ¾ in. long, faced on the ends and spaced 2 in. on centers, are bedded in the concrete. The timbers are held in place by ¾-in. tie rods passing through these sleeves. A cut washer 2 in. in diameter and ⅛ in. thick is placed between the timber and the sleeve and a faced nut and washer on each end of the tie rod. The timber is shimmed for adjustment on 1:2 cement mortar. The track rails rest on tie plates, which, besides distributing the load on the timber, also drain the space between rails by permitting the water to flow out under the rails. The rails are secured to the timbers by screw spikes instead of the ordinary variety. This is the same spike that is being used on the new work of the South Side Elevated Railroad, Chicago, and which was described in the *Railroad Gazette* April 28, 1905. The design for through girder application is practically the same as the one just described, except that the concrete is extended upward to the top flange of the girder on each side.

Regarding these designs Mr. Schaub says: "The necessity of some form of solid floor for bridges has long been known, and all sorts of schemes have been resorted to, but all with the view of using ties for supporting track rails. Some exceptions may be noted as to this, but only to a limited extent. The use of cross ties necessitates the use of ballast, and with the latter all the ills that go with the attempts to make the bridge floors waterproof. Some engineers will tell you that they have succeeded in making bridge floors waterproof, but all such attempts can be answered, in the light of our present knowledge, by saying, that unless such floors are made of concrete, or some other indestructible material, or unless such floors are properly drained, the moisture will be retained by the ballast, and this will ultimately destroy the floor. There are some excellent examples of this kind in Chicago among the recent structures in connection with the track elevation work."

"As to cost of such floors, the first question appears to be: Does not the increased weight of the floor itself add materially to the cost of the bridge? Not at all, when proper allowance is made for impact, or rather the diminished impact and vibration due to the increased fixed load. In other words, impact formulas are in use which depend upon the relation between the fixed load and a moving load to such an extent that for bridges with ballasted floors no increase in the amount of metal to be used is necessary. As to the floor itself, such floors can be built for less than one-half the cost of buckle-plate or flat-plate floors, and when the maintenance and renewals are considered, such floors will cost no more than the ordinary open floors, to say nothing about the advantage of having a floor proof against fire, the drip of salt water from refrigerator cars, derailments, etc.

"The proposed concrete roadway needs some explanation. It is intended only for roadways long in use and well drained. It is proposed, first, to build a substructure of rubble concrete. This in some cases may have to go deeper than shown, and in other cases may have to rest on a foundation of concrete piles. In other words, the substructure must rest upon a foundation which is well drained and free from the effects of frost and thawing in winter weather. After the substructure is built, and after the same has been in use for some time, with the ordinary ballast and track, the ballast and track are removed, the rubble concrete is to be made level with a bed of mortar upon which the concrete floor is to be placed in sections. The floor is then ready for the longitudinal timbers and the track rails, provided the bed of mortar has had sufficient time to set. Such a floor, if properly constructed, should require no renewals except the timber upon which the track rails rest."

A detailed estimate of cost given with the earlier design, referred to at the beginning of this article, placed its cost per mile at $14,000; while the usual form of track was estimated at $6,000 a mile, a difference of $8,000. Assuming a yearly maintenance cost for present track to be $390 a mile greater than for the permanent track (on the basis of one man more per mile of track at $1.25 a day), and balancing against this difference in maintenance cost the interest at 4 per cent. on the difference in first cost, gives $70 a mile a year on maintenance in favor of the permanent construction. The saving on renewals is figured at $180 a mile a year, making the total saving per mile per year $250. Carrying these speculations still further, estimates were made on the saving of fuel and of repairs to rolling stock, which worked out at $135 a mile, bringing the total up to $385 per mile per year.



Solid Concrete Roadway Construction.

The extent of the railroad system of the German Empire is given May 1, 1905, as follows: State railroads, 31,779; private railroads, 3,177; total, 34,956. Thus the extent of the state railroads is almost exactly 10 times that of the others. About two-thirds of the state railroads are included in the Prussian Hessian system, worked under the direction of the Prussian Ministry of Public Works. Of the whole German mileage 1,257 miles are narrow gage lines, and only 20,743 miles are worked as main lines (Hauptbahnen). The others are not subject in all respects to the same regulations.

A New Crank Shaft Forming Machine.

The accompanying illustrations show a new crank shaft forming machine made by the Espen-Lucas Machine Works, Philadelphia, Pa. This machine has but recently been placed on the market and as far as we know it presents a radical departure in the method usually followed in doing this class of work. Crank shafts were formerly made by drilling holes across the web of the crank forging and then cold-sawing to meet the holes and breaking out the piece from the throw. It was then necessary to center the pin and shaft and balance the forging in the lathe so that the pin could be turned. To finish the cheeks of the crank a milling machine was generally used. With the machine shown in the illustration the crank shaft is placed as shown and is turned up from the rough blank. The crank shaft shown in the machine was turned up in 1 hr. and 30 min. This remarkably fast time is largely due to the fact that the crank was held vertically in the machine, thus preventing the rise and fall of the heavy crank portion which has to be contended with when the forging is placed in a horizontal position as in a lathe. The machine is fitted with a universal vise for roughing out and with a stationary vise for finishing the crank shaft. The vises are readily adjusted to different sizes of crank shafts by means of a scale on the table which shows the different settings for different throws and sizes of cranks. The machine shown can rough out and finish crank shafts having a 20-in. throw or smaller. Fig. 1 shows the machine roughing out the throw. The size of the tool shown is 2½ in. wide. Fig. 2 shows the machine turning and finishing the outside of the cheeks of the crank and Fig. 3 shows the machine finishing the sides of the cheeks. The machine is fitted with automatic feeds in all directions and is extremely powerful, the gears being of hammered crucible steel, and the bearings lined with bronze. The total weight of the machine is about 20,000 lbs.

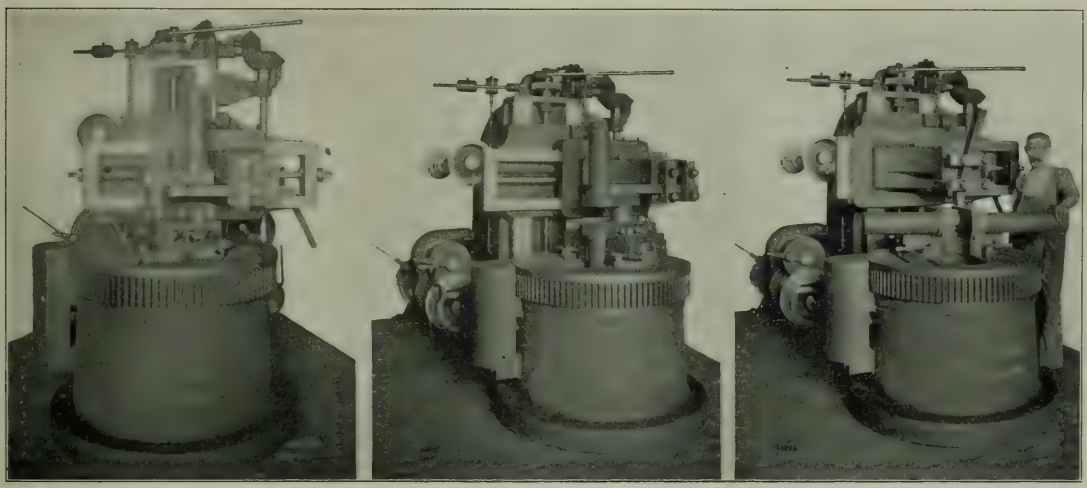


Fig. 1. *Fig.* 2. *Fig.* 3.

A New Crank-Shaft Forming Machine.

Needed Changes in the Standard Code.

BY H. W. FORMAN.

Not a great many years ago a railroad which was owned and operated by a state issued a time-table in pamphlet form, showing only one train on each page. Immunity from accident must have been due to long familiarity of its employees with the road, as a stranger would have found it a task to safely move an inferior train over that road under a time-table so difficult to check. Extra trains must have been the exception, as, before permitting one to start, the rules required advance notice to be given by instructing some regular train to carry a warning signal. There were many other rules which, now that we have the standard code, seem unsafe, or at best very clumsily worded. At least one despatcher's sheet on that road was unique; there were two rows of stations printed in reverse order in the center. When Nos. 1 and 2 started out on their runs their departing time was placed at the top of the sheet and their peregrinations were followed downward on both sides. You train despatchers of this decade who are waxing fat and opulent in your easy chairs, with a mere bagatelle of some 75 trains a day to care for on about a hundred and fifty miles of single track, how would you like to have borne the burdens of your brother despatchers of antebellum times, who handled trains across two states with train sheets of this kind?

As to train order forms, they were of the kind known as "single," and were as varied as the leaves of a forest. But what else could be expected when it is remembered that many of the train despatchers of those times were advanced from the position of "cub" in some small office, without any knowledge whatever as to how trains were moved on any road but their own and who had seldom passed beyond the confines of their native state? In this respect, a similar condition exists to-day in a great many parts of the country. A college that can fully exemplify practical railroading, at least so far as the rights of trains is concerned, is the crying need of the hour. A valuable adjunct to such a place of learning would be a museum containing improper train orders, impossible train sheets, and ambiguous train rules. The walls might be enlivened with a few paintings, done infernally, illustrating the probable fate of the train despatcher who persisted in issuing improper and lengthy orders, and stopped trains unnecessarily on heavy grades to receive them. Enginemen who habitually whistled contrary to rule should also be warned of their impending fate—if indeed, there is any modern Dante who could conceive anything diabolical enough.

But let us not waste all our pity on those who have made their record and "lain down in their last sleep," for, possibly, perfection has not yet been reached, although it is difficult to convince blind adherents of the standard code, among whom I desire to qualifiedly cast my lot, that such is not the case. Picking up a late time-table of one of our great western systems I find a rule to the effect that when a delayed train is overtaken at a blind siding by a train moving in the same direction, it shall require such train to get it out by displaying signals for it to the next open telegraph office. Should the train thus impressed already have signals up for a following section, it is likely a collision would result, if the rule were to be obeyed literally, for to have two second sections of No. 1 running on the road at the same time and within the same territory is inviting disaster. Should the attention of the officials of that road be called to the inconsistency of the rule it is probable that they would reply that everyone knew what was intended, and that it had been in effect for years without anything serious resulting. The fact that nothing in the way of an accident has resulted from its being printed on their time-table is not because the rule is safe, but because the men on that road are too intelligent to obey the rule, knowing it to be both unsafe and often impracticable. Another road in the same locality has a flagging rule which provides that when a passenger train is due within ten minutes the flagman must not return to his train when called in by the whistle of his engine, but must wait until the passenger train referred to arrives. Should such first class train break down, be held for a connection, or be annulled, the flagman would be kept out some time. It is hoped that he does not neglect to take a lunch and a blanket whenever he goes back to protect his train. Charitably disposed officials ought to at least accord him the privilege of riding in on a freight train. Provisions of this kind are not to be found in the standard code, but often are added to such rules when the code is adopted. All such inconsistent rules are "explained." But what sense in

making rules and then sending a man over the road to tell employees what shall be understood under them? It is entirely possible to draft rules that can be fully comprehended at a glance, and cannot be misunderstood, except, possibly, the rule concerning time-table changes.

But even dismissing such vagaries as those mentioned do we find ourselves emancipated from past inconsistencies by a strict adherence to the present standard code? It was put into effect some 17 years ago and, after a test of about ten years, was revised, and the revision was thought to have been so scientifically worded that a flaw could not be found in it. At present this revision is being again worked over with a view to changing some of the rules and forms which have been found faulty in clearness or in substance, even after having been most patiently pored over a second time. The query now is, will the forthcoming revision be so perfect that it will endure for a long term of years; will the committee, even at the expense of a few thousand more words, so fully explain everything that no questions need hereafter be asked; so the duty of examiners will be confined to simply examining prospective employees to ascertain if they have read their books?

The first step to be taken by those who contemplate offering suggestions would seem to be a dissection of the present code to learn if it is fully understood; whether it is sound theoretically and technically; and if any part of it has failed to stand the test in actual operation. That the rules in the main are based on correct theories is generally admitted, but that they are entirely so, or so worded that anyone concerned can get at their exact meaning and can find sufficient information to always guide them, has not been found to be true, at least not within my experience. Ask almost anyone what "train order" means in Rule 82 and a half dozen different explanations will be forthcoming, hardly any of them in accord with the views of the men who made the rule. Snags bob up before passing the second definition. It says a regular train may consist of sections. How can a train, necessarily a single, inseparable unit, be split up into several sections? Unquestionably the committee had "schedule" in mind here, as well as in Rule 20; but why not have the literal wording of the rule correct? Why depend on the explanations of a board of examiners? Why refer at all to sections in this definition? They are fully provided for in the definition covering them. I am reminded of the farmer who attended a populist meeting in Kansas years ago. He looked wise a long time and then protested. He said: "I do not know what you mean, but I do know what you are saying, and I am on my feet to say that I can't get it through my head." Until a definition is provided covering "precedence" it must be admitted that when one train is scheduled to pass another of the same class it does so without a governing rule, as the words "right, class or direction" do not furnish such authority. Another grave inconsistency in the present rules is in the treatment of extra trains. Throughout they are held to be as of inferior class to regular trains; if classified at all this must be so, else we are confronted with a condition involving at least technical collisions in many of the rules. But extra trains never should have been and never can be regarded as of any class whatever, since, by the same rules, only time-table trains may enjoy that distinction. The sooner this fact is admitted and remedied the better it will be all around. The present code fails to say how many minutes an extra shall clear a regular train in the opposite direction; it merely says that extras must clear regular trains as required by rule. A search of the rules does not reveal one relating to such movements. Such rules as 14 (k), 81, 89, 94, 96, etc., must be revised to clearly provide for extra trains before the code can be considered perfect, so far as it affects them. Even our old standby, Rule 106, seems to need a little bracing up, as the words "doubt or uncertainty" are closely related as to meaning.

In the matter of safe clearance between trains, I seem to occupy the unique but undesirable position of the twelfth juryman; no one will agree with me that it is necessary to require the inferior train to clear the superior train of the same class a given number of minutes; but so long as my arm has power to move a pencil over paper, or my tongue can articulate, I shall be found at the old stand, pleading for a clearance of at least two minutes between such trains. Question almost anyone as to the safety of the present practice and it will develop that, taken in connection with Rule 90, it is his conviction that Rule 88 is entirely safe. Rule 90 may be depended upon to partly safeguard Rule 88 when the superior train of the same class is on time and there is but one inferior train of that class due to be on the road; but what if the superior train should be an hour late and this much of its time is given to the inferior train of the same class to move it beyond its schedule meeting station? We then have a mental picture of the somewhat alarming specter of a belated passenger train speeding past stations at the rate of 50 miles an hour, while its companion train in the opposite direction is moving against it with only the requirement that it shall clear its time-table time; and with the further risk of the time of the watches of the two trains being (as allowed by these rules) a minute apart. Should the train start out on its trip against overdue inferior trains of the same class, the situation is all the more unsafe. If Rule 90 was ever intended to make a safe provision for such contingencies it fails miserably, as anyone who cares to study it will learn. It should be changed to read that until all overdue inferior trains of the same class are met, the superior train must be prepared to stop at all stations. I am well aware that the code allows companies to require the inferior train to clear the superior train of the same class five minutes, and superior class trains ten minutes, but as this greatly hampers trains on single track, most companies accept the rules as they come to them, believing, evidently, that there is strength in numbers. Possibly there may be—in the courts; but we are dealing with trains which must remain on the rails, or, through just such rules, land in the ditch. It will not be contended that trains cannot be operated under rules providing a clearance of two minutes in the case of trains of the same class, and five minutes between an inferior and a superior class train. If time is so fast that the inferior train cannot make its meeting point and clear two minutes, it is generally too fast to permit it to try to make such station at all, without the assistance of the train despatcher.

Some other defects in the rules are, failure to provide a way for an operator to send a "19" order to a train which is far away on a long siding; insuring an engineman receiving all the orders delivered to his conductor by the operator, by showing their individual numbers on the clearance card; imperfect wording of such rules as 82, 93, 95, 99, 206, 218, 220, 221 and 222, in addition to those already referred to; using the word "annulled" in Form F when a train is not annulled and where the word "discontinued" would more clearly express the desired movement; and failure to provide the despatcher with enough train-order examples.

Read each rule for yourself, not as it may have been explained, but as it can be understood by those who understand only fairly well this language we speak, and then apply your knowledge to the practical operation of a railroad, and what is your verdict? Are the rules all sufficient?

Journals published in the interest of railroad men cannot do them a greater service during the next five months than by inviting a full discussion of this important subject. It is likely that the Train Rule Committee will submit a revision for adoption when the American Railway Association convenes next April, and if those who are interested in good rules allow this opportunity to slip by, as was the case the last time the rules were generally revised, they cannot complain if the forthcoming revision does not fully provide for every condition. The committee is composed of busy men who have other duties, and even if this were not true, they cannot be expected to discover every possible weakness or deficiency that may have developed throughout the United States. And no one should hold back because at some time in the past he may have expressed an opinion which has since been found to be wrong. Let us frankly admit that we were wrong then, and start out in our new light.

Foreign Railroad Notes.

Hermann Rumschöttel, a Berlin engineer, has been appointed expert and agent of the Japanese State Railroads in Germany, and will collect information for them and represent them in contracts for materials, etc. Heretofore the Japanese railroads have had such an agent in London only.

On account of the heat in India the passenger cars have double roofs, the one from 2½ to 8 in. above the other; and the upper roof is continued down the sides of the car about 28 in., forming, as it were, an awning over the upper part of the windows. Another peculiarity of first and second-class cars is a servants' compartment at each end, as almost every European passenger takes at least one servant with him.

October 2 last the Bavarian State Railroad authorities reduced the time for a day's work in the railroad shops from 9½ to 9 hours. This example was followed in Wurtemberg, and also in Baden, where, however, the working day was already 9¼ hours. The workmen's representatives were consulted as to whether the time should be taken from the forenoon or the afternoon, and whether the morning should be lengthened.

An investigation of railroad rates in Spain is under way, under the direction of the Minister of Public Works, Count Romanones, which will call for testimony from the railroads and the various commercial organizations supposed to represent the interests of the patrons of the railroads. All the latter have commissioned an official of one of the companies, with the very Spanish name of Senor Gustav Bauer, to represent them in the inquiry, for which no less than 21 committees and sub-committees have been appointed. Rates are high in Spain, but profits are small.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 19. FRIDAY, NOVEMBER 10, 1905.

The railroads which last week remonstrated against being required by law to use air-brakes on at least three-fourths of the cars in every freight train gave a striking picture of the difficulties which the present tremendous rush of freight has imposed on most of the big roads of the country. Yards everywhere are crowded, and every additional switch to get air cars to the front part of a train helps to limit the capacity of the yard and thus to delay freight, inconvenience shippers and inflict losses on consignees. New cars cannot be had as fast as they are needed, and old cars, which the owners had hoped to keep out of main line service, have to be kept in commission. A company which wants to enlarge its yards is unable to find contractors with equipment to do the grading. Whatever fault may be chargeable to the railroads by reason of their failure to put air-brakes on old cars, there can be no question that in the present situation it is important to keep in service every car that can carry freight. The method of doing this with the highest degree of safety was not touched on at the hearing; the roads were so busy arguing against a legal requirement that they forgot to emphasize the need of the self-imposition of the same requirement, regardless of the law—the requirement to use as many air-brakes as possible on every train. The more air-brakes used, the less the danger of damage from break-in-twos and from shocks in ordinary service. The danger from these causes is uncertain, yet on double-track and four-track roads it is potentially one of the worst to which the lives of passengers are subject; for a comparatively mild shock may throw a car body immediately in front of the fastest express train. Clearly, it is a duty, so long as non-air cars must be used, to run them at moderate speeds and to restrict their use as far as possible to single-track lines and lines on which passenger traffic is lightest. The Commission might well prescribe a higher percentage of air in trains on lines of heavy traffic than on those branches, referred to at the hearing, on which heavy cars cannot be run. The suggestion of Mr. E. E. Clark that the Commission should issue an order with the date far enough ahead to make reasonable a 100 per cent. requirement is impracticable (if the law be strictly construed), and Mr. Clark no doubt will on reflection so decide. With everything in perfect order, as in passenger-train service, all the cars in a train, if equipped, can be used; but why, after a 50-car freight train (all equipped) is made up, should the conductor be required to delay his own and perhaps other trains while he sets out two or three cars on which the air-brake apparatus is found to be out of order? The risk of danger from the presence of those cars in the train would be too small to warrant the delay.

"I cannot refrain from saying that John F. Wallace is a man in every sense of the word. After the unsparing manner in which Secretary Taft handled him when he resigned last June I surely would never have thought he or any other man in like circumstances would act so magnanimously. He is a man of rare patriotism and the finest moral timber."

This is a statement made last week by a member of the Advisory Board of Panama Canal Engineers, and is repeated here, not because Mr. Wallace needs rehabilitation among those who know his record, but because he has been ignorantly abused, and also a principle is involved. When, last summer, he resigned his position as Chief Engineer of the Panama Canal Commission, his motive was impugned by two of the most important members of this government, and their condemnation in language unworthy of high officers was printed by newspapers generally. He was accused of a lack of patriotism, of "deserting an army drawn up in battle line before an enemy." But the enemy in this case was simply a difficult engineering problem, and his army had already been made by him ready for battle, inasmuch as he had completed an organization, fully competent for its task—so efficient, indeed, that he modestly believed his loss would not be felt. In that plague-stricken region the Sanitary Department had accomplished little. He was stricken with fever and fully warned that his constitution was such that he could not live if he stayed. To live there, with the reward of great honor and high pay, was attractive. To stay a little longer and die, accomplishing nothing, was not attractive. The engineer has a right to life and liberty. In civil service or in corporation service he may honorably resign at any time if his record is clean. Mr. Wallace's record was not only clean, it was distinguished, and the occasion for the tribute printed

above is the aid which he is now giving, freely and patriotically to the Advisory Board in studying out the problems involved in making the Panama Canal a sea-level canal.

"The Track of the Future," an editorial in these columns several months ago (May 19, page 513), forecasted the form of rail support the railroads will adopt as a substitute for the wooden cross-tie system when these ties become too scarce or costly, and expressed the belief that it would be a longitudinal, continuous-bearing system composed of concrete beams on suitably disposed ballast for a foundation and rolled steel I-beams to carry the rails. We showed last week, page 426, a design of permanent roadway for steam roads proposed by a well-known engineer, which in essential features is in agreement with the ideas above outlined. Instead of parallel concrete beams under the rails, Mr. Schaub, whose scheme was first formulated several years ago, uses a single wide slab of reinforced concrete resting on a foundation of rubble concrete instead of ballast. This structure is rigid enough not to require longitudinal steel beams for rail support, the rails being secured to timbers bolted to the concrete. The previous article said that "it seems to be generally conceded that if some satisfactory form of longitudinal continuous support could be devised, the cost of which would compare favorably with the cross-tie system, it would meet with a prompt and hearty reception." Mr. Schaub's design, according to his estimate, would cost about $14,000 a mile, which is rather more than double the cost of present first-class construction. It was further said in the editorial before mentioned that the time may come when this cost consideration may become of less relative importance, and when difference in first cost may be offset by economies in the cost of maintaining track and equipment, due to better permanent way. The average yearly expenditure for track maintenance for all railroads has increased 50 per cent. in seven or eight years, the last available figures of the Interstate Commerce Commission showing that it costs to-day on an average $900 a year per mile of track for renewals of ties and rails and repairs to roadway, or a total of 188 million dollars, about 15 per cent. of the total operating expense; the figure for rails being $17,395,000; for ties, $31,213,000, and for roadway repairs, $139,213,000. But while the average for all roads is $900 a mile, in those sections where we find the densest traffic and the best examples of present track, this figure will reach $1,200 to $1,500. It is only for such lines, where the density of traffic and large expenditures per unit of track for maintenance would justify the consideration, that this permanent roadway is proposed.

An interesting light is thrown on the value of shop improvements by extracts from recent annual reports of two widely separated railroads. The Mexican Central report says:

"The operating expenses show a decrease for the year of $2,020,696, Mexican currency, brought about largely by economies made possible with new and economical locomotive and car shops, increased equipment of larger locomotives and freight cars and improvements to track and structures."

The report of the Boston & Maine says:

"The Boston & Maine has not in recent years possessed repair shops of such modern and up-to-date capacity as would enable the necessary locomotive repairs to be made within a reasonable minimum of either time or cost. This lack of needed facilities has, during the last three or four years, become so acute that some of the locomotive repair work has been done at outside shops. Many locomotives have been kept too long out of needed service during the winter season while waiting their turn in the already overcrowded shops."

The relative value of adequate repair shops to other improvements is too often underestimated. The repairs and maintenance of equipment represent from 16 per cent. to 30 per cent. of the total operating expenses as will be seen from the following table:

Road.	Maintenance of equipment.	Operating expenses.	Ratio.
Chesapeake & Ohio	$4,077,943	$13,250,966	30.8 per cent.
Norfolk & Western	3,917,268	14,614,434	26.7 "
Lehigh Valley	4,894,269	18,929,701	25.8 "
Pennsylvania	19,753,563	81,802,988	24.1 "
Lake Shore	4,340,250	21,627,046	20.0 "
Mexican Central	3,309,721	17,599,176	18.7 "
Chic., Mil. & St. Paul	5,181,586	32,294,041	16.0 "

About 90 per cent. of the cost of maintenance of equipment can be charged directly to repairs of cars and locomotives. Assuming that half the cost of these repairs is not affected by any improvements in shop methods or tools we have about 11 per cent. of the operating expenses on which to effect a possible saving by putting into use modern shop tools and facilities. It is a conservative estimate to say that a modern shop with electric cranes, individual motor driven machines using high-speed steel tools and good shop management will show a saving of 25 per cent. over an old shop of similar size or capacity. That is to say, nearly 3 per cent. of the whole operating expense may be so saved. Railroads do not hesitate to spend many millions every year in new locomotives of higher power, larger freight cars, new terminals, grade improvements and similar projects which produce only a fraction of the saving which might be had by the judicious expenditure of a less sum on their shop facilities. Good shops pay big returns on the investment.

TWO STATISTICAL TESTS.

Two statistical tests of conditions and processes in American steam railroads and of electric railroads are worth their passing attention. One is the capitalization of the steam roads of the country in stock and bonded debt, and its changes during the last four years. The second test is found in the official returns for the past year of the Connecticut electric roads as printed in the newspapers of that State in advance of the regular volume of the State Railroad Commission. Both tests throw light on somewhat different subjects, and from somewhat different directions. But both are significant of one railroad—and railway—times and methods.

Annexed is the table showing the capital stock and bonded debt per mile of steam railroad operated in the United States during the last five years:

	Per mile			Per mile	
	Capital stock.	Bonded debt.		Capital stock.	Bonded deb..
1900	$30,205	$29,967	1903	$30,719	$32,494
1901	30,521	30,811	1904	30,686	35,418
1902	30,439	32,377			

Thus during four years when the stock capitalization of American steam railroads per mile remained practically stationary, and, in fact, slightly decreased during the year 1904, the bonded debt ran up $5,451 per mile, or about 18 per cent. It proves rather strikingly that we are in a "bond period" of railroad construction—during the four years there is an increase of 18,912 in mileage operated—and probably, to an even greater extent, in a "bond period" of railroad financing of old railroad properties. The two classes of bonding obviously cannot be separated in the general returns. If they could they might supply some features of absolute as well as comparative interest.

The reasons for the growth of railroad bonding can easily enough be found, and have been conspicuous in latter-day financing of American railroads. The low bond interest rate of solid American railroad companies has been a steady and forceful incentive to the issue of that class of security to pay for improvements and extensions. While shareholders may, in some cases, look at it somewhat askance, in general it conforms with sound financing both from the viewpoint of stockholder and the public. To another category belongs the invention of extinguishing stock by bonds through the device of the "holding company," which has been characteristic of the four-year period. It is no small factor in the stationary stock mileage and the waxing bond mileage.

The second test from returns, to which we have referred, is of value as indicating what may be called the "natural" growth of electric railway earnings in a fairly typical Eastern State, Connecticut, which contains somewhat more than 700 miles of electric lines. There are no long distance lines, exactly speaking, but every other class—urban, suburban and cross-country—is represented. The advance returns show very generally increased earnings, gross and net. Thus the Hartford system, with 97 miles of track, returns an increase of gross earnings from operation of $64,638, or $32,839 net more than in the previous year. The Connecticut Railway & Lighting Company, with 171 miles, shows an increase in gross from $1,243,107 to $1,420,093, and in net from $404,564 to $582,477. The Consolidated Railway Company, with much larger properties in the State than the corporation just named, has during the year so changed as to prevent exact comparison of the returns. But the figures indicate a large increase, both in gross and net. Of the independent railway companies of the state, with completed properties, ten in number, all but two show additions to the surplus in their balance sheets. All this has come to pass, too, without any important additions to the electric railway system of the state, and with nothing, or next to nothing, to be credited to "novelty" traffic. It fairly represents a general tendency in a pretty highly populated commonwealth, and, apparently, with nothing ahead to check it, except industrial depression.

The two statistical tests, in two different branches of transportation, are, we repeat, not strictly cognate and relate to somewhat divergent elements. But, besides being synchronous, it is not amiss now and then to measure well-observed tendencies of rail transportation by the exactitudes of statistical returns.

A DEEP WATERWAY FROM THE GREAT LAKES TO THE MISSISSIPPI RIVER.

At the coming session of Congress the fate of the project to build a deep waterway from the Great Lakes to the Mississippi river will probably be decided. Throughout the central west the scheme, which involves the utilization of the Chicago drainage canal and considerable portions of the Des Plaines and Illinois rivers, has been persistently agitated by commercial and other associations for several years; but so quietly has the matter proceeded that comparatively few outside of the districts through which the canal is projected have known anything about it. As long ago as 1897 the General Assembly of Illinois adopted resolutions favoring the construction of such a waterway and in 1902 an appropriation of $200,000 was secured from the 57th Congress as a part of the River and Harbor Bill, the same clause creating a board of army engineers to carry out the necessary surveys and make a report. After three years' work the report has been submitted to the Chief of Engineers of the United States Army and will be transmitted to Congress with the board's recommendations. While the report has not been made public it is understood that it will not recommend the building of the waterway on the grounds of too great a cost for the commercial value of the project, although it is feasible to create a 14-foot channel from Chicago to St. Louis. This will probably result in the abandonment of the scheme for the present, at least. Elsewhere in this issue an outline of the project is given.

The desire that this ship canal should be built is a reasonable one. One needs study the map of the Mississippi Valley but a moment to realize that the existence of a waterway from the Great Lakes to the Gulf might almost have been expected as a provision of nature. As a matter of fact, such a waterway did exist in former ages, the geologists tell us; and in the natural course of geological processes now going forward, they say it will come into existence again in about 2,500 years. The barrier at present is a narrow strip of land separating Lake Michigan from the headwaters of the Des Plaines river, and it is this barrier that the drainage canal pierces. Although built primarily in the sanitary interests of Chicago, it is serving in a measure to restore conditions as they once existed, and anticipating those which it is predicted will occur again. An important and costly part of the work is, therefore, done. The remainder consists in deepening and otherwise improving portions of the channels of the Des Plaines and Illinois rivers and canalizing the Mississippi river for about 40 miles from the mouth of the Illinois to the deep channels below St. Louis, a dredged channel being impracticable.

It is conservatively estimated that the controlling works of the canal, which would be the restricting feature regulating the amount of traffic the waterway could accommodate, would permit the passage of a boat every 20 minutes in either direction. The maximum size of boat spoken of in connection with the proposed depth of 14 ft. is 4,000 tons, so that the maximum traffic capacity of the waterway reckoned on this basis would be more than eight million tons a month, or 100 millions a year. The 14-ft. depth would be available in the Lower Mississippi for a good many months in the year, although the low-water stages prevail over a larger portion of the year than the high-water, and the minimum at the present time between St. Louis and Cairo is 6 ft. Moreover, navigation is usually suspended from December 1 to March 1. The work that the United States Government is doing on the river between St. Louis and Cairo, which already has resulted in the 6-ft. minimum, is expected ultimately to increase this depth to 8 ft. This, of course, takes no account of the volume of water which the projected deep waterway would contribute, and which should further increase this minimum.

Just what traffic might reasonably be expected over the proposed waterway, no one appears to have attempted to estimate. It would seem that any great commercial advantage which such a waterway might be expected to yield would be largely conditional upon the existence of an Isthmian canal. The completion of the Panama Canal will convert the Gulf of Mexico into one of the most important bodies of water in the world, since it will then doubtless become, as it seems by nature intended to be, the outlet for the largest part of the tremendous volume of export traffic originating in the great Mississippi Valley, as well as a highway for world commerce. The Ohio and Mississippi rivers at the present time form the greatest internal waterway system in the world, except the Great Lakes. But while the river commerce has been declining, Great Lakes commerce in deep-draft vessels has increased enormously. It does not seem unreasonable, therefore, to assume that by uniting these two great inland systems and the Gulf of Mexico, with its great commercial promise, there would be established an avenue for traffic that would be an important factor in the business of transporting to tidewater the vast output of raw and manufactured products of this great region. Of course, the railroads would carry the greater part of the traffic as long as only a 14-ft. channel was assured for such a waterway, and that during a season averaging less than half the year. While a 20-ft. or deeper channel is, perhaps, practicable for that portion of the route at present projected, it is not by any means so certain that an equal depth could be attained and maintained in the Mississippi even with the expenditure of an enormous amount of work and money. The mere presence of such a waterway, however, might have some effect on railroad rates, even if the actual proportion of traffic using the route was small; just as the hopelessly inefficient Erie Canal controls the rates between the Atlantic Seaboard and the Central West, during the period of open navigation.

The Ohio Shippers' Association and the railroads of the state have entered into an agreement to settle by arbitration all disputes as to discrimination. J. W. McCord, of the Shippers' Association, says that the railroads will appoint a committee of three men and the shippers will appoint a like committee to confer upon all complaints; that the purpose is to have arbitration of all complaints, and that a plan of like nature is now in force as to car service and demurrage, and has proved satisfactory. This report has a beautiful rose color, and it is to be hoped that it is true, as well as rosy. Shippers' associations do not always hold together when most needed, and railroad committees sometimes turn out to be ropes of sand; but both are based on right and useful theories and ought to be encouraged. As long as railroads must act together in making rates it will often be a measure of economy to act together in dealing with shippers. The fact that many questions with shippers must be settled independently does not alter this fact. Shippers should unite for the simple reason that they are scattered and lack the power individually to carry on their own contests. As railroad organizations ought to be in the hands of traffic experts of broad views, so the traders should choose for leaders men free from the narrow notion that one city can successfully follow out the plan of getting everything for itself, regardless of the interests of other cities.

Chicago & North-Western.

The Chicago & North-Western operates 7,408 miles of line; the Chicago, St. Paul, Minneapolis & Omaha, operated separately but a part of the system, 1,683 miles. Together, as the "North-Western Line," they occupy the richest of the territory north and northwest of Chicago, and control a wonderfully large and profitable traffic. Incorporated in 1836 as the Galena & Chicago Union Railroad, and its first 10 miles of strap-rail track built in 1848, the Chicago & North-Western was the first railroad in Chicago, and had in consequence first choice of locations. To-day its 51 miles of double main track and 198 miles of other tracks form the most extensive system of terminals in the city.

In spite of its great success as a grain carrier, the Chicago & North-Western can hardly any longer be limited to the designation of a granger line, any more than a big city department store can be called a dry goods shop. With the wonderful development of its territory it has grown beyond, though not out of, its class. It is at least doubtful whether grain now furnishes the most important part of its business. Unlike most railroad companies, it gives no traffic figures of kinds of commodities carried, but certain of its traffic activities cannot be hidden.

The Chicago & North-Western has the largest live stock traffic of any road into Chicago. During the calendar year 1904 it carried into the city over 3,600,000 head—62,600 cars—of live stock. Its merchandise traffic north, northwest and west of Chicago is very large and profitable. In return, from these three radiating main lines and their branches and feeders, it carries, in its own refrigerator cars, very large shipments of perishable goods. On its Michigan peninsula division it has an iron ore traffic, earnings from which have been jokingly said to be large enough to pay the operating expenses of the entire system.

As these are only suggestions of some of the most important parts of the North-Western's business, there is no need of saying that the road is prosperous. Gross earnings last year were $55,745,275—$7,525 per mile of road. Net earnings, before deducting taxes, were $19,285,940, or $2,603 per mile of road. Taxes, which amounted to nearly 4 per cent. of gross earnings, were $2,189,977—$295 per mile of road. Gross earnings increased $2,410,641 over 1904, operating expenses $1,070,031, net earnings before taxes, $1,340,610, and taxes $352,171.

There were increases of $2,038,292 in freight earnings, $312,000 in passenger earnings, and $60,344 in express, mail and miscellaneous earnings. The total increase of over $2,400,000 in gross earnings

was not only notable in itself, but more particularly so on top of the large increases during the past few years. Gross earnings in 1904 increased $2,695,492 over the preceding year; in 1903, $3,198,659, and in 1902, $3,545,534, an average increase for the four years of over $2,960,000 a year. As the dividend rate (8 per cent. on the preferred and 7 per cent. on the common stock) has remained unchanged during this time, and requires by no means all of the net income, it might be supposed that much of the surplus had been turned back on the road in improvements, but it would hardly be expected that this had been done in so liberal a fashion as is the fact. Of the $5,816,315 "construction charges" during the past year, $4,600,000 was charged against income. In 1904 $4,000,000 was appropriated out of income for improvements; in 1903, $5,013,417, and in 1902, $4,697,055. Although the year 1902 marked the beginning of the recent series of nearly three million dollar annual increases in gross, appropriations for improvements had in the two years previous to that time been almost equally as large. There was spent in 1901, out of earnings, $4,169,526, and in 1900, $4,542,041. This is a total appropriation out of earnings for additions and improvements for the six years of $27,022,044, against $27,560,118 paid out in dividends during that period.

Naturally, the physical condition of the road has been brought to a very high standard. At the same time, the management has not been behindhand in extending its lines at various points necessary to safeguard, maintain or extend its traffic. Each year the building of new branches and extensions have been undertaken by constituent companies, to be absorbed on completion by the parent organization.

Three such subsidiary companies are mentioned in the present report. One of these, the Manitowoc, Green Bay & North-Western, is to build 114 miles of line which will more closely unite the Ashland and peninsula divisions and effect important savings in distance, grades and curvature.

The Milwaukee & State Line is building a continuation of the third and fourth main tracks of the Milwaukee division, now terminating at Lake Bluff, and generally known as the Lake Bluff cut-off, to a point near Milwaukee. This is an extension of the plan adopted a few years ago of relieving the very heavy traffic of the Milwaukee division, which, aside from its ordinary large business has probably the largest suburban traffic of any one line into Chicago, by separating the through freight and passenger, from the local and suburban passenger tracks. The first step in carrying out this plan was the building of a cut-off from Mayfair, on the Wisconsin division, north to Evanston, 12 miles from Chicago, on the Milwaukee division, together with a freight cut-off south from Mayfair to the West Fortieth avenue freight yards. Soon the suburban business began to encroach on this new line. In order to get the freight and through passenger trains promptly into the Chicago terminal district it was found necessary to extend the cut-off, or rather, build a new one, from Mayfair north to Lake Bluff, on the Milwaukee division, 18 miles north to Evanston, over which the third and fourth tracks were carried. This cut-off, in its turn, has been found insufficient, and the additional track construction now under way will carry the third and fourth tracks the entire 85 miles between Chicago and Milwaukee.

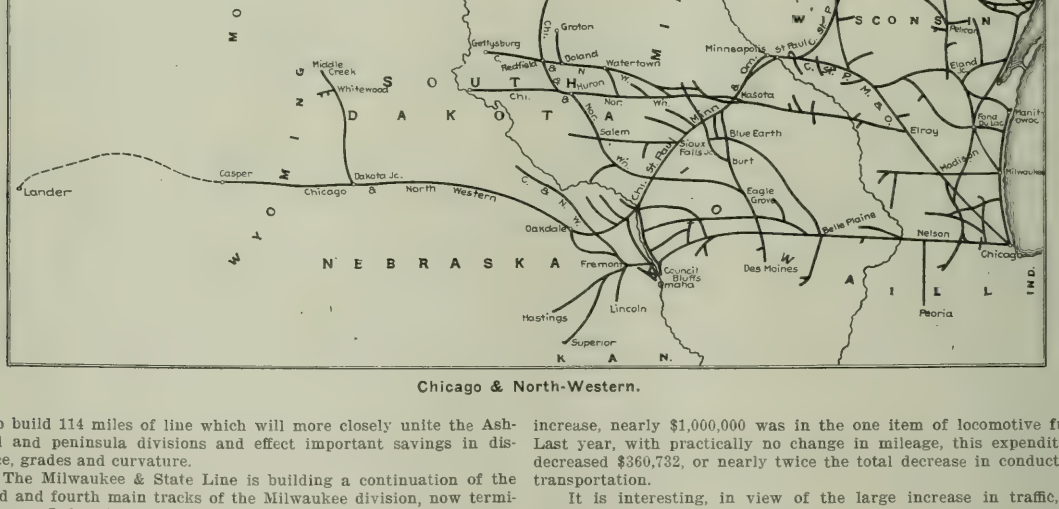
The third subsidiary company is the Wyoming & North-Western, which has already (November 1) laid track on eight miles of its line from Casper, Wyo., the farthest western point reached by the North-Western, west via Wolton and the new town of Shoshoni to Lander, at the edge of the Wind River, or Shoshone Indian Reservation, which is to be opened to settlement next June. This will bring the Chicago & North-Western to a point almost directly north of the Colorado-Utah boundary.

Another piece of new road to the westward, not mentioned in the report but already under construction, is a line from Pierre, S. Dak., west 150 miles to Rapid City, now reached only by a branch of the Chicago & North-Western's Wyoming line. It is interesting in this connection to observe that the company's closest competitor, the Chicago, Milwaukee & St. Paul, is also building a line from its present terminus at Chamberlain, S. Dak., 200 miles west to Rapid City; so that both companies are filling in the gap between their present termini on the Missouri river and the Black Hills region.

Track elevation in Chicago is a betterment—enforced to be sure—which has taken large sums of money for improvements. With more than twice as much track in Chicago as any other road, the Chicago & North-Western has for the past several years spent in this way very large amounts, and considerable expensive work is still to be done in the elevation of some of the freight lines within the city.

The improvement policy has had its effect not only in making it possible to actually handle the large increases in traffic but to handle traffic more efficiently. The number of passengers carried one mile last year increased 16,000,000, and the number of ton miles 226,000,000, yet the cost of conducting transportation showed a decrease of $194,000.

The cost of locomotive fuel, to be sure, had much to do with this. In 1904, with an increase of nearly 1,000 miles in the average mileage operated (due to a full year's operation in 1904 of the absorbed Fremont, Elkhorn & Missouri Valley Railroad), conducting transportation increased $2,000,000 over the preceding year. Of this



Chicago & North-Western.

increase, nearly $1,000,000 was in the one item of locomotive fuel. Last year, with practically no change in mileage, this expenditure decreased $360,732, or nearly twice the total decrease in conducting transportation.

It is interesting, in view of the large increase in traffic, to notice the principal changes in the items under the head of conducting transportation. As is natural, there was a general increase in the amount of wage payments. Agents received $21,000 more, switchmen, $48,000, and engineers and firemen, $66,000 more than in the previous year. Freight train supplies increased $30,000, while on the other hand locomotive supplies decreased $10,000; station supplies, $65,000; oil, waste and tallow for locomotives, $18,000; damage and loss of freight, $27,000, and personal injuries, $72,000. On the whole, this seems a very creditable showing. Of the total operating expenses of $36,459,335, conducting transportation took 58.9 per cent.

Maintenance of way cost $7,466,944, 20.48 per cent. of the total operating expenses, not including taxes. There were 420 miles of track replaced with heavier rails and 2,977,941 new ties laid. New ties cost $364,872 more than in 1904, an increase of one-third. Maintenance of way cost $1,008 per mile in 1905, against $968 in 1904.

Maintenance of equipment expenditures ($6,419,190, an increase of $909,446 over 1904) were 17.61 per cent. of operating expenses. Under this account, 48 locomotives, 8 passenger cars, and 1,800 freight cars were acquired for replacement and charged to operating expenses, against 1 passenger car and 1,675 freight cars acquired in 1904. General repairs of locomotives cost $1,999,791, of passenger cars $478,340, and of freight and work cars $1,541,266. Including cost of renewals and a proportionate share of the other charges, this

works out at $2,260 per locomotive, $521 per passenger car, and $55 per freight car, against $1,749 per locomotive, $446 per passenger car, and $53 per freight car in 1904.

Eighty-five per cent. of the total increase of $1,070,031 in operating expenses was in maintenance of equipment, 28 per cent. in maintenance of way, and 5 per cent. in general expenses. The decrease in conducting transportation was 18 per cent. of the amount.

The $13,339,714 passenger earnings, a decrease of $312,005 from 1904, came $9,094,656 from first class, $2,289,967 from round-trip, and excursion, and $1,796,856 from commutation passengers, together with $74,288 from emigrant passengers, and $83,948 from parlor car fares. The large proportion of passenger earnings (13 per cent.) coming from commutation fares, shows the importance of the Chicago & North-Western's suburban traffic. There were 661,289,753 passengers carried one mile, or 89,267 per mile of road, against 87,125 per mile of road in 1904. The average distance each passenger traveled was 31 miles, and the approximate earnings per mile run by passenger trains were $1.09 against $1.06 in 1904.

The number of tons of freight carried one mile per mile of road last year was 579,434, against 549,182 in 1904. The average earnings per ton mile were 0.92 of a cent in both years. The average distance each ton was carried decreased 7 miles, from 145 miles in 1904 to 138 miles in 1905. The steady increase in earnings per freight train mile during the past few years is very noteworthy. They have increased from $1.96 in 1900 to $1.98 in 1901, $2.02 in 1902, $2.05 in 1903, $2.07 in 1904, and $2.19 in 1905, the latter an increase of 6 per cent. over the preceding year and a record figure in the company's history.

The balance sheet shows $224,443,272 charged to cost of property, an increase of a little over $1,000,000 over 1904. Against this is outstanding $22,395,120 preferred stock and $48,335,938 common stock, a total of $70,731,058, or $9,548 per mile. The funded debt outstanding is $152,915,500, or $20,642 per mile. The company is exceptionally strong in its small total capitalization of $30,189 per mile of line, and in this respect reflects many years of the most conservative financial management.

With a territory as rich as any in the United States, a double track line to Omaha (the only double track line between Chicago and the Missouri river), a close traffic connection at that point with the Union Pacific, a first-class line to Minneapolis and St. Paul, an exceedingly profitable iron ore traffic on the Michigan peninsula, the investment of large amounts of surplus earnings in improvements, high operating standards, and splendidly conservative management, the Chicago & North-Western easily ranks as one of the strongest railroads in the United States.

The Chicago, St. Paul, Minneapolis & Omaha, whose lines are included on the accompanying map, shows gross earnings of $11,926,000, operating expenses of $7,676,528, and net earnings of $4,249,472. After payments for interest and rentals and an additional appropriation of $400,000, for additions and betterments, 7 per cent. dividends were paid on both classes of stock. These amounted to $2,086,861, of which $982,400 went to the Chicago & North-Western as dividends on its 147,000 shares of Chicago, St. Paul, Minneapolis & Omaha stock owned. These, by the way, are carried in the Chicago & North-Western balance sheet at $10,000,000, on which valuation the investment pays nearly 10 per cent.

For the Chicago & North-Western the principal operating figures for the year are summarized below:

	1905.	1904.
Mileage worked	7,408	7,404
Freight earnings	$39,292,830	$37,254,539
Passenger earnings	13,339,714	13,027,708
Exp., mail and miscellaneous	3,112,731	3,052,387
Gross earnings	55,745,275	53,334,634
Maint. of way and structures	7,466,944	7,166,308
Maintenance of equipment	6,419,189	5,509,734
Conducting transportation	21,460,447	21,654,456
Operating expenses	36,459,335	35,380,304
Taxes	2,189,977	1,837,805
Net earnings, after taxes	17,095,964	16,107,525
Gross income	57,281,110	54,823,864
Net income	10,417,822	9,399,741
Surplus for the year	5,242,898	4,224,817
Appropriations for betterments	4,600,000	4,000,000

NEW PUBLICATIONS.

Proceedings of the Thirty-eighth Annual Convention of the American Railway Master Mechanics' Association, held at Manhattan Beach, New York, June, 1905: Joseph W. Taylor, Chicago (Old Colony Bldg.), Secretary.

The majority of our readers are so familiar with the contents of these volumes from year to year that a detailed review of the present volume is not necessary. Aside from the association's rules and standard committee reports and topical discussions, it contains two individual papers, one on the "Technical Education of Railroad Employees" by G. N. Basford, of the American Locomotive Company, formerly editor of the *American Engineer and Railroad Journal*, and the other on the "Use of Superheated Steam on Locomotives" by H. H. Vaughan, of the Canadian Pacific. The volume contains 411 pages, which is somewhat smaller than the last year's volume, which had 552 pages, the largest one ever published by the association. The index is in substance, arrangement and typography a model in bookmaking. It makes all the information quickly available to a busy man.

TRADE CATALOGUES.

Foundry Information.—The latest number of the Obermayer Bulletin, published by the S. Obermayer Company, Cincinnati, Ohio, contains articles on "Aluminum, Silicon and Phosphorus," by F. J. Davis; "Partamol," a new compound for parting molds, a paper read before the Philadelphia Foundrymen's Association; "Molding and Casting a 15-ft. Fly Wheel," by H. Krohmer; "Foundry Facings," by E. D. Frohman, a paper read before the American Foundrymen's Association meeting at New York; and "Plumbago, Sea Coal and Core Wash." There is also considerable other information of interest to foundrymen.

Convertible Cars.—The Rodger Ballast Car Co., Chicago, has issued a "reference book" on its Rodger ballast Hart convertible cars. It is a convenient pocket size and illustrates and describes the various types of gondola, flat, box and stock cars all convertible into self-clearing hoppers. Half-tone engravings show various views of the different types, and engravings from line drawings show the general construction and principal dimensions. Cross-sectional views illustrate the methods of handling materials in these cars. The booklet will be sent free on application.

The Chicago & North-Western is distributing folders giving information concerning the industrial opportunities on its lines. A list of industries now wanted is given, together with a considerable list containing brief descriptions of factory buildings now available for immediate occupancy. Other business opportunities are enumerated, and an outline is given of the new lines being built by the road to open up new territory hitherto undeveloped. Other advertising literature includes a circular regarding the enormous crop being harvested in the northwest and announcing homeseekers' excursions to that region; and a pamphlet illustrating and describing the new equipment of the "Overland Limited," its crack Pacific coast train.

Steel Lath.—The Northwestern Expanded Metal Co., Chicago, sends an artistic eight-page pamphlet regarding its "Kno-Burn" steel lath. The advantages of steel lath over wooden lath are set forth and directions given for its application. The desirability of this lath for use in the cement exteriors for dwellings that are coming into vogue, is dwelt on, and also the small increased cost of concrete-steel construction over wood and the manifold advantages and superiority of the former. Half-tone engravings show both the standard and diamond mesh lath and weights and essential dimensions are given.

Hydro-Electric Power Plant.—Bulletin No. 13 of the Arnold Company, Chicago, is a description of the hydro-electric plant of the Spring River Power Company, Joplin, Mo., largely reprinted from articles in *Engineering News* and *Western Electrician*. The description is complete and is fully illustrated by half-tones and engravings from line drawings. The pamphlet is 9 x 12 and contains 14 pages.

Draft-Gear and Air-Brake Tests.—The Westinghouse Air-Brake Company, Wilmerding, Pa., sends a neatly gotten up pamphlet in which is given an interesting detailed account of the air-brake and draft gear tests recently made by the Westinghouse Company under the auspices of the Lake Shore & Michigan Central Railroad at West Seneca, New York.

Friction Draft Springs.—The Frost Railway Supply Company, Detroit, Mich., sends a catalogue descriptive of the Harvey friction draft spring. Illustrations showing this spring in cross section, under various stages of compression, are given, as well as diagrams in which the results of both compression and drop tests of the spring are shown.

Electric Storage Batteries.—The Westinghouse Machine Co., East Pittsburg, Pa., sends a small folder descriptive of the Westinghouse storage batteries for railroad signal service. The first few pages are devoted to explaining the merits of this new battery, and the remainder of the folder contains detailed illustrations of its various parts.

Iron and Steel Works Equipment.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, sends a handsome catalogue in which is illustrated various designs of heavy cranes especially designed for use in iron and steel works. A number of full page half-tone illustrations showing these cranes installed in well-known works are also given.

Valves.—The October issue of *The Valve World*, published by the Crane Company, Chicago, contains a number of interesting articles, including the "Beginning of the Manufacture of Wrought-Iron Pipe in the United States" and "The Growth of Artificial

Refrigeration." It also contains a description of the Crane quick-acting, self-opening steam radiator valve.

Concrete Building Blocks.—The American Hydraulic Stone Co., Denver, Col., sends a 15-page pamphlet describing its system of concrete building block construction. Views of a number of public buildings, residences, business blocks, etc., built of these blocks are shown, and testimonial letters from engineers, architects, etc., are included.

Stone Channeling Machines.—The Ingersoll-Sergeant Drill Company, New York, sends its catalogue No. 60 in which is illustrated and described various designs of stone channelers made by the above company. A number of half-tone illustrations are also given in which these machines are shown in actual use.

Machine Tools.—The Gisholt Machine Tool Company, Madison, Wis., sends pages 37 and 38 of its loose-leaf catalogue showing the latest method of attaching a motor drive to the Gisholt lathes. An illustration of a 13-in. lathe is also shown, this being the smallest lathe made by the company.

Graphite.—The Joseph Dixon Crucible Company, Jersey City, N. J., is distributing its November issue of *Graphite*. It contains an interesting article on steam and return pipes for heating systems, by W. H. Wakeman, as well as its usual amount of short talks on graphite and its various uses.

Alternating Current Generators.—The National Electric Company, Milwaukee, Wis., sends its Bulletin No. 358 in which it illustrates and describes in detail its full line of belt-driven alternating current generators.

Electric Storage Batteries.—The National Battery Company, Buffalo, N. Y., sends its Bulletin No. 3, in which it illustrates and describse its electric storage batteries of the "Unit Accumulator" type for car lighting.

CONTRIBUTIONS

Honeycombing Flue Sheets.

South Portland, Me., Oct. 31, 1905.

To the Editor of the Railroad Gazette:

Referring to the editorial in the *Railroad Gazette* for October 27, regarding the honeycombing or capping of tube ends complained of by some of the western roads, the Boston & Maine experienced the same difficulty when burning "Otto" coke on their through passenger runs, and had to abandon its use on that account. This coke, I understand, is wet down (on coming from the retorts) with salt water, which may account partly for this action. I cannot say whether they tried thimbles in the tubes, but it seems to me that would have helped the matter and will no doubt prevent to some extent the capping with the western coals, the idea being that the sharp edges of the thimbles will tend to break the cinders. They certainly will not adhere as readily to a sharp edge as on the rounded or beaded ends of the tubes. At the same time the shoulders of the thimbles will protect the ends of the tubes from abrasion.

J. V. N. CHENEY.

Oct. 30, 1905.

To the Editor of the Railroad Gazette:

It is quite a common thing in the west to have flues honeycombed, even with hand-firing, as I have seen different instances where the flue sheet is practically plastered over with a mass of clinker. You state in your editorial note that the stoker occupies the fire door and makes it inconvenient to use the scraper. As a matter of fact, this method of putting the stoker in the fire door must only be a temporary or an experimental one. The regular arrangement which has been devised for this, in connection with the stoker, gives a regular fire door above the place occupied by the stoker, so that this can be opened and access had to the fire-box, either by means of tools or, when the fire is extinguished, by permitting a man to crawl inside in the usual way and do any work that may be necessary without in the least interfering with the stoker. This may serve to destroy any apprehension which your readers might have in regard to the inaccessibility of the fire-box when the stoker is in use.

G. R. HENDERSON.

Jersey City, N. J., Oct. 31, 1905.

To the Editor of the Railroad Gazette:

I note with interest your editorial in the issue of October 27 referring to the difficulty in using automatic stokers on account of a coating gathering on the sheets and flues. I have known trouble of this kind to develop under strong forced draught and the accompanying intense combustion. I have understood that this peculiar coating can only be developed under like conditions. It is possible that with the automatic stoker at work and with the powerful draught applied to locomotive furnaces from the exhaust, that like conditions to those I refer to may be developed and this peculiar substance liberated in locomotive furnaces fired with the automatic stoker. I have found that steam jets under the grates of a closed furnace have overcome this trouble to a considerable extent in marine service, and it is possible that steam jets, either above or below the grates, might contribute to some extent in overcoming the trouble referred to where the automatic stoker is used.

W. M'INTOSH,
Supt. Motive Power, C. R. R. of N. J.

Middletown, N. Y., Oct. 31, 1905.

To the Editor of the Railroad Gazette:

Although we have never used the automatic stoker and consequently cannot say very much about its use, we are much interested in its application. Our traveling engineer tells me that at the last convention of the Traveling Engineers' Association held at Detroit a few weeks ago, automatic stokers were very thoroughly discussed and no one complained of the coating of the flues referred to in your editorial note in the issue of Oct. 27. At one time when we were burning a certain grade of coal we had this same trouble until we applied the Bates fire-door, which allows a large amount of air to pass into the firebox. This practically remedied the trouble. I would suggest a greater amount of air be taken in the firebox as an experiment.

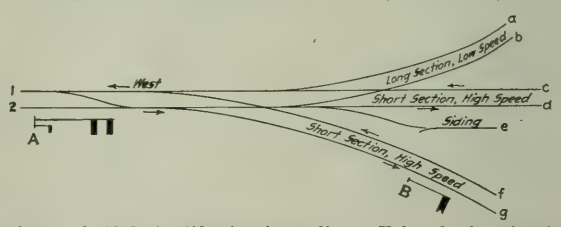
GEORGE W. WEST,
Supt. Motive Power, N. Y., O. & W.

Arrangement and Forms of Signals.

To the Editor of the Railroad Gazette:

I have read with much interest the communication from Mr. Henry Johnson, published in the *Railroad Gazette* of October 27, page 387. While Mr. Johnson's long experience and his thorough knowledge of signaling in England compels one to respect his views, the fact that Americans have for these thirty or forty years ignored the English idea of using more than one post for the signals of one track leads Yankees to question seriously the propriety of making a change at this late day.

It seems to me that to justify his proposition he should show a saving in the total number of signal arms, and further, should



show a decided simplification in readings. Unless he is going to fix his posts nearer to each other than 4 ft. he will, on four-track lines, labor under the serious disadvantage that his signals for parallel tracks are not far enough apart to produce as much difference as there should be between the bracket post, as shown in his letter (for one track), and the bridge signals which he would use for two parallel tracks.

Under the approved American practice of to-day, such as you will find on the four-track sections of the Pennsylvania, the signal to be used at the point of divergence into the three divisions which are shown by Mr. Johnson, would be as indicated at *A* in the drawing below. In this arrangement the upper arm is cleared for the route *d*, the second arm for *g*, and the dwarf arm for *b* and *e*. The defect in this arrangement is that—as it is necessary, in order to adhere to a consistent principle, to have the second arm indicate less than the highest speed—we unnecessarily restrict the speed of trains running to *g*. But, on the other hand, we secure the advantage of simplicity. Four-track lines are now found on many roads, and this Pennsylvania arrangement of a second arm to indicate a second grade of high speed, which was designed primarily for No. 20 crossovers at which one fast train needs to run around another which is moving in the same direction, is simple and logical for all situations. The situation at Mr. Johnson's junction might be met either by submitting to this reduction of speed, say, from 65 or 70 miles an hour to 45 or 50 miles, or by putting into the rules an exception for this junction. Surely, the junctions at which both of two diverging lines may be traversed at the highest speed are not going to be very numerous on any road. For that matter, it may well be claimed that this double junction is not a common situation, or at any rate should not be. It would be worth while to make a change in the location of a switch, if it could be done at moderate cost, to avoid the complicated arrangement of arms which Mr. Johnson provides. It is true that the arrangement of five arms on a single post has a tendency to mystification, but it will be hard to convince American

engineers that the same is not in a considerable degree true of Mr. Johnson's arrangement.

The two distant arms which Mr. Johnson shows on his bracket post might reasonably be put somewhere else. Either the distant signal in the rear of *A* should be kept against trains running to *g* or else there should be a separate distant at *B*. The same argument applies to the route to *d*. Rather than have Mr. Johnson's bracket post I would put the two distants on a separate post six or eight feet farther away from the track. Another way would be to put the lights for the distants 12 or 18 in. to the right of the post. Still better would be Mr. Vernon's double lights for the distant arms (one on each side of the post, both at same level). By day the forked arm would differentiate the signals.

Both Englishmen and Americans give undue importance to the theory of grouping as many signals on the same post as possible. In some other things money is spent liberally to make possible the use of a correct theory, while in this matter we seem to be blind to everything except saving in cost.

Why is it desirable to confine oneself to the principle of having only one home signal on a post? Signal engineers frequently discuss the dire possibilities of an extinguished light, and some of them have lately said a good deal in favor of having two lights on all posts everywhere. But when has trouble ever occurred from this source? Trouble, I mean, which was fairly chargeable to the signal department. Locomotive engineers will now and then get themselves into trouble with any possible arrangement of signals, but it is not the function of the signal engineer to provide against such lapses.

One important principle espoused by Mr. Johnson receives insufficient attention in this country; that is, the principle of obscuring a dwarf signal until the engineman comes within a comparatively short distance of it. Proper consideration of this point would settle some of the signal engineers' difficulties. Everybody is working all the time, more or less persistently, to get rid of unnecessary red lights, yet the red lights on dwarf signals constitute one of the most unnecessary elements of confusion to the runners of fast trains. This point was touched upon briefly in one of the discussions at Niagara Falls last month. I was sorry to see, however, that even the best informed speakers ignored the need of blinding those dwarf signals which are used for back-up movements on the main line. At interlockings situated on curves red lights in these signals unnecessarily disturb the runners of fast trains on the other tracks; or, if the runners have become hardened to them the lights become an element of danger, as by reason of their existence the runner unconsciously relaxes the vigilance of his lookout for other red lights. Not long ago there was a rear collision in which the engineer at fault claimed that the red lights in a caboose some distance ahead, on an up grade, appeared to him exactly like the red lights in certain dwarf signals.

Those roads which have adopted the practice of blinding every dwarf signal light when it is in the stop position are, I believe, fully satisfied with the idea. Those which use purple glass for the stop indication are also well satisfied; evidently they are afraid of the radical idea of blinding the light; they secure all of the advantages of blinding, for the purple will never be mistaken for red.

Mr. Johnson's suggestion about train-order signals evidently is born of his English experience, for the American railroad superintendent wants his train order signal to be so arranged that it can be used to hold the train for orders. This cannot be done after the engine has passed the signal. The only completely satisfactory arrangement is to have separate signals for the two directions and to fix each in advance of the station. At the same time, Mr. Johnson is right in saying that there is no need of a separate design of signal. As in the case of the automatic signal, if, after the engineman has brought his train to a stop, he does not know enough to find out why he has been stopped, and to get all necessary additional or auxiliary information, he is a pretty dull fellow.

In suggesting the use of two stop signals at a draw bridge in lieu of a derailing switch (where the derailing switch is supposed to be impracticable) Mr. Johnson again brings in an English idea. Does any American railroad officer favor this? It would be highly interesting to bring out the actual state of sentiment on this point. It is to be admitted that some American roads have gone to the absurd extreme of putting in a derailing switch which would almost surely throw a train into the river; but the rational use of the derailing switch or diverging track is the only true solution. If one is not willing to go to the expense of arranging a derailer or diverter in a reasonably safe manner, he ought to pay the penalty by being required to run all of his trains at low speed for several miles on both sides of the drawbridge.

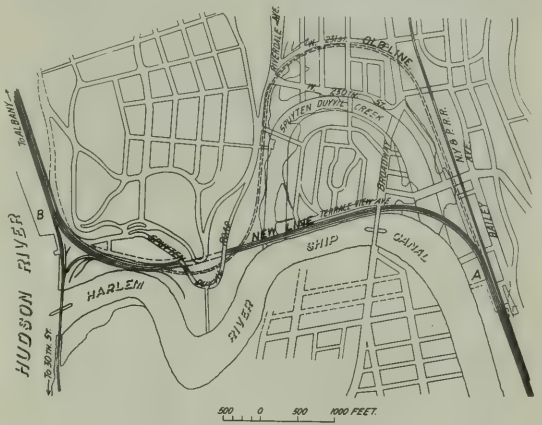
S. G. A.

Improvements of the New York Central & Hudson River Within the Electric Zone.*

A previous article (*Railroad Gazette*, Oct. 20, 1905, p. 366) outlined the improvements now being made by the New York Central within the electric zone and described in detail the work being done south of the Harlem river, rebuilding the Park avenue tunnel and excavating for the new Grand Central yard. This article will describe other important improvements farther out.

Marble Hill Cut-off.

This change of line, now under construction, leaves the present main line at a point about half a mile south of Kingsbridge and

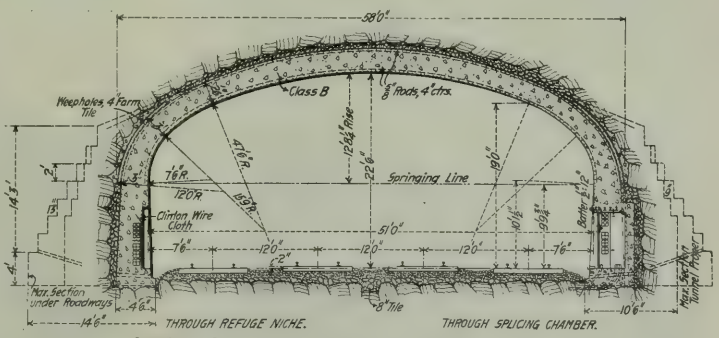


Map of Marble Hill Cut-Off.

swings west across Spuyten Duyvil creek, under Broadway and along the north shore of the Harlem river ship canal by Marble Hill, again across Spuyten Duyvil creek, and through Spuyten Duyvil hill in a four-track, single arch, rock tunnel to the point of connection with the present line just south of Spuyten Duyvil station. By the new line seven grade crossings are eliminated, and the line is shortened about three-quarters of a mile, saving also about 138 deg. of curvature. The new line is to be four-track throughout.

The special feature is the concrete-lined, four-track tunnel, which will be about 660 ft. long, and which so far as the writer is aware, will be the only four-track single arch rock tunnel in the world. Two short span fixed bridges will span Spuyten Duyvil creek, and crib bulkheads will sustain the new four-track roadbed along the ship canal.

The plans provide for a new station to be known as Marble Hill where the line crosses under Broadway, to take the place of



Section of Four-Track Tunnel in Rock, Marble Hill Cut-Off.

the present main line station at Kingsbridge, which will be abandoned after the new line is in operation. This station will be on the line of Broadway with stairs and baggage elevators leading from a concourse over the tracks to the platforms. As the Rapid Transit Subway crosses the ship canal on the Broadway bridge, a station will be located at the end of the bridge adjacent to the new Marble Hill station, and stairways with elevators will be arranged to allow convenient interchange of passengers between the two lines. Thus with the conveniences proposed at Grand Central Station there will be two points where passengers may change conveniently from the railroad to the subway. The Marble Hill cut-

*By G. R. Wadsworth, late with the New York Central.

Line of Marble Hill Cut-Off Looking South from Tunnel Portal.

Line of Marble Hill Cut-Off Looking North Toward Tunnel Portal.

Side-Hill Cutting in Rock, Marble Hill Cut-Off.

Fill Below High Bridge for Temporary Engine Terminal.

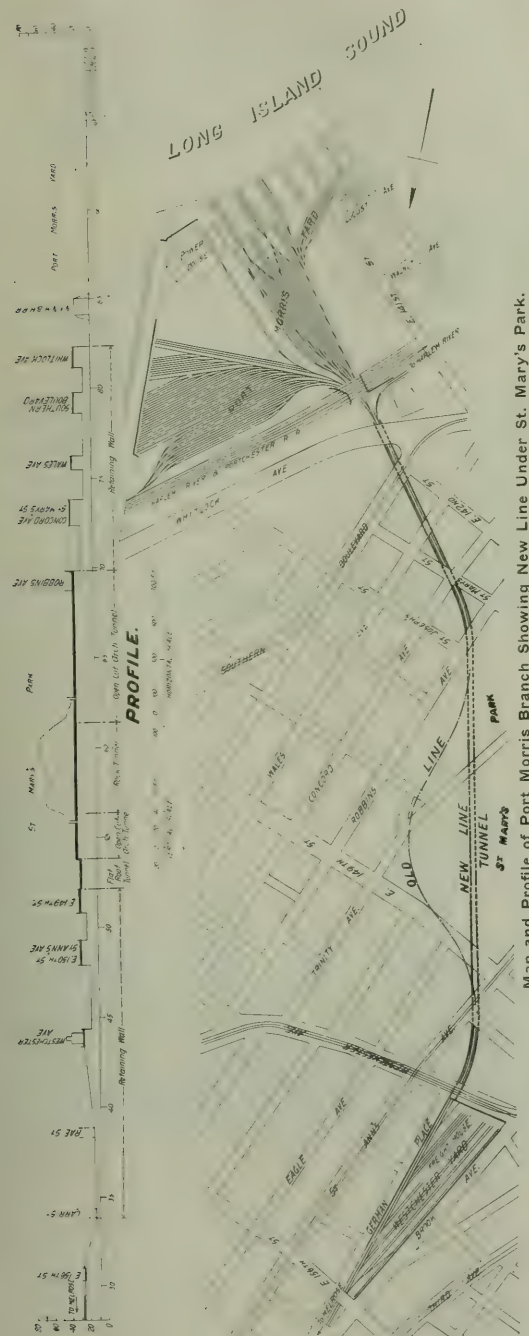
North Portal of St. Mary's Park Tunnel.

Interior of Double Track Tunnel Under St. Mary's Park.

off is now under construction, D. D. Streeter, of Chicago, contractor. The Spuyten Duyvil rectification, comprising the four-track tunnel, has not been started, but the contract has been awarded to the John Shields Construction Co., of New York.

Port Morris Branch Depression.

The Port Morris Branch extends from Melrose, about a mile east of Mott Haven on the Harlem Division south about two miles



Map and Profile of Port Morris Branch Showing New Line Under St. Mary's Park.

to the Port Morris docks on the East river. This branch was partially depressed in connection with the Harlem depression completed in 1890, and the balance of the depression about a mile long from Westchester avenue to Port Morris, is now under construction.

The work involves the double-tracking as well as the depression of the line, and includes the elimination of all existing street grade crossings, the streets being carried over the tracks, and also provides for the crossing of streets not now built, by constructing the necessary abutments and bridges. The alinement of the branch is changed as shown on the accompanying map, being carried in a double track tunnel under St. Mary's Park. When completed the tunnel will be about 2,000 ft. long, concrete lined throughout. Only about 500 ft. required tunnel excavation, however, the balance being open cut work.

Cut and North Portal of St. Mary's Park Tunnel.

This piece of construction is not a link in the great chain of terminal improvements, it being more or less isolated, and used solely for freight purposes. It is mentioned, however, as having a bearing on the policy of the railroad in its consistent action to abolish all grade crossings in the vicinity of New York. Incidentally it should be mentioned that incorporated in each of the two concrete side walls of the depression is a battery of 32 single tile ducts for the electric power transmission cables from the Port Morris power house. Work on the depression has been under way for about a year. The United Engineering & Contracting Company, of New York City, contractors.

Elimination of Grade Crossings and Special Station Improvements.

Within the zone of electrification each station has been studied with a view of improving and increasing the facilities in connection with the elimination of grade crossings. Plans have already been perfected for a large majority of the stations and at some points the construction work will begin next spring. The building plans for the new stations will be prepared by the associated architects for the Grand Central Station, and the station grounds will be laid out by the landscape gardener of the railroad company.

Concrete Walled Cut in St. Mary's Park.

Between Mott Haven and Spuyten Duyvil, new overhead sta-

tions in connection with new street crossings have been designed, for High Bridge, Morris Heights and University Heights, to be used jointly with the Putnam Division. The present stations at University Heights and at Fordham Heights will be abandoned after the completion of the new University Heights station, which will be located about one block south of the present Fordham Heights station, at 184th street. This street is to be carried across the Harlem river by a bridge to connect with 207th street in Manhattan. Plans for this new bridge have been finished by the city bridge department, and the pivot pier for the draw span is already completed. Work on these three new stations and street bridges is under way, the contract having been awarded to the Snare & Triest Company, of New York.

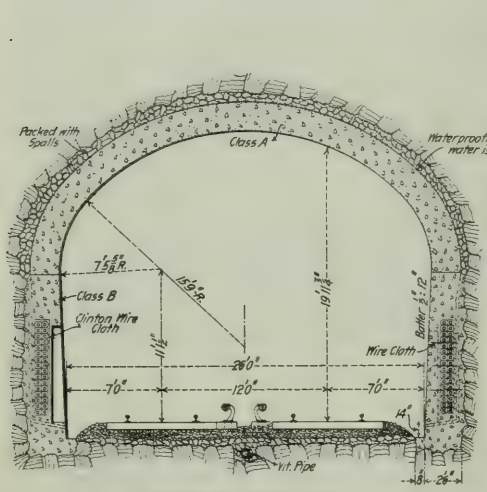
Between Spuyten Duyvil and Yonkers new stations will be built at Riverdale and at Mt. St. Vincent, and at Ludlow the two streets crossing the tracks at either side of the present station will be merged into one overhead crossing, with a new overhead station.

The Yonkers improvement provides for raising the tracks throughout the city, the streets in most cases being carried under the railroad, substantially at existing grades. The improvement includes a handsome new station at the street grade, access to the platforms being by stairways from the passenger concourse underneath the tracks, and by special elevators from the baggage and express subways. This improvement includes also new overhead stations at Ludlow and Glenwood. For the Yonkers local service middle tracks are provided between the main tracks for the storage of trains, and to facilitate the movements for the return trip. Besides the four main tracks a fifth or industry track will extend throughout the city for the purpose of serving local industries. Extensive additions have also been provided to the local freight facilities.

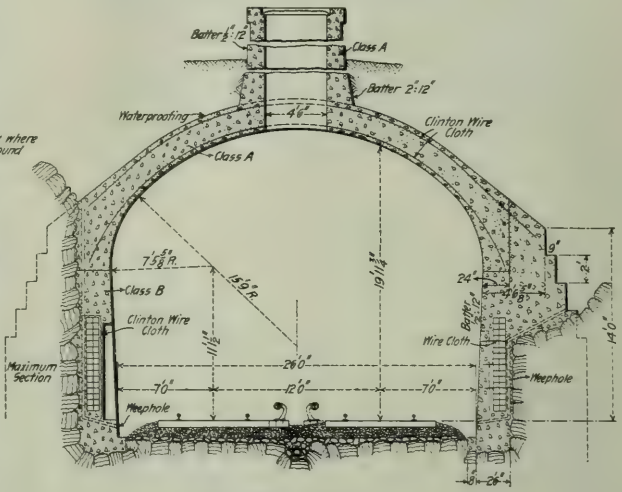
A new station has been planned for Hastings together with the elimination of grade crossings. Through Irvington and Tarrytown the grade crossings will be eliminated, and at the latter station the grade of the tracks will be raised to allow the streets to pass beneath the railroad.

Through Ossining the two existing double-track tunnels beneath the prison grounds will be widened for four tracks, center columns with flat steel concrete roof replacing the present brick arch in the longer tunnel, the shorter one to remain an open cut with retaining walls. A new station has also been planned at this point.

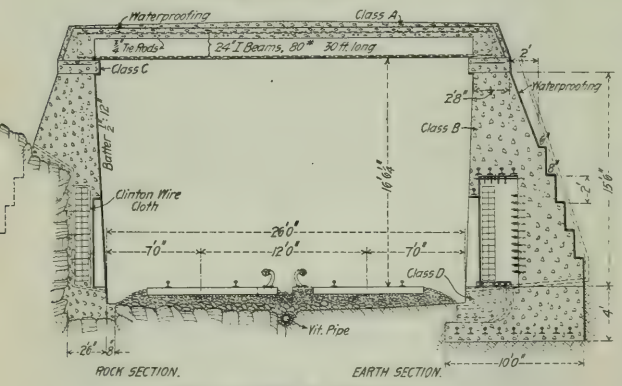
On the Harlem Division a new overhead street crossing together with a new overhead station has already been completed and recently put into service at 233d street, Woodlawn. Extensive improvements through Mount Vernon have been planned, involving a radical change in alinement together with the elimination of all grade crossings and a new station. Similar improvements are also contemplated for White Plains, where, too, the alinement will be considerably changed. The intermediate stations of lesser im-



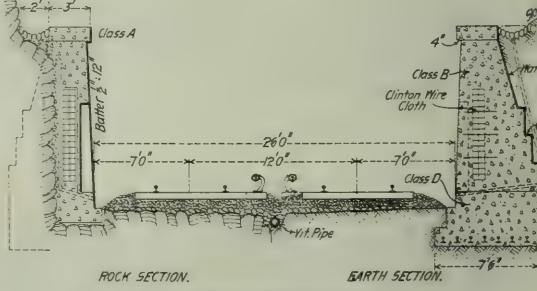
Arch Tunnel Bored in Rock.



Arch Tunnel in Open Cut.



Beam Roof Tunnel in Open Cut.



Retaining Walls in Open Cut.

Typical Tunnel Sections Used in Port Morris Branch Improvement Under St. Mary's Park.

portance have received attention and improvements will be perfected at each point. Largely increased local freight facilities will be provided at many points to suit the needs of growing communities and to encourage the establishing of industries within a short distance of the New York market.

The new station layouts have all been designed for four tracks, with right hand operation in pairs, the express trains using the middle two tracks. All platforms will be of concrete. It is proposed ultimately to have the suburban trains served with high platforms, level with the car floor, similar to those in the subway; but during the period of gradual installation of the new equipment, temporary low wooden platforms will be used in the new stations first constructed. The express platforms will be low, and of the island type between the express tracks. All platforms will be connected with the passenger and baggage concourses by stairs or elevators to an overhead bridge or a subway, and no crossing of the tracks at grade will be permitted. The company has adopted the "butterfly" section type of canopy for island platforms, as being in all respects best suited to fulfill the requirements of a pleas-

ing and serviceable shelter. For the local side platforms shelters with cantilever supports rising from the outer edge of the platform, the rear of the platform being entirely enclosed, are being considered and may be used jointly with the "butterfly" type. The local platforms will be from 350 to 500 ft. long, and the express platforms from 600 to 1,000 ft.

The stations are classified in three types. Local, where provision is made for the landing of passengers from suburban trains only, there being an outside high platform for traffic in each direction; local express, where occasional express stops are desirable in connection with the regular local stops, effected by crossovers between express and local tracks at either side of the station, there being a low platform extension to the high platform; combination, providing for regular stops for both local and express train service.

Consideration has been given to the minor features of the proposed new stations, platforms, stairways, etc., and in several instances the company has had constructed and put to actual use experimental designs before reaching a decision.

In connection with the elimination of grade crossings the masonry abutments and retaining walls will be largely of concrete, except at such points where the approaches to bridge crossings built by the municipality, may be of stone masonry, where a similar treatment will be carried out to give the proper architectural harmony.

Proposed Station at University Heights.

Four-Tracking the Hudson and Harlem Divisions.

In connection with four-tracking and station improvements particular attention has been given to the rectification of alinement throughout the entire territory involved. Almost every curve has been considered with a view to its complete or partial elimination, and the consequent improvement of alinement, and at several points the work of building the new roadbed on the rectified line is now progressing. The question of eliminating curvature has been studied from a standpoint of economy in operation. Modern improvements and refinements in track and in permanent way have been many, and with the 100-lb. rail, rock ballasted track, and curves in general not exceeding 2 deg., with spiral easements, which are normal conditions on the New York Central along the Hudson river south of Croton, the question of warranted expenditure to eliminate curvature, intangible at best, resolves itself into one of judgment. Investigations as to the material underlying the bed of the Hudson river adjacent to the roadbed have been made by wash and core borings, and in several instances river mud to a depth of 50 or 60 ft. has been found. At certain points contemplated radical changes in alinement to reduce curvature were abandoned on account of the great difficulty and consequent expense involved in securing suitable foundations for the new roadbed.

The present Hudson Division is double-track from Mott Haven, where it leaves the Harlem Division, to Spuyten Duyvil, and from there north to Ossining there is a middle track between the north and southbound mains. The entire line will be four-tracked to Croton with double storage or emergency tracks between the local and express tracks, each of two 75-car trains capacity, for traffic in either direction, located at convenient operating intervals. From Spuyten Duyvil north for a distance of some three miles the two freight tracks from the west side, or city division, will be carried along the river side of the four main tracks to Ludlow, where a system of crossovers will serve to divert the freight traffic to or from the main passenger tracks.

Proposed Station at High Bridge.

The filling for the new embankment for the additional tracks along the Hudson river will be obtained largely from the excavation at the Grand Central yard. This material is more than half rock and is well adapted for filling along the river front. After the new embankment is completed a substantial sea wall of riprap will be constructed.

The Harlem Division is at present four-track to Woodlawn, where the New York, New Haven & Hartford joins. From Woodlawn north through White Plains, at present double track, two additional tracks will be constructed, making the four-track line complete to North White Plains terminal. The four-tracking involves the extension of all bridges and culverts, and in many instances complete new structures of a type appropriate for the four tracks have to be provided. When completed the roadbed structures will practically be renewed throughout.

The shorter signal blocks made necessary by the contemplated large increase in suburban train service under electric operation, will require the complete renewal of the existing block signal system. Automatic block signals will be employed. The increased track facilities also require new power interlocking plants at all the important stations. The installation of the third or contact rail will be carried on together with the new track and switch work as far as practicable.

The Commercial Cable Company's New Atlantic Line.

The Commercial Cable Company's fifth Atlantic cable from Canso, Nova Scotia, to Waterville, Ireland, was completed and put in operation on October 6. This makes seven transatlantic cables worked in direct connection with the lines of the Postal Telegraph-Cable Company. All of them are duplexed, so that their combined capacity is fourteen messages at one time.

The new cable is the best and most expensive submarine cable ever laid. It was manufactured by the Telegraph Construction & Maintenance Company, of London, having been begun in March, 1905, and finished and shipped on board the construction company's steamer Colonia on August 3, 1905.

Atlantic cables are always laid from west to east because of the prevailing westerly winds in the summer months on the Atlantic, consequently the Colonia landed the heavy shore end of the cable at Canso on the morning of August 18. Moving out from the shore she struck a rock and was fast for four days. The injuries compelled her to go into drydock at Halifax with 2,300 miles of submarine cable board. On September 23 she laid her course from Canso, N. S., paying out cable. On September 28 she passed through a hurricane in mid-Atlantic, although on that day the weather on both sides of the Atlantic was reported fine, with gentle winds. On October 3 she arrived without mishap at a point 187 miles from the coast of Ireland, where the final splice was to be made between the cable that she had laid out from the American side and the 187 miles of cable previously laid westward from the Irish coast by the steamship Gambria in June. The weather was heavy, and the Colonia hove to until October 6, when the final splice was made.

At some points the cable was laid nearly three miles below the surface. The material used in the manufacture of the cable was 1,411,200 pounds of copper; 799,688 pounds of gutta-percha; 1,500,000 pounds of brass tape, jute yarn, iron wire and preservative compound.

The signaling speed of this cable is 15 per cent. greater than that of any other of equal length in the Atlantic. The cost varied from one thousand dollars to six thousand dollars per mile, according to the character of the ocean bed and depth of water. This variation was due to the different diameters and weights of the sections. The cable laid in the deepest water is lightest, because it would be impossible to retrieve a heavy one from the deep water. Cable in deep water is little liable to injury, and does not need to be so strong. The sections laid near shores are of massive construction and expensive. In the neighborhood of the fishing grounds off the coast of Newfoundland, a type of cable midway between the deep water and shore end cable is used. This intermediate size is made strong enough to resist injuries from the anchors of fishing craft, which is a prolific source of danger. This intermediate type is made just heavy enough to afford reasonable prospect of retrieving it in the event of its being damaged by an anchor.

Two Baldwin Four-Cylinder Balanced Compound Locomotives.

The accompanying illustrations show two new types of four-cylinder balanced compounds recently turned out by the Baldwin Locomotive Works. The Atlantic (4-4-2) type engine is one of two built for the Chicago, Rock Island & Pacific, and the Pacific (4-6-2) engine is one of an order of 28 for the Atchison, Topeka & Santa Fe.

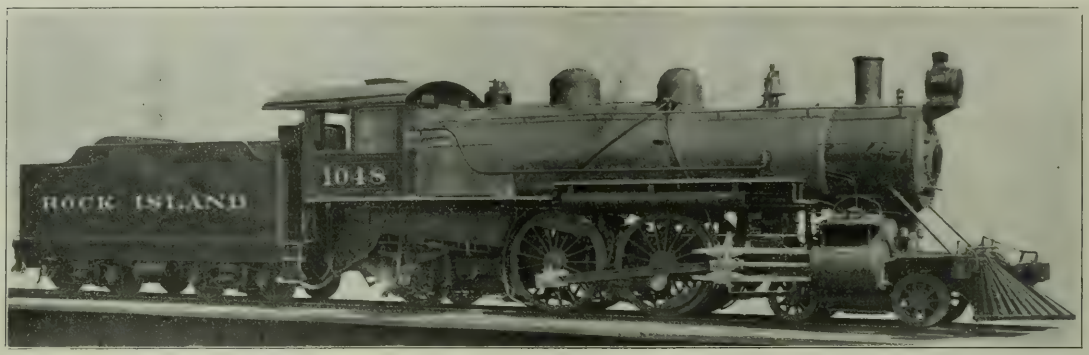
The Rock Island engines follow closely that road's standard design for simple Atlantic type locomotives prepared by the motive power committee appointed some time ago to standardize the locomotive equipment on the Rock Island System. The wheel base has been increased 2 ft. 9½ in. to permit the inside cranks to drive on the forward axle without setting the high pressure cylinders forward as in the Cole engine. The total weight has been increased 14,400 lbs. over the simple engines, but of this increase only 1,540 lbs. has been added on the drivers. Some changes have been made in the design of the boiler also, the working pressure being increased from 185 lbs. in the simple engines to 220 lbs. in the compounds. The compounds have 820 sq. ft. more heating surface and 5.4 sq. ft. more grate area. Their tractive power, however, is about the same as the simple engines, the compounds having 24,000 lbs. as against 24,700 lbs. for the simple engines. These engines will be tested on the Illinois Division in comparison with the simple Atlantic engines now in service.

The Santa Fe locomotives are the second lot of Pacific type balanced compounds turned out by the Baldwin Works, the first engine of this type having been built for the Oregon Railroad and Navigation Co. last spring and placed on exhibition at the Manhattan Beach convention of the Master Mechanics' Association last June. The Santa Fe engines have the same size cylinders, 17 in. and 28 in. x 28 in., as the O. R. & N. locomotives, but they are heavier on drivers and more powerful in every way. The inside rods are bifurcated and drive on the middle axle with the outside rods. The weight on each driving axle is 50,630 lbs., which is not so high as the weights usually applied in Atlantic type balanced compounds. They are equipped for oil burning. The following table gives some of the principal dimensions of the Santa Fe engines and the first locomotive of this type built for the O. R. & N. Co.:

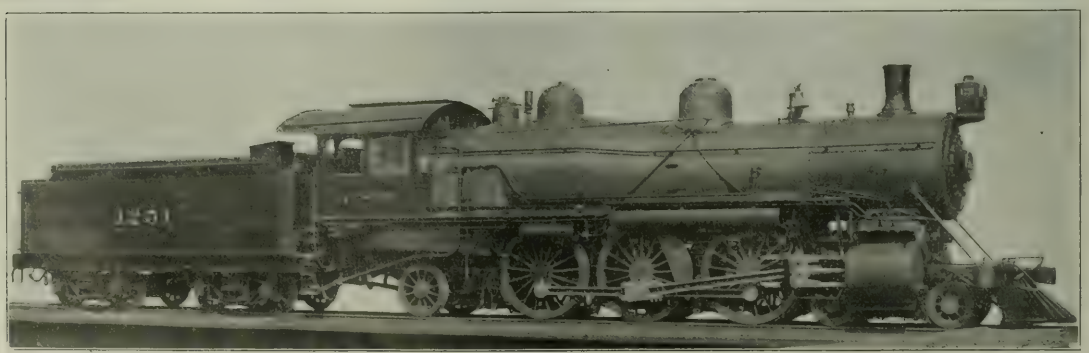
	Santa Fe.	O. R. & N. Co.
Total weight	226,700 lbs.	231,300 lbs.
Weight on drivers	151,900 "	143,600 "
Grate area	.....	49.5 sq. ft.
Heating surface	3,595 sq. ft.	3,053 sq. ft.
Boiler pressure	220 lbs.	200 lbs.
Diameter of drivers	73 in.	77 in.

The general dimensions of the Santa Fe and the Rock Island engines are given in following table:

	Rock Island: Atlantic type.	Santa Fe: Pacific type.
Kind of fuel	Soft coal.	Oil.
Weight on drivers	105,540 lbs.	151,900 lbs.
" on forward truck	51,780 "	35,800 "
" on trailing truck	42,080 "	39,000 "
" total	199,400 "	226,700 "
" eng. and tender loaded	340,000 "	402,783 "
General Dimensions.		
Wheel base, total, of engine	30 ft. 3 in.	34 ft.
" " driving	6 " 10 "	13 ft. 8 in.
" " total eng. & tendr	60 " 8 "	66 " 11½ in.
Heating surface, firebox	194 sq. ft.	192.8 sq. ft.
" " tubes	3,015 "	3,402.2 "
" " total	3,209 "	3,595.0 "
Grate area	50.2 "	.....
Wheels and Journals.		
Drivers, number	4	6
Drivers, diameter	73 in.	73 in.
Truck wheels, front, diameter	33½ in.	31¼ in.
Truck wheels, trailing, diameter	45 in.	43 in.
Journals, driving, main	10 x 10½ in.	11 x 10 in.
" driving, others	9 x 12 "	9 x 12 "
" front truck	6 x 12 "	6 x 10 "
" trailing truck	8 x 14 "	7½ x 12 "
Cylinders and Valves.		
Cylinders, diameter	15 in. and 25 in.	17 in. and 28 in.
Piston, stroke	26 in.	28 in.
Valves, kind of	Balanced piston.	Piston.
Boiler.		
Type of	Extended wagon top.	Wagon top.
Working steam pressure	220 lbs.	220 lbs.
Diameter of first ring	66 in.	70 in.
Thickness of sheets	11/16 in. and 15/16 in.	21/32 in., ¾ in. & 25/32 in.
Staying	Radial.	Radial.
Firebox.		
Length	107 9/16 in.	108 in.
Width	67¼ "	71¼ "
Thickness of sheets, crown	¾ "	⅜ "
" " " tube	9/16 "	½ "
" " " sides	⅜ "	⅜ "
" " " back	⅜ "	⅜ "
Water space, front	4½ "	4½ "
" " sides	4½ "	5 "
" " back	4½ "	4 "
Tubes.		
Number	273	290
Material	Iron.	Iron.
Wire gage	No. 11.	No. 11.
Outside diameter	2¼ in.	2¼ in.
Length	18 ft. 10 in.	20 ft.
Tender.		
Tank capacity	7,000 gals.	8,500 gals.
Fuel capacity	12 tons coal.	3,300 gals. oil.



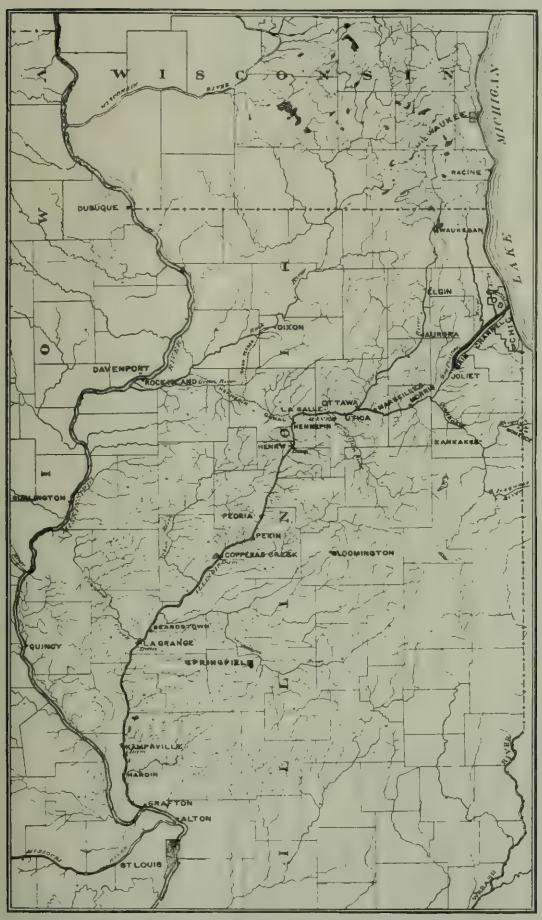
Atlantic (4-4-2) Type Four-Cylinder Balanced Compound for the Chicago, Rock Island & Pacific.



Oil Burning Pacific (4-6-2) Type Four-Cylinder Balanced Compound for the Atchison, Topeka & Santa Fe.

A Deep Waterway from Chicago to the Mississippi River.

As the chief feature of a vast scheme for diverting from Lake Michigan the sewage of Chicago which had hitherto been polluting the city's water supply, the Chicago Drainage Canal has world-wide fame. But while made primarily for sanitary purposes, its possibilities as a navigable channel and section of a deep waterway of considerably greater length had also a foremost place in the minds of its promoters and designers, as is indicated by its legal name of "Chicago Sanitary and Ship Canal." In order that its importance and value as a waterway may be understood fully, reference should be made to the accompanying map. As will be seen, the canal establishes a connecting link between Lake Michigan—or, more properly, the Chicago river—and natural waterways extending through the State of Illinois to confluence with the Mississippi river. These waterways, however, in their present state



The Waterways of Illinois.

do not furnish a channel depth sufficient to float the large craft requisite to the commercial success of the project, and considerable work would have to be done on them to develop a commercially profitable waterway. This, of course, requires the co-operation of the Federal government, and as a matter of fact, the government has already taken some steps in the matter, the 57th Congress having appropriated $200,000 for making surveys of the route and preparing plans and estimates. The survey has been completed and the estimate is in the hands of the Chief of Engineers of the United States Army and will probably be submitted to Congress at its next session. Shortly after the above-mentioned appropriation had been made, the Trustees of the Sanitary District of Chicago addressed a memorial to Congress urging the construction of the deep waterway and submitting a mass of information to prove the importance and feasibility of the route. Much of what follows, including the accompanying map, is taken from that document.

The canal proper begins at the west fork of the south branch of the Chicago river and extends to Lockport, a fraction over 28 miles. The lateral dimensions vary from 110 ft. at the bottom and 198 ft. at the water line, to 202 ft. at the bottom and 290 ft. at the water line. Through solid rock cuts these dimensions are 160 ft. and 162 ft. respectively. The grade of the channel is 1⅝ in. per mile through earth sections and 3¼ in. per mile through rock sections. The depth of water varies with the flow, but the minimum is 22 ft. At Lockport there is in the canal a large windage basin cut in the stone to enable large vessels to turn around. The controlling works for governing the flow of water in the canal are also located here.

The flow of water which the canal is designed to accommodate is 600,000 cu. ft. a minute. However, in its present condition it will not admit this volume in all parts without producing a current harmful to navigation. The narrowest section of the canal will carry only 300,000 cu. ft. at a current of 1¼ m.p.h. This section can readily be enlarged, however, when conditions require. The Chicago river, the flow of which was reversed by the canal, will handle at the present time little more than the present capacity of the canal, but improvements to widen and deepen it, of which approximately 60 per cent. have already been accomplished, will make possible a flow of 480,000 cu. ft., and the remaining 120,000 cu. ft. needed to yield the maximum capacity of the canal will be supplied by a large conduit along 39th street (Chicago) to the lake, forming part of the intercepting sewer system which is being built to divert from the lake to the canal the sewage of the south side of the city.

From Lockport to the southern limits of Joliet, 6½ miles, the Des Plaines river is being deepened, widened and straightened to accommodate a flow of 1,500,000 cu. ft. per minute. This provides for the maximum flow from the canal and for all possible flood waters of the Des Plaines valley. A navigable depth for large craft will not be established, however, by the work at present under way.

All bridges concerned in the construction of the canal were built or altered in conformity to the needs of navigation. The cost of the canal when all work is completed will be approximately $55,000,000. This exceeds by $18,000,000 the sum that would have been necessary to meet the needs of sanitation alone.

From Lake Michigan at Chicago to St. Louis by the proposed water route is 362 miles. Of this distance the canal has already developed 34 miles. The Mississippi river section covers 39 miles, leaving 289 miles of the Des Plaines and Illinois rivers to be improved. Figures and estimates contained in the memorial are based on a 22-ft. channel from Chicago to Lake Joliet, and a 14-ft. channel from that point to the mouth of the Illinois. The latter figure is the depth for which the canal would provide the necessary flow of water. The estimated cost from Lake Joliet to the mouth of the Illinois is $17,000,000, of which $10,000,000 is apportioned to the first 54 miles, considerably more work being necessary on this section than on the remaining 227 miles. It is interesting to know that the full flow of the canal—600,000 cu. ft. per minute—is one-half the volume of the Mississippi at Rock Island, Ill., during the low-water season. The discharge of this additional amount of water from the canal would therefore increase materially the volume of the Mississippi during a great part of the year.

The value of a waterway such as is proposed is dwelt on at length in the memorial. Aside from the commercial benefits, the national character and importance of such a waterway are pointed out. A new means of communication in the Central West would be established, also a passageway for light-draft war vessels through the heart of the continent. And while the primary commercial advantage would accrue to the interests of Chicago and St. Louis, it would permit direct navigation between Chicago and the Great Lakes on the one hand and the Mississippi river, Gulf and South American ports on the other. Also, with the opening of the Panama canal, direct communication with the Orient could be established.

Baggage charges on the German railroads by the proposed reformed passenger tariff, permitting no free baggage, are to be by zones and for units of weight amounting to 25 kilograms; that is 26 kilograms will cost twice as much as 25. Up to 25 kilometers (15½ miles) the charge will be 5 cents per unit (55 lbs.). Then for each zone 6 cents, the first ten zones being 50 kilometers (31 miles) each; zones 11 to 13 are 62 miles each, and for these the unit of weight is 110 lbs. and the charge per zone 12 cents. The 14th zone includes all distances over 800 kilometers (500 miles), with a charge of $1.19 for every 55 lbs. Thus a trunk weighing more than 110 lbs. would pay $3.57 for 500 miles or any greater distance. Second class fare for 500 miles would be $8.64, so that with such a trunk the cost of the journey would be $12.21, or at the rate of 2.44 cents per mile. Probably not one German passenger in 50 would carry so heavy a trunk, and not one in 20 more than 55 lbs., and the illustration is to show how the fares would apply to existing American traveling customs. The proposed baggage charges are lower than express charges in many cases (as for short distances), and baggage will not be forwarded unless a ticket is shown.

Kinzie Street Track Elevation of the Chicago & North-Western, Chicago.

Although there is more or less similarity in all of the Chicago track elevation work, each piece has its own special problems, making some stretches much more difficult than others. The Chicago & North-Western has nearing completion one of the largest and most interesting pieces of this work that has been done thus far. Wells street station, the principal passenger terminal of the road, is north of and just across Chicago river from the retail district of the city. It is also a short distance east of the north branch of the Chicago river. The Galena division of the road, which is one of its three double-track main lines out of the city, runs due west from Wells street station along Kinzie street. A portion of this line extending from Fortieth avenue, near the western city limits, eastward to Sacramento avenue, about two miles, was elevated several years ago. The present work is a continuation of this elevation eastward for 2.4 miles, from Kedzie avenue to Ada street, about two miles west of Wells street station.

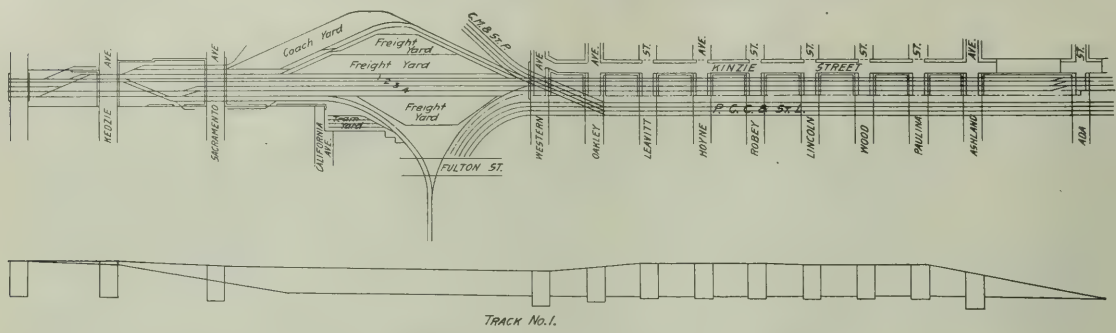


Fig. 1—Sketch Plan of Chicago & North-Western Kinzie Street Track Elevation.

The track and yard situation affecting this work will be understood by reference to the accompanying sketch plan, Fig. 1. Immediately south of the North-Western's tracks are the tracks of the Pan Handle (P. C. C. & St. L.) which come into Kinzie street from the south on Rockwell street. These tracks also are being raised, the work being only a little behind that of the North-Western. At Western avenue the Chicago, Milwaukee & St. Paul comes in from the northwest, crossing over the North-Western to join the Pan Handle tracks, which it uses into Union station. Just west of the C., M. & St. P. junction is the Western avenue freight and coach yard, which also was elevated, though not to the height of the main tracks. An idea of the situation at this point may be gained from Fig. 2. The view is looking west from Western avenue and was taken while elevation of the "north" yard was in progress. Prior to the beginning of the elevation work the main line made a detour southward to run around Western avenue yard, as seen in the photograph, and was separated from it by a high fence. This was to avoid danger from fast passenger trains running through the yards. This has been changed, the line now running directly through the freight yard, but at a considerably higher elevation, dividing it into "north" and "south" yards.

The North-Western formerly had but two main tracks on Kinzie street. It now has four as far east as Ada street, the end of the elevation work. Right-of-way for the third track, which is now the north track, was obtained from the city in exchange for paving, curbing and laying a 5-ft. sidewalk on Kinzie street between Ashland and Western avenues. The fourth or south track was obtained from the Pan Handle in exchange for the site of the old Ada street coach yard of the North-Western, which was abandoned for the coach yard at Western avenue, having double the capacity. East of Ada street there are three tracks to the north branch of the river, where there is a double-track bridge for entrance to the passenger terminal.

Work was begun in the summer of 1904 on the concrete foundations for the retaining walls and footings for the bridge abutments. By the fall of the year the retaining walls were about half built, those from Ada to Robey street being completed all but the coping. The retaining wall work was finished in the spring of the present year and all abutments were built this year. Filling was started in April, the first work being done at Western avenue yard. Filling on the line was begun in May, starting from Oakley avenue and working eastward, one track being raised at a time. The stages of the work are indicated in the cross-section of filling, Fig. 3. Before filling began the north track, which was the first raised, occupied the position indicated by the broken lines almost directly under track No. 2. Sand trains were run upon this track, the material unloaded and used to raise the track, which was lined over into the position of track No. 1 as the raising progressed. Meanwhile a pile-driver went ahead of the filling and drove the piles for temporary subway bridges for the two north tracks. One of these bridges is shown in Fig. 4 with a concrete mixing plant for the column foundations. As soon as track No. 1 was raised it was used as a working track to fill for No. 2, which meantime had been abandoned and was edged up on the side of the fill.

When the bank was ready the rail joints of the track were disconnected and the 30-ft. sections lifted to its top by a derrick car on No. 1 and quickly connected up. It was then used as a working track for the third fill and No. 1 turned over to the transportation department.

The procedure in filling for track 3 was somewhat different from the previous work. In order to avoid encroachment on the north track of the Pan Handle, whose elevation work had not proceeded so far, the track which had been acquired from that road was swung over to the right-of-way line and edged up as shown in Fig. 3 and in the photographic view, Fig. 5, to hold the bank within bounds. Track 3 is therefore a new track. No. 4 could not be put in position until the Pennsylvania had elevated its north track.

Western avenue yards contain approximately 12 miles of track. As already mentioned, these yards were not raised to the full height of the line tracks, the total elevation of which was about 13 ft. The yards were raised 6 ft. above their former grade, the relation of yard and line tracks being as shown by the cross section in Fig. 6. This drawing shows the track plan of the elevation work west of Oakley avenue. To raise the yard, one-half was abandoned and filled at a time. Alternate tracks across the yard were raised at one time, the sand cars being placed on the tracks between.

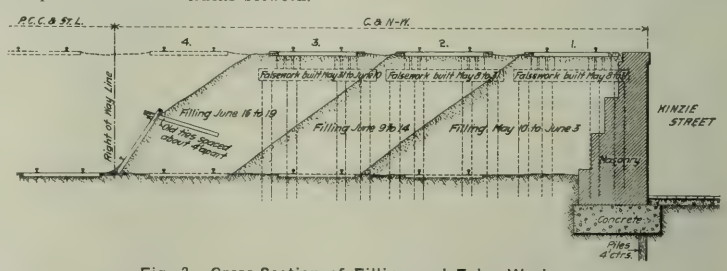


Fig. 3—Cross-Section of Filling and False Work.

In addition to what has been described, the double track from the west which swings southward on Rockwell street has been raised for about three-quarters of a mile. This track runs to Wood street freight yard and the Union Stock Yards. The interlocking plant protecting the junction of this line with the main line, which was formerly at Talman avenue, has been moved west to Kedzie avenue, and is an all-electric plant.

Raising the four-track grade crossing of the Chicago, Milwaukee & St. Paul at Western avenue was a difficult feature of the work. In order to enable this to be done most conveniently, this crossing was moved temporarily to a point east of Hoyne avenue, where the tracks were already elevated. The C., M. & St. P. used the two north tracks of the North-Western west of Hoyne avenue while the crossing was in a temporary position. As soon as the tracks had been raised at Western avenue the crossing was moved back

to its original position. This crossing will be protected by an all-electric interlocking plant.

Sand for the elevation work was obtained from Cary pit, about 38 miles northwest of Chicago on the line to St. Paul. The Track Elevation department had its own train service over this portion of the line, with special locomotives and cars assigned to it. Haskell & Barker side-dump cars were used and all sand was handled at the Chicago end by shoveling at a cost of about 5 cents a yard. The maximum amount of sand deposited in a day was 12,000 cu. yds. and the average was 7,000 yds.

The retaining walls are built of coarse rubble masonry on a foundation of concrete resting on piles. The coping is Wisconsin red sandstone, the body being gray limestone. A cross section of the wall is shown in Fig. 3, and a photographic view in Fig. 8, which was taken at Western avenue, looking east, before filling began. The concrete retaining wall of the Pan Handle appears on the south side.

The abutments for the subway bridges, of which there are nine new ones, are of dimension stone, and the sandstone is used for bridge seats. The column foundations have a concrete footing with a stone cap. The subways are all 66 ft. between abutments. The bridges, which are now being placed, are steel, and a novel floor construction is employed. Drawings are shown (Fig. 9) from which it will be seen that no longitudinal girders are used. The steelwork of the floor consists of longitudinal troughs resting on the abutments and on transverse girders riveted to the columns. The latter are built up of four Z bars riveted to a central web plate, forming an H section. The cross girders are 3 ft. 8⅛ in. back to back of angles. The troughs are 15⅝ in. wide c. to c. of web plates. They are 12¼ in. deep over angles for the sidewalk spans and 18¼ in. for the roadway spans, the lengths being respectively 11 ft. 3 in. and 24 ft. 6 in. The insides of the troughs are swabbed with hot asphalt and they are then filled with 1-3-6 concrete. Over this is laid 1½ in. of asphalt mastic, on top of which is a covering of 1-2-4 reinforced concrete, using ¼-in. corrugated steel bars laid 6 in. on centers. The ballast is laid on the concrete.

The floor drains from the center each way to the ends, the side gutters, formed in the floor, having a zero depth at the center of the bridge and increasing to 6 in. at each end. Drain tiles back of the abutments, under the ballast, carry off the water. At the side of the bridge is a facia girder 2 ft. 11 in. deep. These bridges are designed for a live load of two 177½-ton locomotives followed by a uniform load of 5,000 lbs. per foot of track. There is no allowance for impact because of the ballasted floor. The Pan Handle will use a similar design for its bridges, but which will, of course, be independent of those of the North-Western. The opening between the bridges at the dividing property line will be covered by reinforced concrete slabs, as shown by the detail.

In addition to the nine new subways, the old subway at Sacramento avenue, near the west end of the work, will be revised. It was built in 1893 before any elevation work was done, and was altered in 1895 at the time the western portion of the line now being raised was elevated. It was a skew subway, there being an offset of 17 ft. in the avenue between the north and south sides of the tracks. The lowest point of its roadway was 8 ft. below its present grade. This was below the grade of the sewers and water was constantly present, although an automatic pump was installed to keep it pumped out. This subway has been straightened, a new bridge built, and the roadway raised to give the minimum subway clearance of 13 ft. To straighten the roadway, 17 ft. was acquired by the city on the east side of the street north of the right-of-way. The roadway will have two kinds of paving. On the east 20 ft. granite will be used for heavy teaming. The west 32 ft. will have brick for boulevard purposes. The two will be separated by a concrete curb which will be made of crushed granite to give greater durability. On each side of the bridge it will be 9 in. x 30 in. Under the bridge it becomes a wheel guard and a support for a row of columns. It has a foundation 6 ft. wide and 21 in. deep. The upper part is 3 ft. wide for a height of 3 ft. 8 in. and the remaining 2 ft. tapers to a top width of 1 ft. 4¾ in. Details are shown in Fig. 7. The 17 ft. on the west side, north of the tracks, which formerly was roadway, will be sodded.

Fig. 5—Track No. 4 Edged Up on Side of Fill to Protect Adjacent Tracks of P., C., C. and St. L.

Before the elevation work began there were viaducts over the tracks at Ashland and Western avenues, with truss spans of 190 ft. and 140 ft. respectively. These had to be removed by the railroad companies, which also removed the approaches. The North-Western removed the north approach to the Ashland avenue viaduct, the C., M. & St. P. the similar approach at Western avenue, and the Pan Handle the two south approaches. In addition a 250-ft. span bridge which carries the Metropolitan Elevated Railway over the tracks, had to be raised about 10 ft. This was done by jacking up the end bearings, building up the abutments, and changing the plate girder approaches, all of which was done by the Elevated Railway.

Fig. 4—Temporary Timber Subway Bridge and Portable Concrete Mixing Plant for Column Foundations.

Before the work began there was a passenger station at Oakley avenue. This was abandoned and a new station is being built at Kedzie avenue. It is a one-story building with basement rooms at the street level. The general waiting room, which is at the track level, is 72 ft. x 40 ft., and there are also women's rooms and a smoking room. The material is continental brick with Bedford stone trimmings. The platforms are wood, except over the subway, where concrete is used. There is an inclined driveway of concrete leading up to the waiting room level from Carroll avenue. It opens into an area adjoining the station, also of concrete, which gives standing room for the carriages.

The estimated amount of filling material is 505,000 cu. yds. There were 4,000 yds. of first-class masonry work in the abutments, 17,000 yds. of second-class for the retaining walls, and 15,000 yds. of concrete in the work. There are about 5¼ million pounds of steel in the subway bridges. The improvement of Kinzie street required 15,000 sq. yds. of paving, 3,500 sq. yds. of cement sidewalk and 8,000 lineal feet of curb. Excavation for the sub-

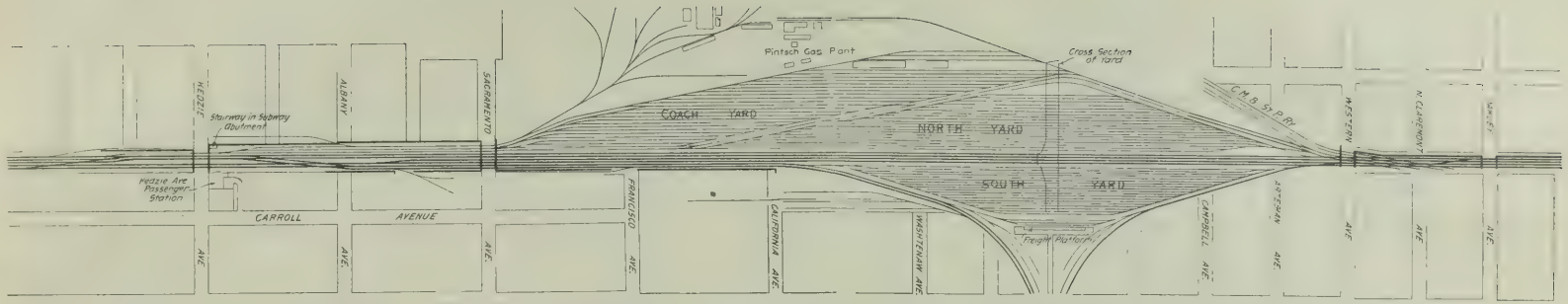


Fig. 6—Track Plan West of Oakley Avenue, Showing Western Avenue Freight and Coach Yard, C., M. & St. P. Crossing and Kedzie Avenue Passenger Station.

Fig. 2—Looking West from Western Avenue Before Filling Was Begun.

Fig. 8—Looking East from Western Avenue Before Filling, Showing C. & N.-W. Retaining Wall on Left and P., C., C. & St. L. Retaining Wall on Right.

ways amounted to 7,500 cu. yds. and there were 15,000 yds. of material in the north approach to the Ashland avenue viaduct. One mile of sewer was laid in Kinzie street to replace a sewer on the line of the retaining wall. It varied from 2 ft. to 4½ ft. in diameter, increasing by 6 in. every 1,000 ft. At Ashland avenue a 24-in. water main running north and south, a 12-in. east and west main and a 6-in. north and south main were all lowered about 4 ft. under pressure. East of Ada street, where the elevation work ends, the tracks are being rearranged and laid with heavier rail. Also, an interlocking plant is being put in to protect a team track yard at Green street. The estimated cost of the track elevation work, not including the Kedzie avenue station, is $1,400,000.

A very heavy traffic over this line had to be taken care of with minimum delay while the work progressed. Besides through and suburban trains, there was some freight traffic, and numerous light engine, empty train and switching movements. There was also the Western avenue crossing of the C., M. & St. P. The abandonment of Ada street coach yard required all empty passenger trains to be moved over the stretch being elevated in going to and from Western avenue yard. As the tracks were raised traffic had to be shifted from one to another, requiring constant changes in switches, signal connections, etc. Two tracks were kept open for traffic except from 10 a.m. to 4 p.m., when only one track was used, which was controlled by operators at Ada street and Western avenue respectively. While Western avenue yard was being raised a part of its work was transferred to the Fortieth avenue yard.

The entire work is being done under the direction of Mr. E. C. Carter, Chief Engineer of the Chicago & North-Western, assisted by the engineers of the track elevation department, immediately in charge of the work. Mr. J. A. Peabody, Signal Engineer, has charge of the signaling and interlocking work, and Mr. J. S. Robinson, Division Engineer, of the passenger station at Kedzie avenue. All work was done by company forces except the street improvements, and Kedzie avenue station, which were done by contract.

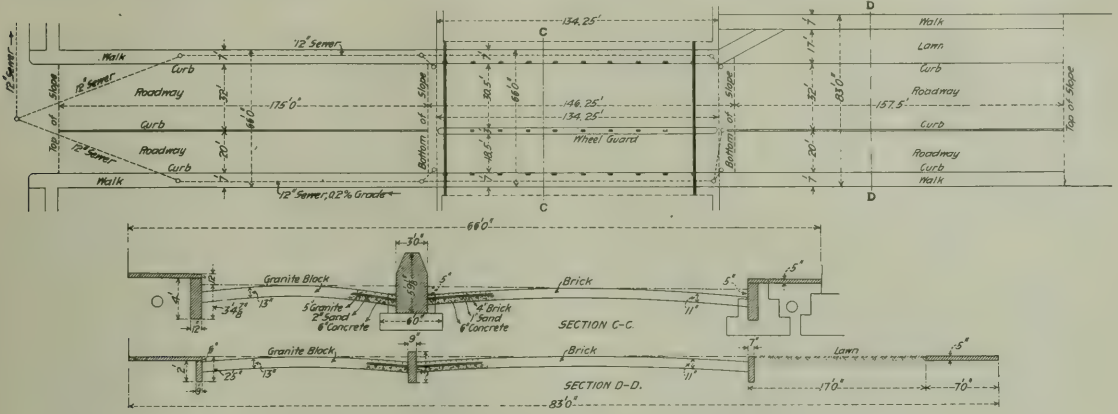


Fig. 7—Roadway Plan and Cross-Sections at Sacramento Avenue.

Hearing on Freight Train Braking.

At Washington, November 2, the Interstate Commerce Commission heard the remonstrances of those railroads which object to an increase in the minimum percentage of cars to be controlled by power brakes in freight trains, the law at present requiring 50 per cent., and authorizing the commission to increase the minimum. The first remonstrant was the Pennsylvania Railroad. This company reports for six months an average of 75 per cent. braked in all of the freight trains run by the company; but 20 per cent. of all of the trains run had less than 70 per cent. braked and about 5 per cent. of the trains had only 50 per cent. braked. General Superintendent Creighton said that the classes of cars in which there are the fewest air-braked cars are those used in the coke and the anthracite coal traffic. These are largely old cars which it would be uneconomical to fit with air-brakes. In the anthracite region old cars have to be used because the loading facilities are not adapted to the new high-capacity cars. In the month of August the Pennsylvania ran 12,859 freight trains in which were 476,742 cars, of which 328,895 had air-brakes which were in use. This is equal to 70 per cent., or 5 per cent. less than the average for the six months reported above.

To comply with the present minimum legal requirement of 50 per cent. causes some delays, cars of coke having to be held 12 hours, sometimes, to properly make out a train. Delays like this would be made necessary in all of the yards if the minimum percentage were raised, and such delays would be especially costly at the present time on account of the great volume of traffic. The company is using every car available, and of box cars and gondolas could just now use as many more if it had them; in other words, the amount of business offering is twice as great as the company can accommodate. To take the old cars out of service for the purpose of fitting them with power brakes would temporarily deprive shippers of that much accommodation.

The Pennsylvania Lines West of Pittsburg (and, indeed, all of the large roads which appeared) made statements similar to that of the Pennsylvania. These lines own about 4,000 rack coke

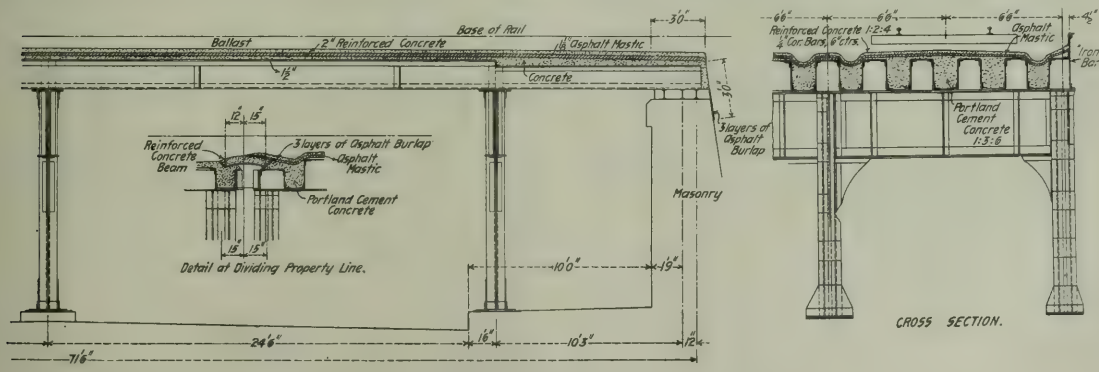


Fig. 9—Typical Solid Floor Bridge Construction on Kinzie Avenue Track Elevation.

cars, of which 45 per cent. are not equipped with air-brakes. Some of these cars are 15 years old. In applying air-brake equipment in the shops at the present time the preference is given to coke cars. Last month 350 cars were equipped in the company's shops. Asked as to the cost of equipping a car, witness (Mr. Crawford) replied that it was from $50 to $60, varying according to whether or not the three-position retaining valve was used and whether or not metal brake-beams were applied.

Mr. A. W. Gibbs, General Superintendent of Motive Power at Altoona, remarked that when they began using a larger percentage of air-brakes, the difficulties with ruptured hose increased. To show the difficulties of getting cars into the shops, Mr. Gibbs stated that his shops east of Pittsburg are now taking in 44,000 cars a week.

Mr. F. H. Clark, General Superintendent of Motive Power of the Chicago, Burlington & Quincy, told of the congestion at yards on his line, and of the difficulty of getting new cars to take the place of those old ones which are not equipped with air. The company is in the market for 2,000 coal cars, but cannot get them until late in 1906. The car shops of the country are said to have taken orders during the last 60 days for 100,000 freight cars, and railroads are asking prices now for 50,000 more. The Master Car Builders' Association has already adopted a rule that after Sept. 1, 1907, cars offered in interchange must have air-brakes; this rule will tend to hasten the application of apparatus.

General Manager Fitzgerald, of the Baltimore & Ohio, testifying to facts similar to those already given, said that of the 70,000 B. & O. cars about 30,000 were on foreign lines. A somewhat smaller number of foreign cars is on B. & O. lines. The company cannot fill half of its orders for cars for grain, coal and iron, though during the past year the movement of freight cars has been greatly improved, the average now being 33 miles a day as compared with a former average of 26 miles a day. The company has ordered 10,000 new cars, but many of them will not be delivered until next year; and the makers give good excuses for the delay. B. & O. yards are more and more crowded and it is increasingly difficult to comply with the 50 per cent. minimum rule. Replying to questions, Mr. Fitzgerald said that on the steep grades of his line, 2 per cent. and steeper, the brakemen are required to be constantly at their posts, ready to use the hand-brakes if necessary, and the retaining valves are always used. Asked why he could not control trains on descending grades wholly by air, as is done on roads in the west, he replied that some of the roads in the west—the Duluth & Iron Range, for instance—used the hand-brakes as was done on the B. & O. If one inquires of those roads, the reply is that the trains are controlled by the power brakes, but actual observation had shown otherwise.

Mr. Maher, of the Norfolk & Western, said that his company had only 1,200 cars yet to equip, but that on certain branches he had to use old cars (largely non-air) because the bridges on those branches are not strong enough for the new and heavy cars. The company is spending large sums annually renewing these bridges, but has not got the work finished. The Norfolk & Western would also be inconvenienced by lack of capacity in yards. The yards are being enlarged as fast as possible.

The Lehigh Valley has 78 per cent. of its cars equipped; but three-quarters of the cars in its trains are foreign. At Suspension Bridge, an important terminal, its switching is done in the yard of another company, so that enlargement of facilities is a difficult matter.

Mr. Seley, Mechanical Engineer of the Chicago, Rock Island & Pacific, said that his road had 80 per cent. of its cars equipped and the St. Louis & San Francisco 85 per cent.; and under normal conditions he would not object to a slight increase, but conditions are now abnormal, both by reason of the rush of traffic and by the excess of work in the shops.

Mr. L. G. Parish, Assistant Superintendent of Motive Power of the Lake Shore & Michigan Southern, said that on the main line his company could comply with a rule requiring an increased percentage, but on branches, where old cars have to be used on account of the insufficient strength of bridges, an increase would be a hardship. His company is retiring low-capacity cars because of their low capacity, and not because they are worn out.

Mr. Smith, General Superintendent of Motive Power of the Atlantic Coast Line, said that his company would have no difficulty with through trains, but on local freights and on branch lines an increase in the required percentage would be a hardship; and the increase in switching necessary to get the air-braked cars together would increase the danger to trainmen. The company has 3,325 new cars now being made. If, by reason of the air-brake rule, cars are delayed, the company is in three states obliged to pay a penalty to shippers for the delay beyond a certain limit.

Mr. J. N. Seale, Superintendent of Transportation of the Southern Railway, explained that his system is made up largely of old and weak railroads. The company has 91 per cent. of its cars equipped, but, with insufficient yards, has difficulty now in complying with the law. Yards are being enlarged as fast as the company can find contractors to do the work, and within less than two years extensive new yards will be made at Atlanta, Asheville, Knoxville, Columbia and Birmingham. In the coal district it is often necessary to delay loaded non-air cars 24 hours in order to comply with the 50 per cent. minimum rule. This is largely due to irregular loading by shippers, the cars (part air and part non-air) having to be distributed for loading at a great many comparatively small loading points. The company needs at this moment 5,000 additional freight cars. Of the penalties for delays to freight, spoken of by Mr. Smith, the Southern has $4,000 now hanging over its head. These penalties have to be paid unless the traffic department is cunning enough to "jolly" the shippers into withdrawing their claims.

Mr. C. Peter Clark, General Manager of the Buffalo & Susquehanna, spoke of the difficulties on his road. At the same time, he is compelled by self-interest, regardless of any law, to keep his braking at the highest efficiency, because of the numerous steep grades. On his grades of 148 ft. to the mile he requires the hand-brakes to be set at the top of the grade, and the engineman is compelled to haul the trains down grade. On the branches some of the grades are 172 ft. to the mile, with frequent switchbacks.

Mr. E. E. Clark, representing the brotherhoods of conductors, brakemen, enginemen and firemen, who had questioned most of the railroad witnesses, put on the stand Inspector Strickland, of the Interstate Commerce Commission, who testified that in Colorado, and elsewhere, trains have for 10 years been successfully handled on 3 per cent. and 4 per cent. grades wholly by air-brakes. The general condition of the air-brake service on the railroads east of the Mississippi river has improved of late, but the improvement has not progressed so fast as it should have done because the railroads have insufficient forces of maintainers and not enough testing plants. Some roads try to use all of the air possible, while others seem content to use just 50 per cent. He had seen many cases where, by making one more switch, the percentage of air in a train could have been materially increased. Speaking of the increased safety to be secured by increasing the percentage of air, Mr. Strickland emphasized the value of this safeguard on up grades, in cases where a train breaks in two. The hand brakes are now so inefficient that when the rear part of a train breaks away the brakemen are often unable to get the brakes applied before the cars elude control and run back.

Mr. Clark, in summing up his argument in favor of an increase in the minimum percentage, said that the brotherhoods had not asked for this hearing, but, the hearing having been appointed, they deemed it their duty to appear. For 12 long years the railroads had been preparing to comply with the spirit of the Safety Appliance law, but with repeated requests for delay and other dilatory actions. The railroads offer the same argument to-day that they made two years ago. They ought to be glad to increase the percentage of air-brakes, as they—some of them—have been able to save money by reducing the number of brakemen on trains. In some cases two men have been taken off. The only trouble arises from the old cars still in service. The plea that cars cannot be equipped cannot be accepted because the New York Air-Brake Company can supply 30,000 equipments by January 1.

An increased minimum percentage is reasonable for the reason that a number of roads have already voluntarily made such a rule. The Lackawanna requires a minimum percentage of 70 per cent.; the Philadelphia & Reading 75 per cent.; the Hocking Valley and three other roads in Ohio the same; the Seaboard Air Line the same; the Atlanta & West Point 85 per cent., and the Boston & Albany (in trains of 20 cars or more) 60 per cent. The General Manager of the Lake Shore & Michigan Southern says that on through trains he insists on all of the air being used; and the New York Central has issued an order that freight conductors shall see that all of the air cars are put ahead.

The roads now opposing the issuance of an order by the commission represent only 32 per cent. of the mileage of the country; the companies operating the other 68 per cent. evidently have no objection.

The employees in the brotherhoods are unanimous in desiring to have the object of the law accomplished as soon as is reasonably possible; but, said Mr. Clark, we will be satisfied with an order requiring 100 per cent. in every train air-braked by July 1, 1907, as has been suggested in the remarks concerning the rule adopted by the Master Car Builders' Association.

After some inquiry as to the propriety of issuing an order requiring all of the cars in a train to be air-braked, and concerning the probable time when the present congestion of freight traffic would abate, the hearing was closed.

The statistical report of the German Railroad Union for 1903 shows for all the roads in the Union average receipts of 1.003 cents per passenger mile. On the Austrian-Hungarian lines the average was 0.969 cent. Per ton per mile the average receipts were 1.280 cents on all lines, 1.276 on the German lines and 1.314 on the Austrian-Hungarian lines.

Percentages of Freight Cars Air Braked.

In connection with its inquiry as to the propriety of increasing the minimum percentage of air-brakes to be used in freight trains, the Interstate Commerce Commission has had reports made by the railroad companies showing how many of their cars are air-braked and how well the freight trains of the past six months have been air-braked; and the data thus gathered are shown in a pamphlet just issued, the substance of which is given below. The pamphlet contains reports only from those roads which own 500 or more freight cars, and the figures are given by territorial groups. The several columns of figures show:

(1) Number of cars owned.
(2) Number equipped with air brakes.
(3) Percentage of owned cars equipped.
(4) Average percentage, in each freight train, of cars equipped with air brakes (the brakes being in use) for the six months ending Sept. 1, 1905.

Some roads are not represented in the list, their reports having been late in coming in.

Name of road.	1. Freight cars owned.	2. Equipped with air brakes.	3. Percentage Equipped.	4. Used in trains.
Group I.				
Bangor & Aroostook	3,181	3,181	100.0	.....
Maine Central	5,243	5,085	96.99	95.0
Central Vermont	3,149	1,939	61.58	72.5
Rutland	2,861	2,047	71.55	60.0
Canadian Pacific	32,133	30,829	95.94	96.0
Boston & Maine	17,175	15,216	88.59	91.5
Boston & Albany	3,415	3,342	97.86	76.0
N. Y., N. H. & Hartford	16,860	16,798	99.63	....
Total for Group	83,977	78,437	.....	....
Average for Group	.....	.....	93.40	....
Group II.				
New York, Phila. & Norfolk	892	892	100.0	50.0
Del., Lack. & Western	25,183	23,176	92.03	....
Philadelphia & Reading	39,288	38,860	98.91	89.39
Cumberland Valley	630	612	97.14	97.79
Western Maryland	826	783	94.79	75.0
West Virginia Central	3,128	2,558	81.14	50.0
Delaware, Susq. & Schuylkill	1,587	1,587	100.0	90.0
New York, Ontario & Western	7,280	6,199	85.15	88.0
New York Central & Hud. R.	61,505	55,655	90.49	85.0
Lehigh Valley	35,800	31,094	86.86	78.7
Central R. R. of N. J.	19,212	18,633	96.99	93.0
Buffalo, Rochester & Pittsburg.	12,776	9,926	77.69	76.0
Washington Run	19,932	17,504	91.97	91.97
George's Creek & Cumberland	821	821	100.0	50.0
Erie	52,822	45,794	86.70	....
Huntingdon & Broad Top	2,583	1,485	57.49	50.0
Lehigh & Hudson River	858	543	63.29	50.0
Pittsburg, Shawmut & North'n	3,163	3,150	99.59	100.0
Montour	841	816	97.03	....
Baltimore & Ohio	70,972	59,171	83.37	....
Delaware & Hudson	13,526	12,887	95.28	70.0
Pennsylvania	129,312	116,275	89.92	75.15
Long Island	1,691	1,219	72.09	50.0
Union	1,100	1,100	100.0	60.0
Silver Lake	620	229	36.94	65.0
Buffalo & Susquehanna	1,971	1,763	89.45	70.0
Total for Group	507,419	452,712	.....	....
Average for Group	.....	.....	89.22	....
Group III.				
Pittsburg & Lake Erie	13,272	12,984	97.82	50.0
Baltimore & Ohio Southwest'n	10,580	7,385	69.80	50.0
Hocking Valley	14,272	10,431	73.09	50.0
Cleve., Cin., Chic. & St. L.	22,184	18,590	83.39	50.0
Zanesville & Western	1,400	770	55.0	50.0
Toledo & Ohio	6,396	4,354	68.07	50.0
Grand Rapids & Indiana	3,247	2,595	79.92	....
Cincinnati, Ham. & Dayton	14,078	10,937	77.69	75.0
Chicago, Cin. & Louisville	587	578	98.47	75.0
Detroit & Mackinac	1,600	1,424	89.0	50.0
Wheeling & Lake Erie	12,983	10,954	84.37	50.0
Southern Indiana	6,122	6,122	100.0	55.0
Bessemer & Lake Erie	9,813	9,807	99.94	60.0
Cincinnati Northern	2,048	1,512	73.83	....
New York, Chicago & St. Louis	8,424	4,640	55.08	84.9
Toledo, St. Louis & Western	2,891	1,430	49.46	65.0
Evansville & Terre Haute	5,132	3,927	76.52	50.0
Michigan Central	14,888	13,501	90.68	85.0
Pennsylvania, West of Pittsb'g	71,786	56,295	78.39	72.4
Ann Arbor	2,215	1,529	69.03	....
Lake Shore & Mich. Southern	26,815	25,954	96.79	77.43
Lake Erie & Western	4,737	4,457	94.09	59.83
Indiana, Illinois & Iowa	1,167	743	63.67	83.96
Lake Erie, Alliance & Wheeling	860	838	97.44	88.93
Pere Marquette	17,775	14,073	79.18	60.0
Total for Group	275,272	225,649	.....	....
Average for Group	.....	.....	81.97	....
Group IV.				
Virginia & Southwestern	1,291	1,280	99.15	94.0
Kanawha & Michigan	4,168	3,901	93.59	50.0
Charleston & Western Carolina	909	837	92.08	80.0
Norfolk & Western	27,817	21,322	76.32	79.0
Chesapeake & Ohio	24,814	20,793	81.79	80.0
Norfolk & Southern	645	461	71.47	63.0
Coal & Coke	1,364	1,340	98.24	....
Total for Group	61,008	49,934	.....	....
Average for Group	.....	.....	81.86	....
Group V.				
Lexington & Eastern	569	545	95.78	75.0
Nashville, Chatt. & St. L.	7,635	7,609	99.66	98.0
Georgia Southern & Florida	2,632	2,630	99.92	95.0
Georgia	1,677	1,573	93.80	93.75
New Orleans & Northeastern	2,381	2,381	100.0	....
Alabama & Vicksburg	1,039	1,034	99.52	....
Gulf & Ship Island	1,084	1,084	100.0	95.0
Florida East Coast	897	897	100.0	100.0
Atlantic Coast Line	15,877	13,809	86.97	50.0
Mobile & Ohio	8,096	6,923	85.51	73.0
Atlanta & West Point	1,103	1,103	100.0	80.0
Atlantic & Birmingham	1,316	1,216	92.40	93.0
Central of Georgia	7,971	7,598	95.32	89.29
Mobile, Jackson & Kansas City	1,014	1,005	99.11	75.0
Seaboard Air Line	10,307	9,670	93.82	95.0
Birmingham Southern	614	....	....	60.0
Louisville, Henderson & St. L.	615	408	66.34	75.0
Louisville & Nashville	33,241	30,850	92.81	81.78
Southern	42,668	38,812	90.96	....
Alabama Great Southern	4,823	4,643	96.27	91.0
Cincinnati, New Orleans & Tex	8,503	7,580	89.14	85.0
Total for Group	154,062	141,370	.....	....
Average for Group	.....	.....	91.78	....
Group VI.				
Duluth & Iron Range	4,423	4,423	100.0	100.0
Duluth, Missabe & Northern	4,674	4,674	100.0	100.0
Minneapolis, St. P. & S. S. M.	10,463	8,627	82.45	80.0
Toledo, Peoria & Western	1,665	1,519	91.23	....
Chicago & North-Western	52,489	47,530	90.55	93.5
St. Louis, Troy & Eastern	856	845	98.71	25.0
Wabash	18,680	16,219	86.83	55.0
Chicago & Alton	9,272	6,865	74.04	80.0
Chicago, Peoria & St. Louis	2,968	2,211	74.50	50.0
Litchfield & Madison	1,202	970	80.70	50.0
Chic., Lake Shore & Eastern	4,284	3,392	79.18	75.0
Elgin, Joliet & Eastern	2,514	2,453	97.57	75.0
Iowa Central	3,087	3,047	98.70	50.0
Duluth, So. Shore & Atlantic	2,768	1,806	65.25	50.0
Mineral Range	559	528	94.45	50.0
Chic., Mil. & St. Paul	42,176	35,845	84.99	77.0
Wisconsin & Michigan	504	93	18.45	84.0
Green Bay and Western	567	567	100.0	90.0
Chicago & Eastern Illinois	16,297	12,224	75.29	70.0
Chic., Paul, Minn., & O.	11,744	10,105	86.04	75.0
Great Northern	30,876	30,876	100.0	100.0
Chicago Great Western	9,676	7,970	82.37	75.0
Chicago Junction	620	577	93.07	55.0
Wisconsin Central	8,627	8,132	94.26	93.0
Chicago, Burl. & Quincy	46,311	37,582	81.15	83.0
Lake Superior & Ishpeming	911	911	100.0	99.5
Quincy, Omaha & Kansas City	846	802	94.80	70.0
Northern Pacific	35,137	34,356	97.78	97.6
Illinois Central	59,862	53,418	89.23	62.0
Total for Group	383,998	338,567	.....	....
Average for Group	.....	.....	88.17	....
Group VII.				
St. Joseph & Grand Island	1,071	1,071	100.0	95.0
Butte, Anaconda & Pacific	541	541	100.0	100.0
Union Pacific	15,059	15,059	100.0	90.0
Total for Group	16,671	16,671	.....	....
Average for Group	.....	.....	100.0	....
Group VIII.				
Missouri, Kansas & Texas	15,648	14,960	95.60	....
Atchison, Topeka & Santa Fe	34,466	34,232	99.32	90.0
St. Louis & San Francisco	25,260	21,585	85.45	75.0
Colorado & Southern	6,592	6,500	98.60	98.59
Miss. River & Bonne Terre	903	903	100.0	90.0
Missouri Pacific	42,505	30,841	72.56	50.0
Fort Smith & Western	1,019	1,019	100.0	99.0
Colorado Midland	1,719	1,719	100.0	100.0
St. Louis Southwestern	10,455	8,558	81.86	91.2
Kansas City Southern	6,383	6,383	100.0	90.0
Denver & Rio Grande	12,898	12,898	100.0	97.0
Vandalia	6,788	5,725	84.34	60.0
Total for Group	164,636	145,323	.....	....
Average for Group	.....	.....	88.27	....
Group IX.				
Texas & Pacific	9,118	9,118	100.0	90.0
Pecos Valley Lines	690	690	100.0	99.50
Louisiana & Arkansas	719	704	97.91	80.0
Chicago, Rock Island & Gulf	1,587	1,587	100.0	80.0
San Antonio & Aransas Pass	1,862	1,862	100.0	99.50
Vicksburg, Shreveport & Pac.	982	982	100.0	....
International & Gt. Northern	3,889	3,889	100.0	85.0
Galv., Harrisbg & San Antonio	17,568	15,704	89.39	81.0
Fort Worth & Denver City	1,050	1,050	100.0	95.0
Total for Group	37,465	35,586	.....	....
Average for Group	.....	.....	94.98	....
Group X.				
Santa Fe, Prescott & Phoenix	595	595	100.0	100.0
Southern Pacific	26,309	25,698	97.68	85.0
California Northwestern	664	664	100.0	100.0
San Pedro, Los Ang. & Salt L.	2,700	2,680	99.26	100.0
Oregon R. R. & Navigatn Co.	2,481	2,030	81.82	90.0
Oregon Short Line	6,223	6,182	99.34	99.99
El Paso & Southwestern	1,236	1,236	100.0	99.68
Total for Group	40,208	39,085	.....	....
Average for Group	.....	.....	97.21	....

Summary of Foregoing Table.

	Freight cars owned.	Equipped with air brakes.	Per cent.
Group I.	83,977	78,437	93.40
Group II.	507,419	452,712	89.22
Group III.	275,272	225,649	81.97
Group IV.	61,008	49,934	81.86
Group V.	154,062	141,370	91.76
Group VI.	383,998	338,567	88.17
Group VII.	16,671	16,671	100.0
Group VIII.	164,636	145,323	88.27
Group IX.	37,465	35,586	94.98
Group X.	40,208	39,085	97.21
Total United States	1,724,716	1,523,334	88.33

Summary of All Roads Replying, including Small Roads Not Shown Above.

	No. of freight cars owned.	No. equipped with air brakes.	Percentage equipped with air brakes.
Group I.	85,219	79,438	93.22
Group II.	510,725	454,533	89.0
Group III.	278,463	228,255	81.97
Group IV.	62,294	50,881	81.68
Group V.	153,692	142,670	91.64
Group VI.	389,091	341,930	87.88
Group VII.	17,371	17,370	99.99
Group VIII.	167,232	147,839	88.41
Group IX.	39,666	37,476	94.48
Group X.	44,835	40,983	91.41
Total United States	1,750,588	1,541,375	88.05

NOTE.—It has been stated that there are about 50,000 private cars in the United States, but it is impossible to obtain accurate information on this point. The private cars, however, are practically all equipped with air brakes.

Handling Freight so as to Avoid Losses.*

I cannot impress upon you too strongly the importance of exercising great care in the selection of your assistants in the office, as well as outside; also in educating them to perform their duties in a manner which will reflect credit upon themselves and your management. No matter how competent you may be, how thoroughly familiar with all that pertains to your station, or how ambitious for record, the employment of careless or incompetent clerks or warehousemen will easily defeat your purposes. It is one thing to know how to do the work yourself, but quite another thing to see that others do it as well, and the larger your forces the greater the need of care in this direction.

The agent of most value to the company is not the one who can handle the greatest tonnage at the least expense, and in so doing load it in disorder causing damage and necessitating rehandling elsewhere, or into wrong cars causing loss or delay, but it is the one who can at reasonable expense handle it in such manner that it will reach destination in order without unnecessary transfers or delay. It is entirely safe to say that a very large proportion of the freight which is lost and subsequently paid for is chargeable to loading in wrong cars, accepting and forwarding it when improperly marked, delivering it to wrong consignees, or delivering it without proper authority when astray. It can also be said that of the damages to freight, which have increased so enormously during the past few years, fully one-half could have been prevented if greater care were given in the handling it receives at stations.

A committee, consisting of the General Freight Agents of the New York Central System of roads, men of large practical experience, is at present engaged in revising and improving the rules, that you may, if possible, be better able to meet the old as well as new conditions with the latest and most approved methods of conducting your work.

You would be surprised to know how frequently the claim department is called upon to pay for goods which were consigned to the shipper's order, but which the agent at destination delivered without first securing the endorsed bill of lading. The rules to agents in respect to the delivery of order consignments are very clear on this point, but when the party notified says "I'll send the bill of lading down to-morrow," the agent says "I guess he's all right," and delivers the goods. Later on he explains at much length how he came to disregard the rule. He does not admit ignorance of the rule, but must be either that or disregard of it. . . . Nor should inspection be allowed to any person other than upon the written authority of the party to whose order it is consigned, or upon the presentation of the bill of lading, and in the latter case you should endorse on the waybill the date, and to whom inspection was allowed, for use in case any question respecting the inspection should subsequently arise.

One recent claim was for several hundred dollars for liquid blacking which was frozen because shipped in cold weather and not put into a frost proof car. It is the small errors and oversights which make up the most of the enormous total of losses. The remedy is in the hands of the agents. Prompt settlement of claims is important, but the consignee wants his goods in due season and in good order; he does not want explanations of delays or even reimbursement for delays or damages; he wants the delays and damages prevented.

Where a consignee refuses goods and they are returned it is important to have the packages re-marked; goods returned with the original marks are sometimes delayed because of difficulty in identifying them, and a delay frequently means a bill for damage.

A valuable piece of marble was marked with a receiving station rubber stamp; the ink penetrated the marble and ruined it for the purpose intended. Ink and brush were used to stencil a burlaped bale of cloth, resulting in the ruin of part of the cloth. A label was nailed on a box, the nails being an inch or more in length ruined a valuable set of books.

Take a firm stand. Personally know how the detail work of your station is conducted, what mistakes occur and who is responsible for them. Train your men in their duties, and see to it that you have the right kind and number of men. Insist upon their careful observance of the rules, and require that a genuine interest be taken in all that affects our employer's affairs. Make frequent inspections of your station and be as familiar with outside conditions as you are of the inside. Do not give all your time to the office. When you receive letters or circulars of instructions, copies of such portion of them as relate to the different branches of your work should be placed in the hands of those of your force who are in immediate charge of the matters to which the instructions refer. If you will adopt this rule and see that they understand the instructions correctly, you will have more time for supervision, and secure more intelligent service from your assistants.

Not long ago we received a check to refund a payment we had made for a lost case of goods, which one of our stations had given a receipt for and apparently forwarded. The shipper subsequently found that the case had never been taken from his warehouse. It is a pleasure to deal with men of such integrity, but it is decidedly unpleasant to know that such occurrences are possible, even at the smallest of our stations, yet such cases too often occur at stations where traffic is heavy and careless receiving clerks are employed. The position of a receiving and delivery clerk is a very important and responsible one, and should always be so regarded by the agent. In delivering goods to consignee never trust him or his truckman to do the checking, no matter how well you may know him. We paid recently for 10 bales of cotton because the consignee was allowed to do the checking. Subsequently, the cotton was found by an agent of the road, in the consignee's warehouse, while looking for other cotton.

An exceedingly perplexing and expensive case is that of a government shipment of a 65-ton cannon, which recently fell from two cars while passing over our River division, and rolled down an embankment. It has thus far resisted our every effort at re-loading, and may require a specially built track before it can be recovered. This accident, which narrowly escaped wrecking an entire train, was directly attributable to loading cars far beyond their capacity, the expense attending the recovery of the gun, as well as the damage it has doubtless sustained, is the result of a single act of thoughtlessness. Had cars of sufficient carrying capacity been used, or the gun not accepted until equipment which could transport it safely was available, the accident, with its expensive consequences, would not have occurred.

Shipments of this character only differ in point of importance from the usual cases of damages resulting from the use of defective cars for loading flour, dry goods, etc. The excuse generally offered in such cases, "The car was apparently all right," or it was the best or only car we had, does not remedy the damage, nor does it assure us that greater care will be exercised in the future. It would be far better to delay the freight until suitable cars were obtained than to take the chances of injuring it by forwarding it in cars which have floors saturated with oil or acids or defective doors or roofs, etc.

In a wreck, which occurred recently, a valuable electrical machine destined to the Pacific Coast was badly damaged. It was reloaded and sent forward, but fortunately for all concerned it was stopped and returned to the manufacturers for repairs. Had it gone to destination it would have been refused by the consignee, and either returned or disposed of at a great sacrifice and loss to the railroad company. In either case the consignee's business would undoubtedly have been injured through delay in securing a new machine, whereas returning it from the wreck to the shippers for repairs caused but slight detention and expense.

In another case a car of furniture destined to a southern point was damaged by wreck, and before we had opportunity to make an inspection it was sent forward. On arrival at destination it was promptly refused by the consignee, and subsequently disposed of by the delivering line for less than the transportation charges. Had it been returned to the shippers much of the furniture could have been restored.

A carload of potatoes was recently refused by consignee at one of our principal stations. The shipper was duly notified of the refusal but neglected to send instructions for its disposal. The agent neglected to report the case to my office, or to send a second notice to the shipper; also failed to take any action to prevent the property from becoming valueless. To this carelessness the entire loss of the shipment is due. Regardless of the apparent lack of interest on the part of the shipper, or what his intentions may have been in permitting the potatoes to remain on our hands, it was the agent's duty to save the company from loss, first, by telegraphing the shipper requesting that immediate disposition be given; second, by requesting my assistance, and lastly, by placing them with some reputable dealer who would handle them as his own. There is never any reasonable excuse for allowing property to become worthless while awaiting disposal by shipper or consignee.

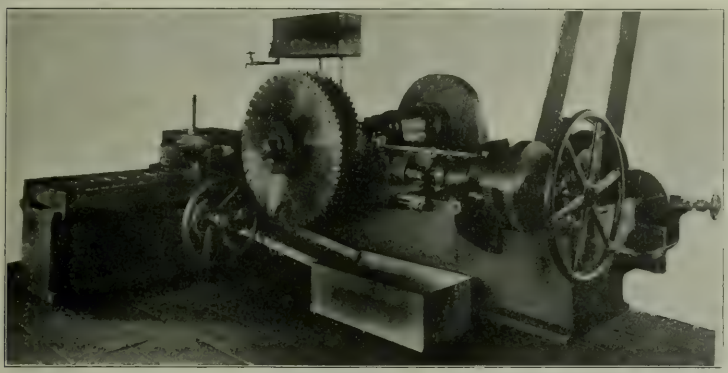
We once paid a claim of $500 for some lost goods, and subsequently found them; also found that they were not worth $5. We also have several claims for alleged shortages, which were made on the strength of errors in waybilling a greater quantity than shipped. Fortunately, however, the bills of lading, which specified the quantity shipped, prevented their payment.

During the past few months shortages of a certain class of goods have been continuously reported at one of our stations. In each instance the full consignment appears to have been loaded at the shipping point, and the cars reached destination under the initial seals. As these shipments originated at different points the natural conclusion is that the shortages occur at the destination station. Whenever you discover shortages under these conditions make your investigations as though you were convinced that the wrong was at your station, and if you are then unable to account for it do not delay in making a special report to me, for we may have in-

*Extracts from an address on Loss and Damage and its effects upon rail road revenue, delivered to the freight agents of the New York Central & Hudson River, by R. L. Calkins, Freight Claim Agent.

formation which will aid in locating it, if not, our special officers will take it in hand. Don't keep these matters to yourselves because they may reflect on your stations.

It is a daily occurrence for me to receive from some of our agents claims which have not been given any attention to whatever; they have been simply enclosed to me as they were received from claimants. They not only omit to secure and attach such documents as the bills of lading, paid freight bills, invoices, etc., but no mention is made of the report or previous correspondence which may have been had on the subject. Over, short and damage reports are the basis of nearly all loss and damage claims, and the more information they contain the less will be the excuse for returning them for the purpose of asking you a lot of questions when the claims are received. It is urged that more care be taken in the preparation of such reports as are lible to result in claims, and that they be placed before you for personal examination and signature. This plan would have the double advantage of acquainting you with the cases in which your station is interested or involved and enable you to see that reports are so made that it will be unnecessary to return them for information which you had at the time, but which is later forgotten, or not at hand.



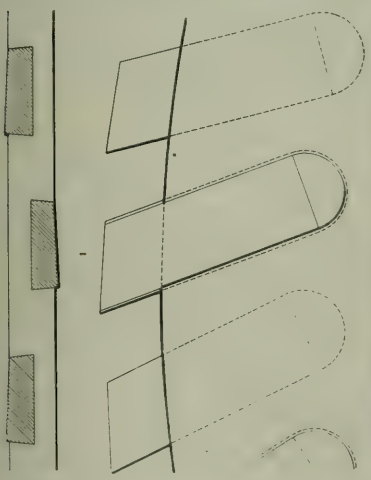
Double Rotary Slotting Machine.

Much care should be exercised in the delivery of overages, which are received on astray waybills. Such freight should never be delivered until full and satisfactory proof of its ownership has been presented by the parties to whom it is marked, and then only after satisfying yourselves that a claim has not been presented, or paid for its value. When making such deliveries full charges should be collected, and the regular waybill invariably located.

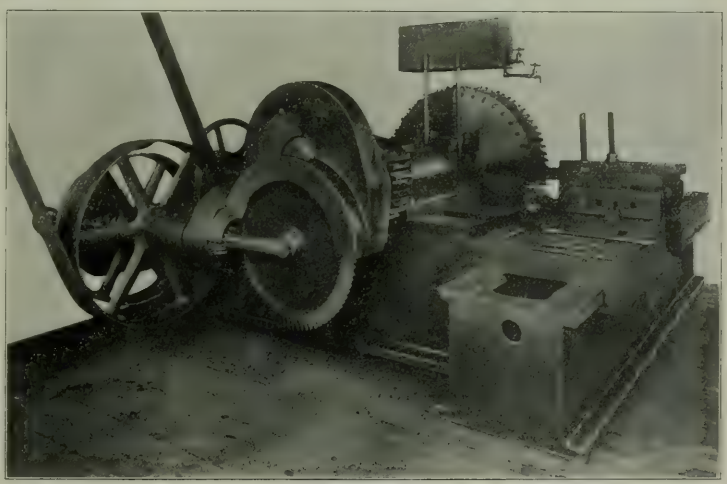
Keep your unpaid bills account clear of outstandings on refused and unclaimed freight by regularly reporting these cases, as required by the rules, and whenever the disposition of such freight is unreasonably delayed make a special report by letter and more special attention will be given it.

Double Rotary Slotting Machine.

The application of the rotary or milling machine principle to slotting is shown in the accompanying illustrations of a double rotary slotting machine made by the High Duty Saw & Tool Co., of Eddystone, Pa., for the Paterson, N. J., plant of the American Locomotive Company. Primarily it is intended to slot out the open ends of locomotive connecting rods, straps for the same, the jaws of eccentric rods and cross heads. The machine, however, is not confined to this special class of work but it is applicable to all classes of slotting either single or double within the range of the capacity of the machine. It can also be used as a cutting-off machine, in which case a single saw only is used. The principle of the machine is that of a continuous cut in place of the intermittent stroke of the ordinary slotting machine. The cutting heads are "Tindel" high duty saws with inserted high-speed steel cutters. Each of these cutter blades is 36 in. diameter by ⅜ in. thick, with 76 teeth or cutters in each blade. The periphery speed of the cutters is about 50 f.p.m. with feeds ranging from ½ in. to 1¼ in. per minute. The machine is of massive construction for heavy work and the main drive, as shown, is by spur and bevel gears instead of the usual worm and worm-wheel. The carriage carrying the saw arbor is square locked in front and tapered on the back side, all wear being taken up with phosphor bronze shoes. The arbor is a high carbon steel forging of large diameter and has a long bearing. The feed is by rolling friction discs through a system of change gearing for changing the rates of feed and is provided with an automatic, adjustable and positive throw-out. Washers are provided for varying the distances between the saws for cutting different sizes of slots. The sizes of these washers are so varied that with a few the width of slot can be made up to 12 in. The inward feed of the machine can be made to any desired depth up to the capacity of the saw blades. The machine is equipped with two tables which are adjustable to work separately or together. By means of gearing below the tables any setting of work to the line can be done by a hand-wheel which is shown in front of the machine. The tables are furnished with "V" blocks, straps and bolts for convenient fastening of the work. By the use of this machine it is claimed that slotting work of the character indicated can be accomplished with a saving of time amounting to about 75 per cent. as against the ordinary type of slotting machine.



Detail of the Tindell Saw



Double Rotary Slotting Machine Showing Main-Drive.

The "Tindell" high duty saws used on this machine are made up to a diameter of 90 in. The blade is a disc of high-carbon crucible steel, and is of sufficient stiffness to withstand any pressure that can be safely put upon the teeth. In each face, as shown in the accompanying illustration, there are slots for the teeth. These are inclined backward from radial lines at such an angle that the pressure on the teeth when cutting has a locking effect; as the resultant of the pressure tends to force the teeth inward, and as there is no tendency to draw them by the cut, the teeth do not

require to be pinned or bolted or otherwise fastened in place. The teeth are of simple design forged from the bar stock in a plain die. As no machine work is required to shape or fit them, the teeth can be made of the modern high-speed steels. It will be seen also that this saw has the special feature of dividing the cut, the teeth being staggered on each side of the blade and slightly overlapped, so that each tooth alternately takes half the width of the cut. The teeth have a slight outward inclination, so as to make the cut clear the saw blade, the points of the teeth being the only part of the saw which touch the work. A broken tooth can be quickly driven out by a chisel inserted in the semi-circular recess at the bottom of the slot, and a new tooth at once put in its place.

The Cost of Locomotive Operation.

XV.

BY GEORGE R. HENDERSON.

(*Continued from page* 423.)

CONSTRUCTIVE MILEAGE.

This term is usually applied to mileage which the engineman does not actually make, but for which he is paid. As we have seen from the schedule, the engineman is ordinarily paid for 100 miles, even if his run should be only 70 or 80 miles; the amount for which he is paid and which he does not make, is thus a type of constructive mileage, and is strictly unremunerative, as far as the railroad company is concerned. By careful management and adjustment of runs, such mileage can be reduced to a minimum, but it requires continuous watching.

There is another kind of constructive mileage, however, which cannot be reduced, and this is the allowance of a greater mileage in the pay than actually exists between the points. For instance, terminals A and B may be 130 miles apart, but the run may be counted as 150 miles and paid for on this basis. This will be understood as actually raising the rate of pay for such portions of the road, and it usually applies to heavy grades or difficult parts of road, where the engine works harder if the men do not. On large systems, it is sometimes considered desirable to have a standard rate of pay per 100 miles, and the method of constructive mileage allows a higher rate to be paid on certain designated parts of the road.

As an example of constructive mileage, we give below the actual distances and the allowed distances on one of the Western lines:

		Mileage	
		Actual.	Constructive.
Section	1	92	100
"	2	115	129
"	3	143	159
"	4	23	29
"	5	28	30
"	6	51	59
"	7	149	153
"	8	167	170
"	9	69	77
"	10	46	53
"	11	23	24
"	12	82	100
"	13	50	51

It will be seen that this plays an important part in the cost of transportation. It sometimes occurs that hills must be doubled, that is, the train is heavier than can be taken up by the engine in one train, so it is cut in two—part is taken to the top and the engine then returns to the foot of the grade and brings up the remainder, when they are again united and taken to destination. This may occur because the engine has been overloaded, or because it is not in prime condition and cannot haul the regular load, or again, the profile of the division may be such as to make this an economical proceeding. The writer has in mind a division with easy grades, except at one point, where there was a heavy grade for a few miles. The traffic did not warrant maintaining helpers at this point, so the hill was doubled regularly. It is generally customary to pay for the mileage, which in a case of this kind is really run, and if the hill were five miles long there would be ten miles added to the actual length of the division for such a trip. A southern road contains this clause in its rules: "If at any time engines are unable to handle their rating, and have to double, they will be allowed ten miles for each double, unless this distance is exceeded, when actual mileage will be allowed. Another road allows one hour's time at hourly rates for each double, provided the doubling is not attributable to any fault of the engineman. It will be seen from this that there are different methods in vogue for settling these various points in the several sections of this country, but in all cases the effect is to increase the cost of operation per ton-mile, with apparently no return to the company.

LIGHT ENGINE MILEAGE.

It frequently happens that, owing to an excess of traffic in one direction, or heavier grades going one way, that the power becomes congested at one end of a division, and empty engines must be sent back to the other end, where there is a greater demand for them. This is a costly and unremunerative service, as it requires not only engineman and fireman, but also fuel, water and oil, and adds a proportion to the repair costs, while there is no transportation of changeable commodity. As a rule, enginemen are paid reduced rates for such mileage; thus, one road states that enginemen running light will be paid passenger rates, as per class of engine, and as these are usually less than freight rates, there is a reduced pay, if it happen to be a freight engine, as is generally the case. However, in contradistinction to this, we find some rules that say the pay will be according to the class of train over each district. This is somewhat ambiguous, as there is really no train, but it is evidently meant that a freight engine will entitle the engineman to freight rates.

Sometimes we see a heavy freight train sent out with one engine, and either preceding or following it, a light engine is sent in the same direction. It might in this case save the wages of a train crew, but frequently this crew must be moved also. It would be more economical to either split the train, or at least double head, as the fuel economy would be greater, and the train reach its destination quicker. Of course, if the light engine leads, it can make better time than the loaded one, but there may be such traffic conditions existing, that little will be gained by the light engine. The real object of such an arrangement often is to make an apparent record for heavy tonnage per train-mile, or per loaded engine-mile, regardless of cost.

POOLING.

Something should perhaps be said here on the subject of pooling. While it does not ordinarily affect the cost of operation as far as the pay of the crew is concerned, it doubtless has an effect upon some of the other lines of expense. Some of the reports made to the last International Railway Congress (1905) on the subject of pooling were very clear on this item of expense. In the report by Mr. Camille Boell, representing an equipment of 22,000 locomotives, mostly in Central Europe, it is concluded "that the pooling system always leads to a very perceptible increase in the expense per mile, and therefore it ought not to be employed, except in case of absolute necessity." Only one of the roads included in the report uses the system exclusively, the St. Gothard, of Switzerland, it having been in force on this road since 1888. By comparing the expenses for 1886 and 1889, the following increases have been found:

Fuel	5.5 per cent.
Lubrication	42.0 "
Maintenance	11.6 "

Other causes have no doubt had their influence upon these expenses, notably an increase in the speed of trains and weight of engines, so it is impossible to determine the proportion of these increases due to pooling. While many roads believe there will always be an increase in the above expenses due to pooling, we at times find those who profess to believe otherwise. There is little doubt, however, that the prevailing impression is that an increase in cost always follows pooling, and that it is a practice that is of benefit during a congestion of traffic, when the men are not able physically to stand the mileage which the engines can, but which should be abandoned when the normal conditions are restored. Double and treble crewing will often permit the engines to make as much mileage as when in the pools, and with much better satisfaction all around.

EFFECT OF SPEED.

The speed of the train is about the only element which affects the cost of engine running, if by this term we mean "average speed," or miles between terminals divided by time between the same as loading, stops, switching, etc., affect the speed between terminals, so the cost will be affected, but only because these items alter the speed. Then it is only below certain limits that even the speed affects the cost. We have seen that in most of the schedules for freight engineers, the pay is practically by the mile, as long as an average of 10 miles an hour is maintained. If 15, 20 or 30 miles an hour be maintained or averaged between terminals, the pay will be by the mile, providing the run is at least 100 miles, and that constructive mileage does not apply. Therefore, for speeds in excess of 10 miles per hour there is no change in this item of cost. Of course, a difference per ton-mile may be obtained by changing the lading so that the engine can maintain a higher velocity, and as far as loading is concerned, the least cost for enginemen's wages per ton-mile will occur when the locomotive is so loaded that it can just "average" ten miles an hour over the road.

When the speed is less than ten miles, however, the effect on this cost is great. Suppose, for instance, a running rate of five miles an hour is the best that can be done, owing to layouts or too much tonnage. If the distance be 100 miles, the trip will consume 20 hours, and the engineman will be entitled to 10 hours overtime, and as the usual rate for this is equivalent to 10 miles an hour, he will actually be paid for 200 miles, though running but 100. This is just double the cost per engine or train-mile. Consider what happens, however, if the run is less than 100 miles, say, 60, for example. At 5 miles an hour, 12 hours will be consumed. Overtime will not apply until he has been out 10 hours, as pay is allowed for 100 miles in any case. He will, therefore, be entitled to 100 miles plus 2 hours' overtime, equivalent to 20 miles, or a total of 120 miles. This is again double rate, as in our last discussion. Now, if the trip had been made at 6 miles an hour, or 10 hours for the trip, or any speed in excess of 6 miles, he would be paid for 100 miles without

any overtime, so that the actual rate would be 9/14, or 66 per cent. increase over the standard rate per mile, due to the constructive mileage on a run of less than 100 miles. Thus we see that the speed limit for changes in cost "per engine-mile" depends on the length of the run, as generally set forth by the various schedules.

(To be continued.)

Valve Gear of the Symons Four-Cylinder Balanced Compound Locomotive.

It will be remembered that the first of the Baldwin Locomotive Company's four-cylinder balanced compounds was completed in 1902 for the Plant System, of which W. E. Symons was then Superintendent of Motive Power, and that he had part in designing this locomotive. Mr. Symons has lately taken out patents on an independent design of four-cylinder balanced compound locomotive, with separate patents on the valve gear. The drawings of the latter, taken

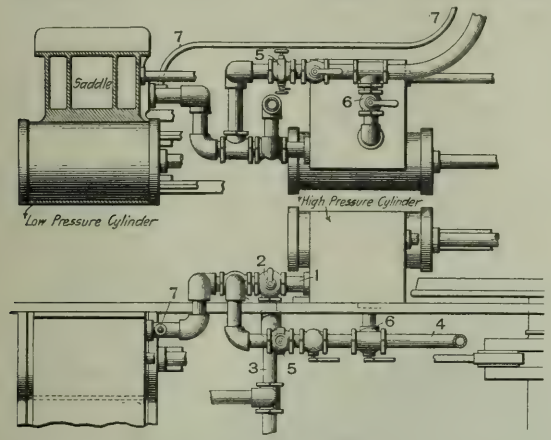


Fig. 1—The Symons Valve Gear.

from the patent specification are reproduced herewith; also the relative arrangement of high and low pressure cylinders, which are separated and given independent valves and valve gears, together with their piping, which will permit the independent use of either the high or low pressure cylinder when desirable or necessary.

Taking up the last-named features first and referring to Fig. 1, it will be seen that the low-pressure cylinders are inside the frames, under the saddle, connecting to the crank axle of the front pair of

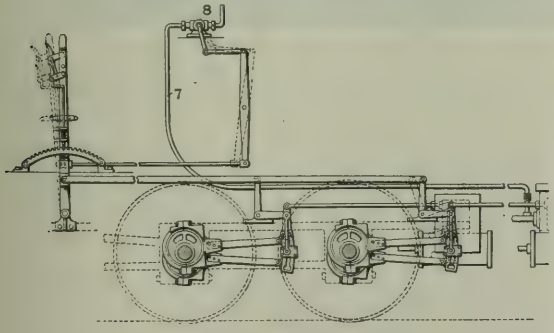


Fig. 2—The Symons Valve Gear.

drivers. The high-pressure cylinders are outside of the frames, back of the low-pressure cylinders, and connect to the rear drivers. The exhaust pipe from the high-pressure cylinder to the steam chest of the low-pressure cylinder is shown at 1, and 2 is a cut-out valve which will divert the exhaust into the emergency exhaust pipe 3 when desired. To supply live steam to the low-pressure cylinder when the high-pressure cylinder is out of service, an extension to steam pipe 4 connects, through a pressure-reducing valve, 5, with exhaust pipe 1 beyond the cut-out valve, the high-pressure cylinder being cut-out by valve 6.

Admission of live steam to the low-pressure cylinder at starting is obtained through pipe 7. Figs. 1 and 2. This pipe extends from the dry pipe through a three-way auxiliary valve, 8, the arm of which is connected by a link to a lever having its opposite end connected by a rod to the lower end of the primary reversing lever in the cab. When the latter is in the front or back "corner" live steam will be admitted to the low-pressure valve chest. The moment the lever is moved out of either of these extreme positions, this live steam is shut off.

Independent valves and gears are provided for the high-pressure and low-pressure cylinders, and in this mechanism is comprised one of the novel features of the design, namely, the provision for independent adjustment of the cut-offs of these cylinders. The purpose is to enable the most favorable ratio of steam volume to be maintained between the two cylinders according to the speed of the locomotive and the weight of train, following European practice in this respect. The scheme embraces two reverse levers (Figs. 2 and 3), known as primary and auxiliary. They may be regarded as twin levers, or as parts of one lever, for while they are designed to have a limited relative movement, they are adapted to swing in unison, and they perform the same function, although for different sets of valves. The reach rod moving the high-pressure links is attached to the primary lever and that from the low-pressure links to the auxil-

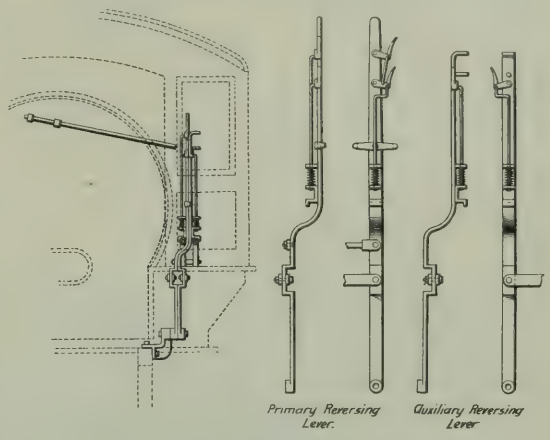


Fig. 3—The Symons Valve Gear.

iary lever. The relative movement of the two levers is limited under ordinary service conditions by a detachable stop-bar having stops at each end. The bar is made detachable to enable it to be removed quickly in case it should be desired to increase the range of movement, or leave one lever in a fixed position under such conditions, for instance, as one pair of cylinders being out of service. Each lever has its individual toothed quadrant and spring latch.

British Standard Specifications for Cement.*

BY ROBERT W. LESLEY.
Vice-President American Society for Testing Materials.

It is interesting to compare the American standard specifications for Portland cement which were recently adopted by the American Society for Testing Materials and those adopted in December, 1904, by the Engineering Standards Committee of Great Britain.

On the first item of the definition of Portland cement, the British specification suggests both water and sulphate of lime as materials which may be added to retard the setting, and covers both in its specification, limiting the amount in either case to 2 per cent. In the American specification, any addition, subsequent to calcination, is limited to 3 per cent.

On specific gravity, both specifications practically agree to 3.10, but the English specification raises the amount to 3.15 where the cement is sent direct from the mill to the laboratory in tightly sealed packages.

On fineness, there is a material difference in the screens used, and it may be stated that the American specification, which has 8 per cent. on a No. 100 (10,000 mesh) sieve and 25 per cent. on a No. 200 (40,000 mesh) sieve would require a finer grinding than the British, which has 3 per cent. on a 5,776 mesh sieve, or 22½ per cent. on a sieve of 32,400 meshes.

In the matter of setting, the specifications are again at variance. Our specifications require that the cement shall develop initial set in not less than 30 minutes, but must develop hard set in not less than one hour, nor more than ten hours. The English specification recommends three distinct grades of setting time, designated as quick, medium and slow. The first is not less than 10 minutes nor more than 30 minutes; the second in not less than one-half hour nor more than two hours, and the third in not less than two hours nor more than five hours, and yet while these grades of time of setting are recognized, and each of them will have a material bear-

*Extracts from a paper read before the American Society for Testing Materials.

ing upon the tensile strain of cement, the British specification, in the matter of tensile strength, has but one series of limits, namely:

7 days.		28 days.	
Neat	400 lbs.	Neat	500 lbs.
3 sand, 1 cement	120 lbs.	3 sand, 1 cement	225 lbs.

The American specification on the other hand, while not recognizing different classes of cement, so far as the time of setting is concerned, does recognize different strengths in tension, and has what the British specification has not, a 24-hour test which may possibly in some quarters be considered superfluous for Portland cement. The American requirements are:

7 days.		28 days.	
Neat	450 to 550 lbs.	Neat	550 to 650 lbs.
3 sand, 1 cem't.	150 to 200 lbs.	3 sand, 1 cem't.	200 to 300 lbs.

and are all higher than those of the British specification, which is no doubt due to the fact that there is more rotary cement manufactured in our country than possibly anywhere in the world.

More interesting, however, is the difference in the matter of gain in strength at longer periods, a new requirement which has only come into cement testing since the introduction of the Rapid Transit specification in New York. In the United States, in view of the fact that the matter has not been thoroughly settled, we recognize broadly that no cement shall show retrogression. In the English specification, however, this question of the increase of strength between the 7-day and 28-day periods is graded according to the initial strength shown by the cement at the 7-day period, which seems to be a very fair method of determining increased strength between the periods stated. In their specification, a cement showing 400 to 450 pounds at 7 days is to gain 25 per cent. in 28 days; 450 to 500 lbs., 20 per cent.; 500 to 550 lbs.,15 per cent., and all over 550 lbs. at 7 days, an increase of 10 per cent. at 28 days. This is a very fair view of the subject, as a cement that pulls 600 to 800 lbs. at 7 days will have to increase very many pounds in tension to acquire the strength to show 25 per cent. increase between the 7 day and 28 day periods, while a 10 per cent. increase would be a much more reasonable figure.

The great and salient difference between the two specifications is that governing the test for constancy of volume, or what are known technically as accelerated tests. In our specification, we have adopted the hot and cold water tests prescribed under the German normal test, and which have been in use so successfully for so many years, and have supplemented them by a steam test after the cement is set for 24 hours, consisting in exposing the pat in an open vessel to steam rising from a body of water beneath. The British have adopted what is known as the Le Chatelier test, which is fully described in the specification, and which so far has not been generally adopted outside of France. This is the part of the specification which up to date has attracted most criticism, by reason of possible inexperienced operators not producing similar results, with similar cements under similar circumstances.

The chemical requirements of the cement differ in the two specifications as follows:

In the American specification 1.75 per cent. of anhydride sulphuric acid is permissible, while in the British specification the limit is run up to 2.5. In England 3 per cent. of magnesia is allowed, as against 4 per cent. in this country. Insoluble residue in England is limited to 1.5 per cent. for reasons that may not be necessary in this country.

Another interesting thing in the English specification is that there shall be no excess of lime; that is to say, the proportion of lime shall not be greater than is necessary to saturate the silica and alumina present, or represented by the formula $\frac{CaO}{SiO_2, Al_2, O_3} = 2.75$.

Of course, this would be covered by the analysis of cement described in the methods of manipulation of tests of the American Society of Civil Engineers and the methods of analysis of the American Chemical Society, which are part of the American specification.

It is interesting to note that while the American standard specification has so far stood fire very well, and even its makers can only suggest unimportant corrections, the English standard specification has not been so fortunate. From several quarters there has been some little criticism on the accelerated test, accompanied by statements of different results on the same sample. There have also been some other unimportant criticisms on chemical composition. Whether the difference in mental attitude to the new specification in the two great English speaking countries is due to the respective national characteristics of their people, is still to be determined.

Allis-Chalmers Steam Turbine for the Brooklyn Rapid Transit Company's New Power House.

The sixth large power plant to be built for the Brooklyn Rapid Transit Co. will show, in some respects, a radical departure from the features usually found in stations where reciprocating engines are installed. Among the more important of these is the small floor space needed for the machinery. The engine room of the ordinary station requires about 60 per cent. of the total ground space, and the boiler section about 40 per cent. In the new turbine plant, the turbine floor occupies but two-thirds the space required for the boilers. In other words, a turbine station of a given capacity requires only two-thirds of the ground room needed by a reciprocating engine station. The importance of this is at once apparent in localities where real estate is costly. It also means an equivalent saving in expense incurred for buildings. The new Williamsburg station, which has been erected near the bridge of that name, is designed to accommodate a total of nine steam turbine and generator units, three of which are now being installed. One of the most interesting of these is an Allis-Chalmers 9,000 h.p. unit shown in the accompanying illustration.

The Allis-Chalmers 9,000 h.p. Steam Turbine for the Brooklyn Rapid Transit Company's New Power House.

This turbine is of the horizontal multiple expansion, all-around parallel flow type, generally known as the "Parsons" type, operating at 750 r.p.m. The generator is a "Bullock" alternating current machine built by the Allis-Chalmers Company at its Cincinnati works. It will carry 25 per cent. overload continuously and a 50 per cent. overload for three hours with but a small temperature rise.

A noteworthy feature in the construction of the Allis-Chalmers turbine is the blading; the blades are made of a special alloy and of such form and dimensions as will secure the highest economy. The individual blades are mounted in groups, each group forming one-half of a circular row. The inner ends of the blades are swaged, and are secured in slots in the foundation rings and riveted in slots in their respective channel shaped shrouds. The blade rings are secured by calking strips in machined grooves in the cylinder and rotor. The channel shaped shroud secures the blades at the proper angle and spacing and eliminates the danger of stripping, permitting the turbine to be safely operated with a minimum radial clearance. A direct acting steam pump for use on starting up the turbine is provided. The turbine and generator rotors are direct-connected by a flexible coupling, each being carried in two bearings of the ball and socket type.

The turbo-generating unit measures approximately 47 ft. in length, over all, by 13 ft. 3 in. in width, and 11 ft. 6 in. in height above the engine room floor. Its height above the foundation is scarcely more than that of the low-pressure cylinder of a reciprocating engine, of equal capacity, above the upper platform, and such cylinders are frequently more than 30 ft. above the engine foundations.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX., No. 20. FRIDAY, NOVEMBER 17, 1905.

The first installment of a paper by Chester Arthur Legg, writing for the *Boston Transcript* on the "Sentiment in Favor of Federal Rate Regulation," is printed this week. The paper is eminently fair in its tone and presents the case of those who are in favor of government regulation of railroad rates much better than they have been able to present it themselves. Mr. Legg does not throw any emphasis on rebates, but he shows well the natural advantage which the large shipper has over the small shipper in making his bargains, and in the attention which is paid to him and to his complaints after the bargains are amde. He believes that the special advantages accruing to the large shipper merely because he is a large shipper are the real evil of the present situation, and in this we heartily concur. It is unfortunate that Mr. Legg is not so convincing in suggesting a remedy as in stating the facts. He argues that the proper form of control is a series of maximum rates to be promulgated by the Interstate Commerce Commission upon complaint from the shipper or at its own initiative, and says that this is in effect what the present law provides when it allows the Commission to say that a rate is unreasonable, but that by the present plan the reduction may be so gradual that the patience and the means of the shipper are exhausted before he obtains any real relief. Mr. Legg further objects to the criticism that government-made rates would be inflexible, because he says that temporary rates to meet temporary needs could be made as much below the established maximum as might be desirable. Of course, the obvious weakness of this position is that with any system of maximum rates there would be precisely the chance for discrimination that there is at present—neither more nor less. We are forced to say, therefore, that Mr. Legg has suggested a remedy which will not cure. Nevertheless, his analysis of the situation as it exists is well worth reading.

In a brief, but interestingly worked out paper printed this week, Howard R. Bayne discusses the incorporation of labor unions, and he does not consider that it should be made compulsory. He looks on the union as an outgrowth of modern civilization which need neither be feared nor deplored, and his viewpoint is that our legislation should be aimed at developing labor unions along natural and rational lines for their own best and most profitable uses. The violence and crime that have so marred the union cause he considers entirely an excrescence, holding that crime is an individual act; that no union, corporate or incorporate, ever did, or will, tolerate formal rules or by-laws providing for violence in strikes, since, however much individuals favor it or do it, they are not foolish enough to publish it in the rules of their association, and he adds that criminals do not operate that way. Not all readers will agree with Mr. Bayne in the chief conclusion he draws; that public interest will have nothing to gain by enforced incorporation of labor unions. Recent testimony before the New York courts has shown that while unions may not include violence, described as violence, in their by-laws, they nevertheless lay broad duties on their "committees of entertainment," and have a pretty well established scale of rates which the committee pays its assistants for "entertaining" strike breakers. Incorporation of labor unions would not in itself change their manners, but it would provide an organization that could be sued for breach of contract or for damages arising from other causes. Granted that the union must be recognized as a permanent feature of modern industry, then let it assume the dignity and serious character of the companies and corporations with which it deals. In the present status, unions might fairly be grouped with infants and persons of unsound mind as belonging to one of the classes with which contracts are not enforcible. Incorporation would at least make the unions responsible to the limit of their treasuries, and it is for this reason that it is so bitterly contested as a compulsory measure whenever it comes up for discussion before any legislative body.

TO PREVENT TROUBLE AT THE GRAND CENTRAL TERMINAL.

In the preparations now being made for beginning the operation of the Grand Central Terminal in New York by electric power in September of next year, there is a serious menace to public safety and convenience. The menace is that now, only ten months from the time when electric power is expected to be substituted for steam, the New York Central and the New Haven companies are still far from agreement on the kind of locomotives, or motors, or cars to be used for suburban service and to be admitted to the sub-surface level connecting with the subway. On this level, the New York Central proposes that only motor, all-steel cars shall come; but the New Haven claims the right under its agreement to bring in here its locomotives, hauling wooden cars. We do not need to be taught again that fireproof cars are too often essential for preventing loss of life in an electrically operated tunnel. The holocausts in Paris, in the Metropolitan underground, and in England, in the tunnel at Liverpool, should be enough, but we have more evidence, a kind of accident happening often and seen by

many of those who read this: Electric street cars frequently burn up. The passengers are rarely injured because there is plenty of room to get away, and a demand by the public for fireproof cars in such service would perhaps be unreasonable; but in tunnel service the chances for fire are equally good, and when it comes, few indeed can escape. It is a duty to speak of these things now when there is still time, barely time enough, to prevent the making of a dangerous transportation service, rather than to wait for a killing and the storm of public indignation which drives to cover the railroad officers responsible for it.

Mr. George Westinghouse clearly showed these dangers in a letter to this paper nearly four years ago, from which the following is an extract:

"It should be borne in mind that the electric energy required to operate a heavy train is sufficient to melt a considerable bar of iron, or to start a dangerous fire, if anything goes wrong, upon a car of ordinary combustible construction, much more readily than the car stove, the use of which has been abolished by law: therefore, if a collision were to occur between two electrically fitted trains, each having several combustible cars thereof fitted with electrical apparatus and carrying electrical circuits throughout, there could be an accident of so serious a character as to start an agitation having for its purpose the abolition of the use of electricity altogether, or at least to compel the railway companies to abandon the use of combustible cars fitted with electric motors. The destruction by fire of a car or train upon a street or upon a level is one thing, but such an occurrence upon an elevated railway or in a tunnel, can have consequences the contemplation of which should lead to wise regulations governing the construction and use of electrically propelled trains and thereby insure to the public the rapid development of electric traction."

It is not too much to say that Mr. Westinghouse is, more nearly than any one else, final authority on safety in railroad transportation. He has made safe high-speed travel possible, and his few public statements have been like this one—a warning of danger to human life which railroad officers have always heeded. We venture to predict that this one will have the effect intended.

In the correspondence column of this issue appears a letter from the Electrical Engineer of the New York, New Haven & Hartford in reply to an editorial article in the *Railroad Gazette*, October 20, entitled, "A Matter of Standardization." We suggested only the economies and the public convenience to be secured in agreement and harmonious designing by the two companies which operate the same terminal. Mr. Murray shrouds his meaning, making it nearly as difficult as that of a Delphic Oracle, or one of Browning's poems. Nevertheless, we find an indicative sentence: "After six months' careful study of the possible methods of electrification a conclusion has been reached." If this means, and we understand it to mean, that the company really intends to insist on its claimed right to bring lightly-built wooden cars for suburban service in this electric tunnel, there is danger. If it means, and this has been freely said, that New Haven suburban trains hauled by locomotives are to come in the suburban train level, and either occupy the loop, or wait while the locomotives are switched back, then traffic will be delayed and commuters will love the New York, New Haven & Hartford no more than they now do. If it means, and this also has been said, that the New Haven road intends to land its suburban passengers in the express station level, then commuters will have cause for complaint, the express service of both roads will be interfered with and that part of the station will be used for a service not contemplated by the architect and the engineer.

Either company is at liberty to do as it pleases, except on the short piece of track between Woodlawn and 42d street, where they must work in harmony in order to give travelers as quickly as possible safe and convenient transportation to the attractive region where the congested city of New York is expanding. A failure to keep this engagement with the public, either a delay in the approximate time set for opening, or friction and congestion after it is opened, will not be excusable on the ground that the engineers have disagreed.

RAILROADS AND THE COAL BUSINESS.

The comparison of the Chesapeake & Ohio and Norfolk & Western in the *Railroad Gazette* of October 27 is the subject of comment in another column by a correspondent. We are glad to have it, since it appears that he, at least, has received a somewhat wrong impression from our remarks about the low grade traffic of those roads. He suggests that on account of the steadiness of the coal traffic, the size of individual shipments, and the saving in expenses of handling over higher grade freight, the margin of profit on carrying coal is really not so very narrow, and that therefore money spent by these companies in extending their coal traffic is, from the standpoint of the stockholders, money well invested. With this conclusion we agree, as well as with much of the reasoning which leads up to it. Yet in spite of the fact that merchandise freight, for instance, has to be loaded and unloaded by hand, that it requires freight houses, involves much billing and other clerical labor, and furnishes most of the material for the claim department's activities, it is in general true that the extra rate received more than compensates for the extra expense, and that it is a railroad's most profitable traffic. Conversely, in spite of the fact that the expenses just enumerated are almost entirely saved on coal shipments, we cannot admit that the Chesapeake & Ohio and the Norfolk & Western received a wonderfully large unit margin of profit on their coal business. It is self-evident that they received more than enough to pay operating expenses. Since coal and coke furnished over 60 per cent. of their total tonnage, this traffic must also have paid a large share of the fixed charges and something towards dividends. Nevertheless, the unit rate of profit was small and to obtain it skillful management was necessary.

There was, however, in the review of the two Virginia coal carriers, no intention of suggesting that the size of their coal business was approaching or had reached the limit of profit. It is, of course, a general rule of railroad operation that increased tonnage is increasingly profitable. The more freight a railroad carries at regular rates the greater will be the profits, and these, once fixed charges have been earned, in steadily increasing proportions. Every additional ton of freight raises the average profits on each of the total tons carried. In other words, the more use that can be got out of the roadbed, once the interest on its cost has been paid, as the *Railroad Gazette* has often said in an entirely different connection, in regard to the profitableness of installing block signals, the more proportionately profitable becomes the operation of the railroad.

It should, then, be fair to assume, in view of the business ability of their managers, that the Chesapeake & Ohio and Norfolk & Western are extending their coal traffic as fast as opportunity offers. Is this the case, or is there some justification for our correspondent's opposite implication?

At the present moment there is a tremendous car shortage throughout the country, particularly on the Eastern coal roads. The *Coal Trade Journal* recently estimated that the Philadelphia & Reading is supplying about 65 per cent. of the cars required for freight; the Pennsylvania about 50 per cent., and the Baltimore & Ohio, for coal shipments, about 15 per cent. Also, that in the West Virginia districts, because of lack of cars, one-third time is the best the operators can expect. Figures recently published by a committee of operators in the New River and Kanawha districts of West Virginia, the former largely and the latter entirely dependent upon the Chesapeake & Ohio for transportation facilities, go to corroborate this last statement. In brief, they show that in 1903 the Chesapeake & Ohio handled only 46 per cent. of the coal tonnage available on its line in those districts; in 1904 only 40 per cent., and in 1905 only 36 per cent. This is figured on the basis of 24 working days a month. The number of tons loaded each month during the nearly three years is divided by the daily capacity of the mines, the resultant quotient being the number of theoretical full days each month that the mines were in operation. This does not mean, of course, that the mines were actually closed down on an average of 13 days in 1903, 14 days in 1904, and 15 days in 1905, out of every 24, but that there were only that many days' full operation on the basis of the mines' total capacity.

If it could be shown that one-third time in these districts was only a temporary condition, due to the season's car shortage, the most that could be said would be that the railroad management had misjudged the probable growth of traffic, but when cars are shown to have been lacking month by month through a period of years, it is evident that the Chesapeake & Ohio, at least, is not attempting to provide for anything like all the coal tonnage offered. Here in one small portion of its territory have been thousands of tons of coal available for shipment, on each of which the railroad's profits would have been greater than on the average of the tons which it did haul; yet the company has been carrying less than one-half of the tonnage offered in these districts, and the proportion of available business left untouched seems to have grown larger year by year. Shall we say that the road is not so wisely managed after all?

Were all the soft coal in the United States in West Virginia this might well be said, but the general situation must here be taken into account. It would undoubtedly be very much to the advantage of the Chesapeake & Ohio to greatly enlarge its coal business, as it would be to the advantage of any individual road; but,

while it would be a good thing for an individual road, if *every* soft coal road should do it, the market would soon be flooded with an over-supply of soft coal, prices would drop sharply, mine operators' profits would correspondingly fall off (many railroads operate their own mines), shipments would be reduced, and the railroads as carriers would suffer. This is because there is more soft coal available than the country will pay a profitable price for consuming. The situation is like an agreement between manufacturers to maintain a fixed price on a given product. It is to the advantage of any one of the manufacturers to under-cut the established rate and sell a great many more goods; but if any one manufacturer does it, the others will soon follow suit, and the bottom will be knocked out of the market. Agreements of this sort have usually been failures for this very reason, just as for years prices were utterly demoralized in the soft coal industry. In the same way that prices can be maintained when individual manufacturers are absorbed into a trust, the more stable condition of to-day is the result of concentration of ownership. The Pennsylvania and the New York Central control directly or indirectly most of the soft coal in the East, and it is therefore possible for production to be limited to the demands of the whole business. This naturally meets with strenuous opposition from the less favored operators, who see their individual business almost ruined in order to keep the general situation well in hand. In the West Virginia districts referred to, for instance, their protests are very bitter against the Chesapeake & Ohio's policy of spending money which might have gone to provide more cars, locomotives, and trackage and terminal facilities, in building numerous extensions into new coal districts. These, in their view, are being taken possession of, not to be developed, but simply to be protected from unfriendly interests, and in consequence, condemned to "inadequate service for an indefinite length of time.

These coal operators undoubtedly have a grievance, but it seems very doubtful whether there is any relief from the situation which troubles them. So long as consumers are satisfied, and the bituminous community of interest does not use its power to raise prices unduly, it is hard to see how there can be much change from present conditions. Even the building of independent lines, like the Tidewater Railway which is already under way, paralleling the Norfolk & Western from the eastern end, with Lake Erie as its possible goal, can hardly result in any permanent relief, for the chances are too strong in such a case, at least if past experience is a guide, that the present powers will turn up in control.

There is no question, as our correspondent says, that both the Chesapeake & Ohio and the Norfolk & Western are "splendid business propositions"—both their histories prove that conclusively. Their present prosperity is especially due to the great demand for bituminous coal, which has continued ever since the anthracite strike forced many to abandon, as it has turned out, permanently, the use of the more expensive variety. As long as their coal is in such strong demand and their present improvement policy is carried on, the two properties cannot fail to be increasingly profitable.

MOTOR DRIVE FOR RAILROAD SHOP TOOLS.

Electricity has had a great influence on the general design and efficiency of the most modern railroad shops, besides increasing the efficiency of some of the older shops in which it has been introduced. The advantages to be gained by its use as a motive power are many. Among the most important is convenience of shop arrangement, by reason of the elimination of line shafts; lighter shop construction; a clear headway for cranes; the driving of machine tools directly by motors, and the ease of manipulation and finer increments of speed resulting therefrom; a lighter shop, and a saving in power.

It is undoubtedly true that a saving in power is gained by the elimination of line shafting. Mr. Herbert T. Condict, in a paper read before the National Machine Tool Builders' Association, said: "With the belt drive it has been practically demonstrated that the average loss in shafting and belting amounted to at least 50 per cent. of the total power developed by the engine." This is especially caused by the fact that when a belt is laced it is made as tight as possible, in order to provide for stretching, and this results in loss of power through friction in the bearings as well as in the running of the belt itself. After the belts have run for some time they become loose, and there is a loss of power from slipping. In the case of the line shafting itself, no matter how carefully the line may be put up in the first place, there will in a short time be a certain amount of distortion, especially in a long and heavy shaft, which in time will cause a great loss in the shafting bearings, no matter how well they are lubricated. In electrical transmission, assuming that the shop is to be operated at 75 per cent. of the generator capacity, so that a good efficiency can be obtained from the generator itself, the loss between the engine shaft and the line will be about 6 per cent., and the line loss 2 per cent., an average loss in the motor itself of about 17 per cent., and a loss between the motor shaft and the shaft of the tool itself (when a single pair of gears or a chain is used), of 5 per cent., or a total loss between the engine shaft and the tool shaft of about 28 per cent. With the belt drive the power lost in the shafting and belting is practically a constant loss, no matter whether the shop is operated at its full capacity or not, while the loss in the case of electrical transmission varies practically directly with the power used.

Saving in power is often mentioned as the chief advantage of electric drive over the old method of driving by line shafting, but as the cost of power is but a small item, rarely exceeding 5 per cent. of the total cost of operation, this one saving must be considered a comparatively unimportant matter. Probably the greatest advantage derived from electricity as a motive power is in the saving of time which results from its use. Labor cost, particularly in a railroad shop, is the chief item of expense. Many claim that the saving in time and labor due to the introduction of electric crane service alone will frequently warrant the use of electricity in shops. The adoption of motor driven machine tools and an intelligent use of the fine increments of spindle speeds made possible by their use will also add greatly to a shop's efficiency. Figures showing the saving due to the adoption of electric drive in railroad shops are not as yet available. A record extending over a period of five years in one of our largest industrial shops, however, shows an actual saving of 30 per cent. in labor cost due to the adoption of modern motor driven machine tools and an intelligent use of cutting speeds. It is generally conceded by the most conservative railroad mechanical officers that even if electric power is not at first installed, new shops should be designed with electric drive in view.

The statement is frequently made that the best results can be obtained by individually driven tools. More conservative practise, however, holds that this is going a trifle too far, inasmuch as the results so far obtained from the group system of driving the smaller tools have been most satisfactory. Undoubtedly it is true that the heavier tools, which require from 10 h.p. to 25 h.p., and tools remote from the main shop, can be served best by independent motors. It is practically impossible to lay down any general rule as to where group drive should cease and when individual driving should begin, as each shop presents a different problem. From a series of tests, the details of which were printed in the *Railroad Gazette* of February 13, 1903, made at the Du Bois shops of the Buffalo, Rochester & Pittsburg, to determine the power required to drive machine tools, it was shown that the horsepower of motors used in group drive was from 2 to 2½ times smaller than the total horse-power which would have been required if each tool in the group had had its own individual motor. The results of this test raised the question as to how far the low average power taken by large groups of tools in operation may be due to the flywheel action of the shafts and pulleys. The desirability of being able to run one or more tools while the rest of the shop is idle is another feature of motor drive upon which great stress has been laid. This is, of course, a good feature, but it is perhaps less important than it seems at first glance, for it must always be remembered that power is one of the cheapest of shop commodities. In large, isolated machines, which are only used occasionally and which require motors of from 15 h.p. to 25 h.p., it is probably safe to say that there is no money saving over belt drive when the cost of the motor and its maintenance is taken into account.

In shops where these large machines are absolutely necessary, but are not in constant use, a suggestion which seems practical for reducing the capital outlay for motors is to have each of the large machines fitted with a specially designed motor base, and with the same size driving gears. Then, instead of having a permanent motor attached to each machine, one or even two large motors may be fitted with bases and driving pinions to fit into the special motor bases and driving gears of the large machine tools. This would make the large motors interchangeable with all of the larger machines. The cost of shifting the large motors to the different tools, as occasion required, and of making the electrical connections, would be trifling as compared to the interest on the capital invested in the much larger number of large motors necessary with

permanent individual drive. With a little planning the work which these machines are called upon to do could be arranged so that not more than two of the heavier tools need be operated at the same time.

As to the relative first cost of line shaft and motor drive, it is almost impossible to arrive at exact figures, but it is generally conceded that the first cost of shafting, belts, countershafts and hangers offsets, or more than offsets, the first cost of motors, wiring and other equipment required for electrical transmission. A considerable saving can also be made in the initial cost of the power house when electric drive is used, as there is less loss in transmission of the power between the engine shaft and the tool, and therefore a smaller power plant is required. In regard to the relative cost of maintenance of the two systems, it has been clearly shown in many cases that the cost of maintaining electric drive is considerably below that of belt drive.

An editorial in our last week's issue said that about 90 per cent. of the cost of maintenance of equipment can be charged directly to repairs of cars and locomotives. Assuming that half the cost of those repairs is not affected by improvements in shop methods or tools, we have about 11 per cent. of the operating expenses on which to effect a possible saving by putting into use modern shop tools and facilities. It is a conservative estimate to say that a modern railroad shop with electric cranes, individual motor driven machines using high-speed steel tools and good shop management will show a saving of 25 per cent. over an old shop of similar size and capacity. That is to say, nearly 3 per cent. of the whole operating expenses may be saved. Thus it is quite apparent that adoption of modern shop methods is bound to pay a big return on the investment.

A Very Fast Run.

In a run made by a special train from Crestline, Ohio, to Clarke Junction, Ind., on October 24, over the Pittsburg, Fort Wayne & Chicago, a speed of 74.55 miles an hour was made for 257.4 miles, which gives to the Pennsylvania Lines decidedly the best record ever made for so great a distance. The train which made this run was a special of four cars carrying a party of railroad officers to the Chicago meeting of the American Railway Association. The weight of the cars was 520,000 lbs. The engine was one of the company's standard Atlantic type, weighing 176,600 lbs., and, with tender, 320,400 lbs., making a total for the engine and train of about 420 tons. An officer of the road, who sends this record, says that no particular attempt was made to break records, but simply to have a "comfortable" ride to Chicago.

The details of the run are as follows:

		Time used, min., sec.	Miles traveled.	Rate, miles per hr.
Crestline	Dep. 11:05:00 a. m.			
Fort Wayne	Arr. 12:46:20 p. m.	101:20	131.4	77.81
Fort Wayne	Dep. 12:49:40 p. m.			
Clarke Junction	Passed. 2:32:10 p. m.	102:30	126.0	73.75
Stop at Fort Wayne		3:20		
Time, distance and rate through		207:20	257.4	74.55

The previous records most nearly approaching this are those reported in the *Railroad Gazette* of June 30 and August 11 last. On the latter date we published a record of 66.18 miles an hour for 300 miles, which was made by a regular train over the same road as that which figures in the present report; we also noted records of 200 miles at 71.3 miles an hour, 100 miles at 77.2 miles an hour, and 50 miles at 79 miles an hour. The special train over the Lake Shore & Michigan Southern on June 13 ran 182 miles at 73.2 miles an hour; weight of the three cars in the train, 175 tons.

It will be observed that in the run now reported no stop was made at Clarke Junction. If a stop had been made here, adding, say, 1½ minutes to the time, the average speed from Crestline would have been almost exactly 74 miles an hour.

The principal dimensions of the Pennsylvania standard Atlantic type engines are:

Cylinders	20½x26 in.
Total weight	176,600 lbs.
Weight on drivers	109,000 lbs.
Heating surface, (firebox, 166) total	2,640 sq. ft.
Grate area	55.5 sq. ft.
Diameter of drivers	80 ins.
Tubes: No. 315; diameter 2 ins.; length	15 ft.
Fuel	Bituminous coal.

Besides making no particular attempt to break records the officer before mentioned gave instructions after passing Fort Wayne, to "check the speed." How fully the engineman carried out these instructions we leave the reader to conjecture. The officer in question may perhaps be one who has seen service in the traffic department, where, in ancient times, orders (to refrain from rate cutting) always sounded well but sometimes failed of execution. Or, possibly the order to "check" was not addressed to the engineman but to the men who sat in the observation car and watched the mile posts.

Long Island Railroad.

The report now at hand covers two periods, one for the six months ending Dec. 31, 1904, and the other for the year ending the same day, owing to the change of the fiscal year to make the company uniform in its reports with the other Pennsylvania properties. We have often pointed out in these columns the peculiar situation of the Long Island. Its chief revenue is from passengers, but at present, owing to the imperfect connections with New York City, it only handles its really profitable traffic through a quite short season. The freight traffic of the road is secondary and it is expensive to operate because it must of necessity move in small train loads to diverse localities. From a freight standpoint the Long Island has the characteristics of a switching line rather than of a trunk line. The obvious conclusion to be drawn from these circumstances is that the Long Island cannot work along successfully by the exercise of ordinary, or even of extraordinary, economies. It must spend money in order to get money, and it must spend a lot of it. In the interval between the present rather chaotic state of the property and the completion of the East river tunnels and of the electrification of the New York district the road must just do the best it can, having for its chief consolation the Pennsylvania's guarantee on its bonds.

The present report, owing to the difference in the period of time covered, cannot be compared satisfactorily with that of the preceding year. The supplementary and general income account for the six months ending December 31, however, is compared with the same period last year, and the showing made, in view of the facts previously mentioned, is a good one. Gross earnings increased substantially, operating expenses increased very little, and net income, after computing the increments from interest on investments, ferry operation, etc., and deductions on account of interest on bonded debt, taxes, etc., amounted to $299,649 as against $96,646 for the same six months in 1903. The best gain was that derived from freight traffic, which earned $1,103,265, an increase of $126,958. Passenger traffic brought in $2,363,815, exclusive of express and mails, and the increase here amounted to $86,117. The report does not state what portion of this is due to new business and what portion to the increases in fares, which were made last spring and were quite substantial on some of the branches, particularly on the Oyster Bay division, but by making the unsatisfactory comparison between the entire year ended June 30, 1904 and the entire year ended Dec. 31, 1904, a good increase in the number of passengers is indicated, while the average passenger mile earnings over the entire line actually decreased from 1.44 to 1.435.

As we said in our review last year, the Long Island's expense account is affected quite unfavorably by two rather unusual things. Since Long Island City and Brooklyn were included within the limits and ordinances of greater New York the company has been obliged to use anthracite coal for a tremendous amount of traffic that could previously be hauled with engines burning bituminous. In the year ending June 30, 1902, with 4,011,609 revenue train miles, passenger and freight, coal cost the company $531,726, while in the year ending Dec. 31, 1904, with 4,189,049 train miles, coal cost $844,596. That is to say, coal cost, without material difference in the circumstances of the traffic, and with no let-up in operating efficiency, rose from 13 to 20 cents per revenue train mile, with no relief in sight prior to electrification. The other unusual expense which the Long Island has been forced to shoulder within the past few years is the car mileage balance, which rose from $17,952, in 1902, to $214,787, in 1904, as a result of the per diem rule. During Mr. Baldwin's illness, when Mr. Potter was in active control of the road, he made active efforts to have the Long Island considered as a switching road, so far as the car mileage was affected, but this has not yet been brought about.

In order to finance the elimination of grade crossings, the electrification of part of the system, and large outlay for double track, yards and other facilities, required by the through traffic to be exchanged between the Long Island and the Pennsylvania and New Haven road, the creation of a 4 per cent. refunding mortgage was authorized last year, to the extent of $45,000,000, of which $26,605,000 was reserved for all underlying liens. Of the remainder, $10,000,000 of bonds, guaranteed by the Pennsylvania Railroad, were issued last year. The report at hand shows an additional issue of $2,200,000 4 per cent. bonds due in 1949, with which a like amount of former bonds under several mortgages have been retired. During the 18 months covered by the full term of the report at hand, there has been a total increase in the capital account of $360,665, the largest single item of which was payable on account of the passenger terminal at Long Island City. It is noteworthy that even during these years of deficit, earnings increased enough to considerably more than offset the increase in fixed charges.

Looking more in detail at the operation of the road throughout 1904 it will be seen that the freight traffic shows important increases under two heads, coal and merchandise. As compared

with the year ending June 30, 1903, coal traffic for the year ending Dec. 31, 1904, increased from 571,046 tons to 680,585 tons, while merchandise increased from 249,673 tons to 429,400 tons. These respective increases, one tending to a larger and one to a smaller train load, apparently just about balance each other, as the average train load for the year was 127 tons, compared with 129 tons in 1903. This extremely small loading does not indicate any inefficiency in operation, but shows the peculiar branch line and express goods character of the traffic. In fact, in its traffic problems the Long Island is perhaps more analogous to an English railway than is any other line in this country.

The statistics which follow are for the six months ending with Dec. 31, 1904 and 1903, respectively:

	Six months ending Dec. 31.	
	1904.	1903.
Mileage worked	392	392
Freight earnings	$1,103,265	$976,397
Passenger earnings	2,363,815	2,277,698
Express traffic	579,781	528,173
Gross earnings	4,118,817	3,870,858
Maint. way and structure	341,233	465,545
Maint. of equipment	350,233	362,128
Cond. transportatn—traffic	65,253	1,963,945
Cond. transp.—operation	2,053,052	
Operating expenses	2,928,630	2,878,339
Net earnings, excluding taxes	1,040,495	845,620
Gross income	1,302,689	929,632
Net income	299,649	96,846
Deficit	54,390*	275,205†

*Year ending Dec. 31, 1904.
†Year ending June 30, 1904.

TRADE CATALOGUES.

Mechanical Draft.—Bulletin No. 75, entitled "Mechanical Draft: What it is, what it does," has just been issued by the B. F. Sturtevant Co., Boston, Mass. This booklet not only briefly presents the salient features of this system of draft production, but illustrates a variety of plants which clearly show "what it is." The suggested query in the words "what it does" is answered thus: It does what an ordinary chimney is incapable of doing. Its cost is from 20 to 40 per cent. of that of a chimney; its intensity permits of the burning of finely divided or low grade fuel; it makes possible the utilization of the heat of the flue gases which a chimney wastes in producing draft; it is independent of the weather; is automatically regulated to maintain constant steam pressure, decreases smoke, increases the capacity of an existing plant, and serves as an auxiliary to a chimney already overburdened; saves space and is portable.

Portable Electric Hoists.—Illustrations, price lists, weights and general dimensions of portable electric hoists made by the Yale & Towne Mfg. Co., New York, are given in its new "Electric Hoist" catalogue. The distinctive features of this type of hoist are its steel construction and portability. It can be shifted from place to place like a chain block and used wherever current is available as it is almost as easily wired as an incandescent lamp. The two-ton, four-ton and six-ton hoists can be procured from the makers at once, as they are always kept in stock.

Underfeed Stokers.—The Underfeed Stoker Co. of America, Chicago, publishes a "Publicity Magazine" devoted to the interests of the Jones stoker. The November number, with 16 pages, contains various sorts of information in line with the interests served by the magazine. This company's catalogue, which is put out in folder form as a pocket edition, fully illustrates and describes the device and shows various applications to different sorts of boilers and boiler plants, as well as showing the advantages of the device and of the principle it embodies.

Heating Apparatus.—Sectional catalogue No. 186 of the American Blower Co., Detroit, Mich., is devoted to heating apparatus. The construction of the "A B C" heater is illustrated and described, information regarding capacity is given, and price lists for arriving at the cost of any size heater. Illustrations of a number of possible combinations of heaters and fans are shown. The last few pages give brief information about the "A B C" system of mechanical draft.

Tool Steel.—Wm. Jessop & Sons, Ltd., New York, sends its new catalogue and price list of the Jessop's high grade tool steel. The first few pages are devoted to an interesting discussion in which the advantages of using high grade tool steel are set forth. This is followed by instruction for the hardening and tempering of the Jessop's tool and die steel as well as the Jessop's "Ark" high-speed steel which is specially recommended for use in connection with modern machine tools.

Railroad Supplies.—Fairbanks, Morse & Co., Chicago, have issued 1906 catalogue No. 52A, devoted to the supplies of their railroad department. It is a 6 x 9 cloth-bound volume of 430 pages, and covers in complete shape the large line of railroad supplies carried in this department. The illustrations, which are numerous, are mostly half-tones, and the typographical work is excellent. There is a complete index at the back of the book.

Mail Pouch Catcher.—The Barker Mail Crane Co., Clinton, Iowa, is distributing folders, printed in two colors, describing its new mail pouch catcher which is placed below the car door to enable shorter mail cranes to be used. This catcher was described in the *Railroad Gazette*, April 21, 1905. An improvement has been made since that time by substituting a gear for the cable between handle and catcher.

Railroad Specialties.—A two-leaf cardboard folder entitled "A Signal Advantage," which is a clever little advertising device, is being distributed by the Buda Foundry & Mfg. Co., Chicago. Inside is a signal post and movable semaphore, so arranged that as the folder is opened the semaphore is drawn to danger. The printed matter enumerates some of the lines carried by this company.

The Chicago & North-Western has prepared a handsome booklet to describe its new "North-Western Limited" trains between Chicago, St. Paul and Minneapolis. The printing is in green and black and each page is embellished with one or more artistic pen and ink drawings illustrating the car interiors or features along the line.

Hydraulic Accumulators.—The Watson-Stillman Co., New York, describes and illustrates a variety of types of accumulators and valves which are specially designed for use with accumulators in its new "Hydraulic Accumulator" catalogue No. 67. General information of interest to hydraulic engineers is also included.

Machine Tools.—The November issue of the *Progress Reporter* issued by the Niles-Bement-Pond Co., New York, shows a number of interesting machine tools. Special stress seems to be given to the Niles electric hoists and electric traveling trolleys. Three full-page illustrations showing these machines in use are given.

Electric Car Lighting.—The advantages and operation of the Consolidated "Axle Light" system of electric lights and fans for railroad cars is described and illustrated in detail in Bulletins Nos. 1 and 2 issued by the Consolidated Railway Electric Lighting & Equipment Co., New York.

Hydro-Electric Plants.—A complete description of the hydro-electric plant of the Spring River Power Co., Joplin, Mo., is given in a Bulletin issued by The Arnold Company, Chicago, who designed and constructed the entire plant, including the transmission lines and sub-stations.

CONTRIBUTIONS

Railroads and the Coal Business.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I am interested in your recent article on the Norfolk & Western and Cheaspeake & Ohio Railways. You lay special emphasis upon the low rate of freight, but is the transportation of coal such an extremely "close" proposition as your comment indicates? Ordinary freight has to be loaded and unloaded by hand, freight houses provided for its receipt and storage, and multitudes of bills have to be made out for small shippers; whereas coal shipments on the two roads mentioned are made in large blocks, a train-load a day by some shippers, and there is no expense incurred by the railroads for loading or unloading.

It seems to the writer that the two roads named are splendid business propositions, and that any money spent by them in the further exploitation of their business, the providing of more cars, locomotives and trackage facilities, with a view to getting more of the freight which you characterize as such a low-price tonnage, will be greatly to the advantage of those interested in the ownership of the companies.

F. W. SAWARD.

Indian Minimum Rates.

Calcutta, Aug. 31, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

With reference to my paper on Indian Slow Freight Rates, printed in the *Railroad Gazette*, July 28, 1905, and to your editorial note on the same subject: The position we are trying to get recognized is that in the case of railroads owned by the one proprietor—that is, in this country, the Government—those working at low rates of cost per ton mile shall be permitted to charge lower rates for carriage than those working at a comparatively high cost per ton mile.

If the cheap working line must keep up its rates to the level

of reasonable rates, having regard to the cost of working on its less fortunate neighbors, it will be charging rates higher than it can afford to charge, and in the case of long distance traffic will prevent the cheaper range of commodities from being tendered for carriage by rail. If on the other hand, the line expensive to work goes down to what the cheap line can afford, it will be carrying at a loss. As between Calcutta and Bombay, the sea freight at the Bombay port is much lower than to and from Calcutta, and we might, following the American practice, ask for a differential in favor of Calcutta such as has been given to Boston and Philadelphia. We, however, merely ask that as Bombay is allowed and does make full use of its advantage in cheap sea freight, Calcutta should be allowed by means of low charges for land carriage to profit by the low cost of rail transportation on this side of India.

W. A. DRING,
Chief Traffic Manager, East Indian Ry.

The New Haven Road and the New York Terminal Electrification.

To the Editor of the Railroad Gazette:

Concerning the proposed method of electrification it is interesting to note the unsolicited general concordance of opinion on the part of certain engineers and gratifying in the main to note a temerity in expressing a concrete opinion of our decision.

Without a full appreciation of the relevant factors in the case one could hardly view with a more kindly eye a hearty endorsement of our conclusion than a condemnation of it. Certainly the first indication of a real engineer is his reservation of an opinion until all these relevant factors have, in the full knowledge of their true bearing, been assembled. To-day a conclusion is worth nothing that is not a compromise. A compromise is the true algebraic sum of all the relevant factors.

After six months careful study of the possible methods of electrification a conclusion has been reached. The work has been too initiative, the ground too new and the opportunity too exceptional not to have kept an accurate log upon the method of procedure. Were it possible to devote time to things other than an expeditious and careful continuance of the work begun we would gladly segregate this conclusion into its relevant factors and discuss it with those engineers who by the reservation of their concrete opinion have shown a silent wish to later agree or disagree with its plans.

To the two great electrical manufacturing companies who have placed the genius of their engineering in our hands for consideration we have nothing but the highest tribute to pay. It has been no mean privilege to make a minute study of their individual viewpoint of the problem. It is true their analysis of the situation has dictated widely separated conclusions, and those engineers who appreciate the trust imposed in this decision for the New Haven road can readily understand that the divergence of opinion has served only to double the responsibility of the conclusion but by which the engineers for the New Haven road are in no way disturbed.

To those minds prone to a conclusion without the assistance of the relevant factors it may be a helping thought to say that throughout the study of the New Haven's electrification the Central's plans have been a constant and most relevant factor. The conditions of the New Haven problem, however, are widely different. It has been deemed that alternating current is pertinent to their proper fulfillment. Because the New Haven locomotives will be operative either on direct or alternating current in no way emphasizes the importance of their interchangeability. The condition imposed in effect makes valuable the double characteristic. A criticism of the Central's plans is irrelevant and unnecessary; direct current propulsion is the judgment of their engineers. Our concern is its effect upon us and it is read in the direct current characteristic of our locomotive.

W. S. MURRAY,
Electrical Engineer, New York, New Haven & Hartford Railroad.

Picked Up on the Platform.

Nantucket Lightship, Nov. 11, 1905.

To the Editor of the Railroad Gazette:

Many of your readers must have been well entertained by your recent publications of paragraphs about things "Picked Up on the Road"; but things that are Forced Down Our Throats on the road—and at stations, sometimes stir our feelings, and in such a way that things picked up are for the time being of no account. Have you ever noticed what a heap of inconvenience passengers make for themselves at large way stations, just because station agents and conductors do not co-operate in making their men show passengers what to do? With two or three coaches sandwiched between the baggage cars and the sleepers, trains often are stopped at stations so that those who are to get on find themselves at the front end of the front car when most of the vacant seats are in the rear car. Nobody at the station tells them to go to the rear before the train comes in, and so they do the best they can to fight their way in, crowding the passengers who are coming out; and then they blunder back through two or three cars to find seats. The conductor ought to complain of the station agent, but probably he is too indolent to do so. An aggravated form of this petty nuisance may be seen in connection with heavy through trains which take on a considerable number of passengers at a second city station a mile or two out from the starting point. Such trains, with their elephantine locomotives and their fast schedules, rush past the platform in a way to convince the waiting passenger that not over 15 seconds can be allowed for the 25 or 50 passengers to get on; and yet, one night not long ago, I had to go to two trainmen 150 ft. to 200 ft. apart to find out where to enter sleeper No. 3; and then I was misinformed and had to lug a heavy suit case through the narrow passages and abrupt turns of two or three sleeping cars before I was settled. One of these men was a brakeman and the other a sleeping-car porter. A lone woman would have had the same difficulty in getting information. A half lighted platform makes such a situation worse; and if the weather is very cold it is disgraceful. No station man was in sight on the platform; and if there had been one, it is safe to bet that he would have been unable to estimate within five car-lengths where a passenger ought to stand to quickly find a given sleeping car.

We must recognize, of course, that exhibitions of such ignorance are only samples of what may be seen in other matters; that a large percentage of train and station men of all grades only now and then exercise any more energy, thought or ingenuity than they believe to be the minimum necessary to pleasantly hold their jobs. This narration of a sample incident is only intended to aid the reader to call to mind grievances of his own, and to incite him to follow my example and join the kickers.

But I, also, picked up on the road a pleasing item. I rode three hours in a cheerful and roomy day car which was well ventilated without the opening of either a deck sash or a window. It was well warmed and after dark was beautifully lighted by 20 of the new gas lamps in which an incandescent mantle is the distinguishing feature. It is true that the ventilating arrangements were not severely tested, for the car was not over half full of passengers and the weather was not wintry; still it was a pleasing change from the ordinary passenger car. Moreover, the interior woodwork was light colored and pleasing, the carvings were unobtrusive and chaste, yet suggestive of all desirable richness, and the colored glass and the brass work were in good taste. No railroad need longer have unattractive passenger cars for lack of excellent examples to copy. Being a kicker, I am bound to give you also the two unfavorable impressions of that passenger car. In the first place, by reason of poorly designed or improperly adjusted springs it was by no means a smooth-riding car. It was not remarkably bad, but there was a constant jarring which, considering that the company's heavy 12-wheel cars run smoothly over the same track, was an annoyance to a railroad man with an idle mind. In the second place, the "SPITTING PROHIBITED" notice was painted on the panel above the doorways. To me this reminder of filth produced nearly the same unpleasant effect as would have been caused by some unclean person spitting on the wall of the car. I recognize that to repress the boors who befoul cars with their expectorations it is necessary to post notices; and the notices must be plain in language and loud in appearance. But I like to comfort myself with the notion—perhaps it is more or less of a delusion—that some time we shall become sufficiently civilized to get along without conspicuous notices; and therefore, as a means of supporting my delusion, I would put the placard on paper, in a frame, hung on a hook, and thus give it the appearance, at least, of a temporary expedient, instead of making it a permanent fixture.

KRITIK.

The Cape Government Railways.

In the *Railroad Gazette*, August 4, 1905, a historical sketch was printed of the development of the railroad system in South Africa, with particular reference to the changes since the Boer war. At the August meeting of the Engineering Section of the British Association at Cape Town, a paper was read by A. M. Tippett, Chief Resident Engineer of the Cape Government Railways, which contains much additional information with regard to the working of the lines. Through the courtesy of Mr. Tippett we are enabled to print the following abstract of this paper:

It will be recollected that the railroad development of Cape Colony was undertaken primarily by three main systems, which are now connected, but were formerly entirely separate. The chief of these is known as the Western system, starting from Cape Town and running approximately northeast through Cape Colony and Bechuanaland to Vryburg, 774 miles, on to Victoria Falls, 870 miles further. This latter section is not a part of the Cape system, however, but is the property of the Rhodesia Railways. For the first 109 miles the line traverses the low-lying, rich and picturesque lands of the Cape Town district, with the largest agricultural output of the colony and with towns more numerous than elsewhere. At a distance of 129 miles from Cape Town the railway ascends to the highlands, with severe grades and through

a region of very light traffic. Kimberly, in this section of the line, is 4,012 ft. above sea level. Farther on in Bechuanaland the character of the country again alters, becoming more wooded and better watered.

The system second in importance is the Midland, which starts from Port Elizabeth and connects with the Orange River Colony system. The Eastern system, the third in importance, starts from East London, higher up the east coast than Port Elizabeth, and has a more northerly direction than the others, gradually converging to them until it joins the Midland extension in the Orange River Colony.

The normal gage of these lines is 3 ft. 6 in., including the main routes, the ordinary branches, and the pioneer, or developing branches. There are also two lines of 2 ft., or narrow gage; one running from Port Elizabeth to Avantuur, which is to all intents a main line; the other, from Kalabas to Kraal and Hopefield, which is a branch or trading line. The rails are flat-footed, fastened directly to the ties in the American way, and they weigh from 46¼ to 100 lbs. to the yard. Joints are of the ordinary strap fishplate type with four holes, though on some parts of the line angle plates have been used. The platforms in the chief stations are of concrete, stone, or brick, and are level with the floor of the car, as in British practice; but at the smaller stations they are lower, the top of the coping being 18 in. above rail level. The lines generally, though not up to the standard of English railroads, are well built and well equipped, taking into consideration the gage, sparse population and small traffic. The branch lines are laid with less ballast, lighter rails, averaging from 46¼ to 60 lbs, section, and much simpler station buildings, etc. Most of these are of wood and corrugated iron, for galvanized corrugated iron has played a very important part in railroad development in the country, and every station, village and town has still a large percentage of iron buildings.

The Norval Pont Bridge, Cape Government Railways.

Typical Wayside Station, Cape Government Railways.

The 2-ft. gage lines have been tried as an experiment in economy for certain classes of traffic. The longest of these, still building, and referred to above as designed to run from Port Elizabeth to Avontuur, will be 178 miles long. The other is 47 miles long. It is doubted whether the natural difficulties to be overcome in building the Avontuur line are of such magnitude as to largely affect first cost in comparison with the light 3 ft. 6 in. line, and the traffic, which is chiefly agricultural produce, is bulky and not the best adapted for narrow gage. The other 2-ft. line, known as the Kalabas-Kraal & Hopefield, is of easy construction, being practically a surface line. Its chief traffic is bulky farm produce, and its start is from an up-country junction, necessitating trans-shipment, so that it appears to have little to recommend it as an experiment in narrow gage. The management chose 2 ft. rather than 2 ft. 6 in. gage, as showing a larger difference in first cost, where it was desired to effect economies, but it is believed to be questionable whether the difference in cost between 2 ft. and 3 ft. 6 in. is enough to balance the objections to the narrow gage, and especially to break of gage in a railroad system.

With land cheap and skilled labor dear, there are only 10 tunnels in the Cape Government system. All of these are for single track and the longest of them is 936 ft. long. There are a number of large bridges, but with the exception of a few special 150 ft. spans the 130 ft. span girders are the largest at present in use; the Orange river bridge consisting of 11 spans of 130 ft., the Vaal river bridge consisting of 11 spans of 130 ft., etc. The piers of nearly all these bridges are of cast iron cylinders, 6 ft. internal diameter, placed two for each pier, spaced at 15 ft. 6 in. centers, filled with concrete and connected by diaphragms. During the war the Boers partially destroyed three of these large bridges, which were rebuilt by Cape engineers. Mr. Tippett says in his paper that a very interesting account might be written of the railroad wrecking done by the Boers during the war, and of the temporary expedients adopted to move traffic. Some bridges, as for example, the Bethulie, were destroyed with some science by cutting the lower chords in the center with small charges of dynamite, so that the girders collapsed. The Fourteen Streams bridge, however, was attacked in a very unscientific manner, dynamite having been used on the bearing girders of the cylinder piers. After repeated attempts, the heads of piers and the ends of many of the girders were shattered. The road, it is true, was blocked and broken, but no span was entirely dropped.

The ties now universally used on the Cape Governemnt Railways are of the ordinary timber transverse type, although many experiments were tried in the early days with other kinds. The first railway to Wellington was originally of 4 ft. 8½ in. gage, laid with iron rails on longitudinal timbers. These were replaced by transverse ties and the gage was altered to 3 ft. 6 in. on the acquisition of the line by the Government. About the same time a considerable amount of cast iron bowl or pot sleepers were used, the rails resting directly on the bowls, which were connected by a wrought iron tie. Wrought iron trough sleepers were tried later in the belief that they would be cheaper than the timber sleeper owing to their assumed longer life, and also because they would resist the white ant, which in some parts of the country destroyed all untreated wood and even treated wood, to some extent, when the creosoting had washed out. These iron ties were introduced in 1881 and were used until 1895, when it was seen that they had certain serious objections, such as corrosion of the metal under the rail, working loose of the rivets, and cracking across through the rivet holes owing to defects in the ballast. It was also found that large numbers were crumpled and rendered useless by derailments. Since 1895 these metal ties have been gradually replaced by timber and no more have been imported. Australian hard wood sleepers are now largely imported.

The signaling of the system is manual and is permissive block.

The telegraph operator at A communicates with the one at the forward station B and arranges with him for the advance of trains from either end. The operator at each end, who is in many cases the station master, writes the train order and gives it to the guard of the train, who hands it to the engine driver. There is a line clear order and an "exchange crossing" order when trains meet each other at an intermediate siding. At the siding the guards exchange orders, so that the order authorizing an up train to proceed from A and meet a down train at an intermediate siding is handed over at that siding to the guard of the down train, and becomes his authority to proceed to A.

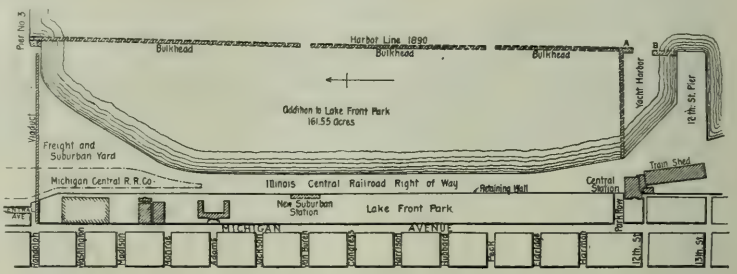
Owing to the heavy grades and severe curves train speed on the lines is rather low. The fast passenger trains to Johannesburg run over the Cape lines at an average speed of 24½ miles an hour, excluding stops, and 22¼ miles an hour including stops. The ordinary passenger trains on main lines run at 22¾ miles an hour, excluding stops, and 17 miles an hour, including stops, the considerable differences between the two speeds being due to the stops at stations for meals. The fast freight trains run at 13½ miles an hour including stops. Some of the suburban trains have a speed of 25¼ miles an hour between stations. All of these speeds, however, are averages, which are of course exceeded at some portions of the runs. Speed was not much of a consideration in designing lines, as the comparison was not between railroad and railroad, but between railroad and ox cart.

As affecting traffic, the results of the Boer war were a greatly increased and exaggerated business during its continuance and for a short time after its ending, followed by a very much reduced traffic and depressed trade, from which the country now seems to be greatly recovering. The Cape Government Railways carried over 11,000,000 passengers during the half year ending June 30, 1904, with an average of 88.2 passengers per train and an average haul of 16 miles. The average rate per mile was approximately 1.8 cents and the net cost of working passenger traffic per passenger mile is figured at about 1.5 cents, exclusive of extraordinary expenditure and of interest. Ton mile figures are kept on the South African Railways, and the ton miles on the Cape Government system for this same half year were 246,810,221; the average haul was 186 miles and the average rate per ton mile was 3.12 cents. The average number of tons carried by each freight train is small, amounting to only 71½, yet this is almost precisely the average obtained by the English lines in handling their fast goods traffic; in handling all classes of goods traffic, in fact, except coal, brick and iron.

The total mileage of the Cape system in 1904 was 2,576 open and the average cost per mile was $10,402, which represents first cost of construction, or purchase, with subsequent additions for betterments, extra rolling stock, and other equipment.

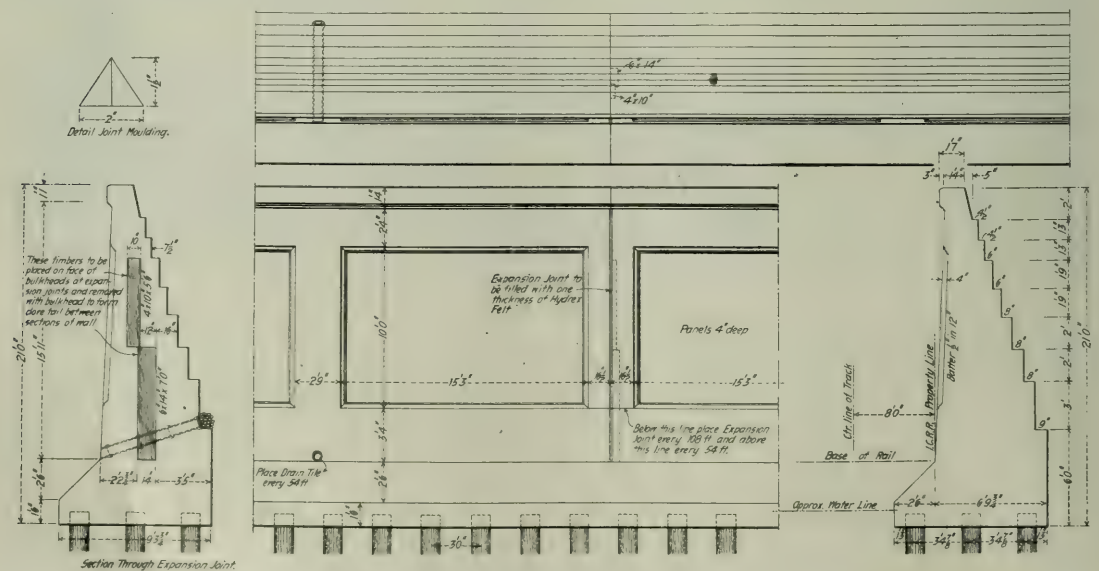
Concrete Retaining Wall of the Illinois Central on the Lake Front, Chicago.

The Illinois Central Lake Front improvements in Chicago were described at length in the *Railroad Gazette*, July 10, 1896, at the time the plans were agreed on. The "Lake Front" is the part of the city water front lying between the north line of Randolph street, extending eastward into the lake, and the south line of Park Row, likewise extended. By the terms of the agreement with the city the railroad company was required to depress its tracks lying within this district to a point not to exceed 6 ft. above city datum, or about 4 ft. below the then existing grade. Masonry retaining walls 22 ft. high above city datum were to be built on each side of its 200-ft. right-of-way throughout the length of the district. It was the purpose of the city to form a Lake Front park by filling in the submerged district lying between the east retaining wall and the harbor line established by U. S. engineers in 1890, an area of about 160 acres; and also the narrow strip between the west retaining wall and Michigan avenue; both fills to be terraced up to the tops of the walls to conceal the movements of trains entirely from view. The tracks were to be bridged at important street intersections with ornamental viaducts. The railroad company did most of the work called for by the plan, including the building of the Van Buren street suburban passenger station, within the next two years, and that portion of the park west of the railroad was completed. Also, the sea-wall or bulkhead along the harbor line, or east line of the proposed park, was built. This work was described in detail in the *Railroad Gazette*, Jan. 28 and Feb. 18, 1898. The accompanying map of the Lake Front is reproduced from one of these articles.



Map of Chicago Lake Front.

The only important part of the railroad company's work which was not completed at that time was the east retaining wall. Construction of this was deferred because the South Park Commissioners, who have control of the park, were not ready to proceed with the filling and there was no need of building the


Detail Joint Moulding.
These timbers to be placed on face of bulkheads at expansion joints and removed with bulkhead to form core for filling between sections of wall
Expansion Joint to be filled with one thickness of Hydrex Felt
Panels 4' deep
Below this line place Expansion Joint every 108 ft. and above this line every 54 ft.
Place Drain Tile every 54 ft.
Ctr. line of Track
Base of Rail
Approx. Water Line
I.C.R.R. Property Line
Batter 1 in 12
Section Through Expansion Joint.

Part Side Elevation and Sections of Concrete Retaining Wall.

wall until this could be done. Some random filling with miscellaneous material from the street cleaning and building departments and by scows loaded with dredgings from the Chicago river has been going on in the time that has intervened up to the present, but lately the work was begun in earnest. The material is being obtained from the Chicago freight tunnels, from various dredging operations and particularly from Government dredging in the outer harbor. The time had therefore come to build the east retaining wall and work was begun about the first of September.

Unlike the west wall, which is rubble masonry, the east wall is concrete, drawings being shown herewith. The wall is 21 ft. high above city datum and will be 6,251 ft. long. It is 9 ft. 3¾ in. wide at base of foundation and is stepped down to an effective width at the top of 1 ft. 4 in. It rests on 30 ft. piles, driven three in a row, the rows being 3 ft. apart on centers. The resultant load is 26,400 lbs. for a level fill, giving 1,412 tons per sq. ft. of foundation and 13.15 tons per pile. For an 8-ft. sur-charge the resultant load is 31,750 lbs., or 1,704 tons per sq. ft. of foundation and 15.88 tons per pile. The wall has a maximum sectional area of 103.77 sq. ft. and a minimum of 100.66 sq. ft., the average being 101.25 sq. ft. The face of the wall is battered ½ in. to the foot, and is paneled as shown, these panels being 4 in. deep, 10 ft. high and 15 ft. 3 in. long, with a moulding at the edges. The distance, center to center, of pilasters is 18 ft. Expansion joints are placed at every third pilaster, or 54 ft. apart. Alternate joints extend down to the foundation, those between going only to the bottoms of the panels. A detail of these joints is shown, from which it will be seen that two timbers 4 in. x 10 in. x 5 ft. 6 in. and 6 in. x 7 in. x 7 ft. respectively are placed one above the other on the faces of the bulkheads of the forms and are removed with the bulkheads, leaving a groove to form a dovetail between abutting sections. One thickness of "Hydrex" felt is placed in each joint, and a triangular moulding 2 in. at the base and 1½ in. high is used in the wall face at each joint. Drain tiles 6 in. in diameter run along the bottom step on the inside. They pierce the wall every 54 ft., being elevated 6 in. at a point midway between the wall openings.

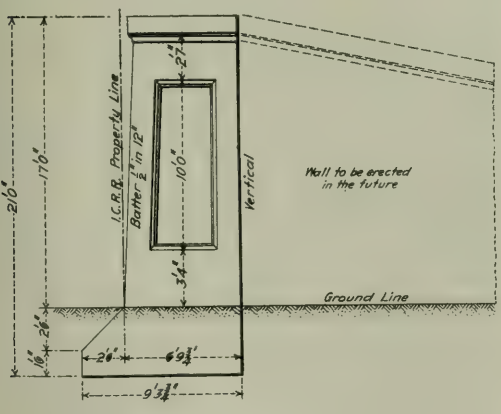
South End of Retaining Wall.

A 1-3-6 mixture of concrete is being used, the total estimated amount for the wall being 22,700 yds. The concreting is divided into four courses for the height of the wall, the footing being laid first, the second course completing the foundation, and the third course going to the bottom of the panel. The section above this is done at one time. Each course is sloped back with a 2-in. drop, and a 6-in. x 12-in. timber is laid in the top of the first three courses, leaving upon removal, a key-way for the succeeding course. The adjacent tracks are a great convenience in mixing and laying the concrete. The mixer is installed on a flat car and a platform built above it. An inclined runway extends from the platform back to the material cars coupled behind the mixer car. The materials are conveyed in wheel-barrows from the cars to the mixer. The mixer dumps into a bucket on a derrick, carried by a car which stands ahead of the mixer car.

South End of Illinois Central Concrete Retaining Wall on Chicago Lake Front.

The face of the wall will have the standard mortar finish of the Illinois Central. The end finish, as shown in the illustrations, will be in keeping with the face. Wing walls extending eastward along the north and south park lines and sloping downward as indicated, will be built when the park work reaches a point that will make them necessary.

The Great Lakes Dredge & Dock Company, Chicago, has the contract for building the wall. It is to be finished by the end of the year, and the work is being prosecuted day and night. The wall was designed and is being built under the supervision of Mr. R. E. Gaut, Engineer of Bridges of the Illinois Central, Mr. H. H. Hadsall, Assistant Engineer of Bridges, being directly in charge, aided by Mr. J. N. McLoughlin, Assistant Engineer.



End Elevation of Retaining Wall.

Forms for Concrete Retaining Wall.

Improvements of the New York Central & Hudson River Within the Electric Zone.*

The two previous articles (*Railroad Gazette*, October 20 and November 10) described the physical improvements made necessary by the change of motive power and the enlargement of the terminal facilities. This article will describe the electric equipment.

Power Houses.

The current for operating trains in the electric zone will be generated at two power stations, at Yonkers, on the Hudson Division, and at Port Morris, on the Harlem Division, the two stations being cross-connected and each having an ultimate capacity of 30,000 kilowatts, which is sufficient to carry the entire load of a train service much greater than that now operated by steam.

The main buildings which enclose the boiler rooms, coal bunkers and the generating rooms are 167 ft. wide, 237 ft. long and 105 ft. high. The switch houses are separate buildings located about 40 ft. from the main power stations. The locations adopted, besides being near the load centers of the electric traction system, are on the waterfront and are also adjacent to existing tracks, so that coal can be delivered by boat or car.

At Port Morris the solid rock is sufficiently near the surface to warrant carrying the concrete foundation down to it, and at Yonkers a bed of hard sand and gravel forms a good bottom for a pile and concrete foundation on the particular location selected, whereas borings taken along the river front over all other portions of the territory near the load center of the electric zone showed either a great depth of silt or other unfavorable conditions.

At Port Morris a concrete bulkhead, built along one side and the outer end of the building to form a slip and dock, was used as a portion of a cofferdam for excavating the foundation, an existing embankment over a sewer forming one wing to reach the shore and a timber cofferdam forming the other. An intercepting ditch on the land side caught the water which drained in from a swamp, and this, together with the seepage through the cofferdam, was easily disposed of with pumps. Excavation was made to rock over the entire area covered by the buildings. In some places the rock was disintegrated and in others it was extremely hard. The surface also was very irregular, making a wide variation in the height of the piers, the maximum height being about 32 ft. A portion of the rock was excavated in order to build the intake and discharge tunnels of the circulating system for the condensers at the proper elevation.

At Port Morris the piping for steam and other connections to the turbine room is carried through tunnels under the floor of the power house. After building the tunnels and piers for columns and foundations for the generators and boilers, the area was filled with sand up to the level of the floor. The concrete floor and walls of the pipe tunnels which extend below the water line are waterproofed with alternate layers of coal tar pitch and felt.

The work on the foundations included 26,000 cu. yds. of earth excavation; 4,500 cu. yds. of rock excavation; 16,500 cu. yds. of concrete; 5,000 sq. yds. of waterproofing, and 25,000 cu. yds. of back filling. The slip and bulkhead wall required 11,000 cu. yds. of earth excavation; 5,000 cu. yds. of rock excavation, and 2,500 cu. yds. of concrete.

The Yonkers power station is built entirely on land under water at a point where the main line of the Hudson Division runs along the bank of the Hudson river with only a riprapped slope outside of the tracks. The land on the other side of the tracks rises abruptly and is valuable for residential purposes. On the site selected for the power station the water runs from a depth of 8 ft. near the shore to 16 ft. at the outer end, the bottom being sand and gravel. As the first step in construction, the piles forming the foundation, spaced in general 3 ft. apart under walls, piers and machinery and somewhat further apart under the floor, were driven to refusal, four marine pile drivers being employed in the work. The area was then surrounded with a cofferdam formed of a single course of 12-in. x 12-in. timbers with 3-in. x 4-in. strips spiked to the edges so as to form a tongue and groove joint. The driving point of each timber was beveled on the edge away from the timber previously driven in order to force them as close together as possible, and great care was taken to see that no pebbles or other obstructions were allowed to get between the timbers and open the joint. Some of the joints which leaked between high and low water as the water was being pumped out were battened with canvas and a few joints under water were caulked by a diver. When the water was finally pumped out, however, there was no difficulty in keeping the bottom dry with an 8-in. pump, although the interior was excavated to a depth of about 20 ft. below the surface of the water at the outshore end. The piles were in general cut off at an elevation of 8 ft. below mean high water and the bottom of the concrete foundations was laid 1 ft. below the heads of piles or at an elevation — 9 ft.

Under the intake and discharge tunnels for the circulating system for the condensers the bottom of the concrete reached a depth of about 18 ft. below high water, and under the tunnel for the coal and ash hoist, a depth of 13 ft. In the Yonkers power house there is no pipe tunnel under the floor as at Port Morris, the piping in the turbine room being carried under transverse galleries.

The main bed of the concrete foundation is 4 ft. thick, bringing the elevation up to — 5, above which the walls and piers for the superstructure and machinery are carried up individually, the spaces between being filled with sand up to elevation 0, over which a 6-in. concrete floor is laid.

Waterproofing consisting of alternate layers of coal tar pitch and felt is laid in a horizontal plane in the concrete bed at an elevation 6 in. above the tops of piles and is carried up the side walls above high water. Six-ply waterproofing is used in all horizontal planes, five-ply in all vertical planes in the building, and four-ply around all ducts exposed to surface or tide water.

In order to take up any tensile stresses in the foundation two courses of round steel rods 1 in. in diameter are laid in each direction at right angles to each other in the bed of concrete above the plane of the waterproofing. The foundation work includes 5,540 piles, 16,500 cu. yds. of concrete, 270 tons of reinforcing rods, and 9,000 sq. yds. of waterproofing.

Aside from the foundations, the two power stations are similar in design. The base and floors are of concrete, the framework of steel, all designed so as to give no inaccessible surfaces; the walls are brick and tile, and the roofs are of concrete roofing slabs covered with copper, with standing seam joints. There are 2,800 tons of steel structure in each power station. There are two Custodis radial brick stacks, 15 ft. 6 in. inside diameter, and 250 ft. high above grates at each power station. They are supported on steel columns and a concrete and steel staging 40 ft. above the boiler room floor, the main boiler room alley passing underneath.

In interior arrangement the power stations are divided by a brick wall into the turbine room, 69 ft. x 231 ft. 8 in., which is open to the roof, and a boiler room 88 ft. x 231 ft. 8 in. over which the coal bunkers of 3,500 tons capacity are placed.

At Port Morris there are three galleries on one side of the turbine room, the first gallery being used as a shop, the second as an operating gallery, and the third for offices. At Yonkers the level of the first gallery is carried across the room as the operating floor with walkways between the generators. The exciters are placed under the galleries on the level of the operating floor, the operating gallery being immediately above them and the top gallery being used for offices and shops.

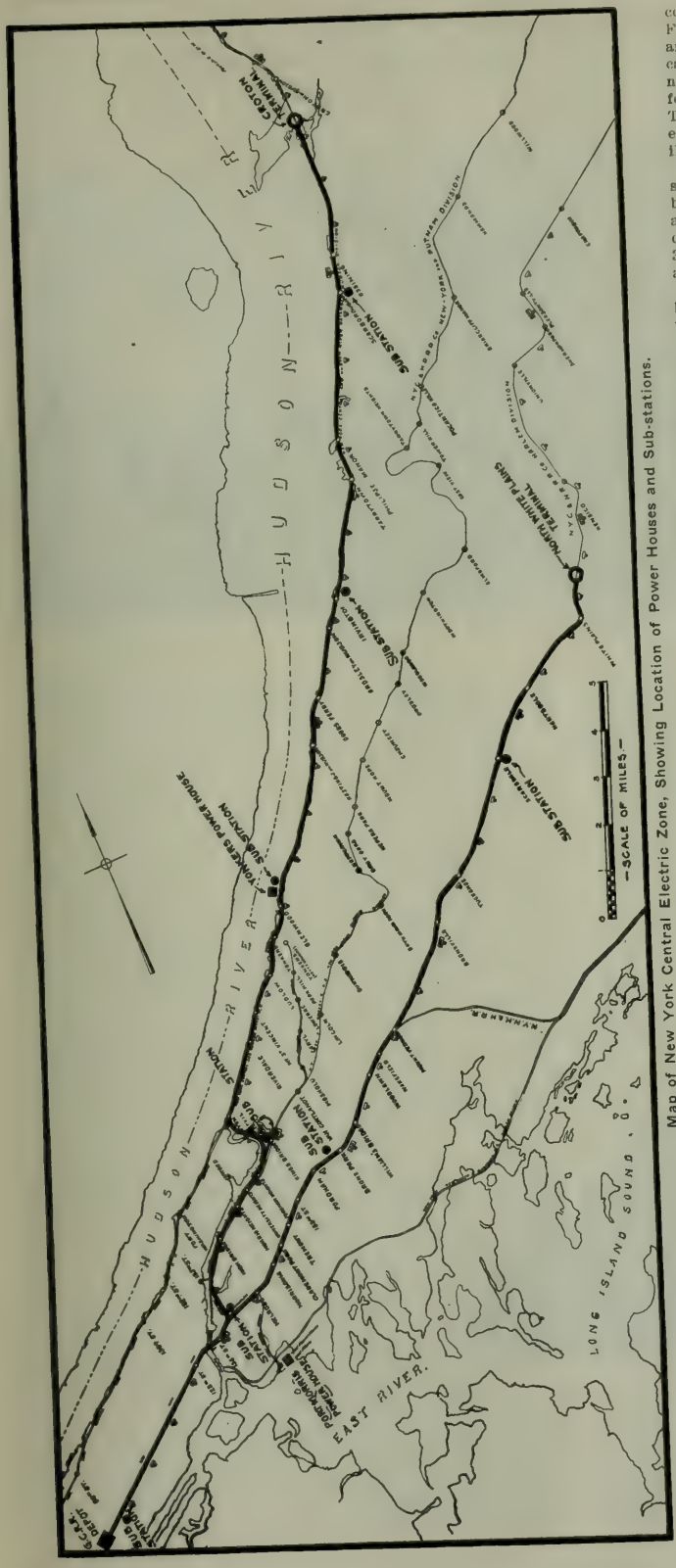
Coal delivered at the power stations on cars is dumped from the cars into pockets from which it is delivered by suspended-flight scraper conveyors into the hoppers of crushers, where it is reduced to the proper size for handling with the mechanical stokers. From the crushers it passes into a pocket conveyor which lifts it to the top of the building and delivers it to longitudinal conveyors of the suspended-flight scraper type which dump it into the coal bunkers over the boiler room. From the bunkers it is delivered through vertical down-spouts to Roney mechanical stokers, operated by steam.

The ashes drop from the grates into hoppers from which they are collected in push cars of one ton capacity running in an ash tunnel in the boiler room basement. These cars are dumped into a hopper from which the ashes are lifted by means of a bucket conveyor into an ash storage bin directly over the coal trestle, from which they can be dropped through a spout in the bottom of the hopper into a car. Cars on the trestle are spotted by means of an electric winch. Coal delivered by boat is hoisted in a clam-shell bucket of one ton capacity, operated by a steam hoist.

The coal handling capacity is 80 tons per hour and the ash handling capacity is 25 tons per hour. The maximum coal consumption at the power stations will be about 220 tons per day. Aside from the hoist for unloading coal from boats, which is steam operated, the coal handling apparatus is all driven by electric motors. The conveyors are driven by 220-volt, three-phase induction motors, varying in capacity from 7½ h.p. for the ash conveyor to 40 h.p. for the coal crusher and conveyors.

Each power station has a battery of 24 Babcock & Wilcox water-tube boilers, rated at 625 h.p. each, all located on one floor and arranged 12 on each side of a central alley. The total heating surface of each boiler is 6,250 sq. ft. and the grate surface is 112 sq. ft., giving a ratio of 55.8. The boilers are designed for a normal working pressure of 185 lbs. and the steam will be superheated to 200 deg. Fahr. above the temperature due to steam pressure. The superheaters in each boiler will contain 1,230 sq. ft. of heating surface, and they are made up of 168 2-in. tubes each 13 ft. 5 in. long. Each section of the power station containing four boilers is equipped with one boiler feed pump of the duplex outside-packed piston type. The pumps are designed for hot water and each pump has a capacity to supply eight boilers under full load conditions. The feed water heaters are of the closed type

*By G. R. Wadsworth, late with the New York Central, and J. C. Irwin, Assistant to the Vice-President, New York Central.


HUDSON RIVER
HUDSON RIVER
EAST RIVER.
LONG ISLAND SOUND
CROTON TERMINAL
SUB STATION
NORTH WHITE PLAINS TERMINAL
SUB STATION
SUB STATION
YONKERS POWER HOUSE
SUB STATION
SUB STATION
SUB STATION
SUB STATION
SUB STATION
HARLEM RIVER POWER HOUSE
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SUB STATION

negative bus. The battery has two end cells on the positive side. One positive bus serves for field excitation of the 5,000 k.w. generators only, while the other serves for certain lights and motors in the station.

The stations will be operated from the operating gallery on the north side of the turbine room. The arrangement of the switchboards in this gallery is symmetrical and all cables and copper connections running to the switchboards are carried in concrete trenches under an Alberene stone floor. The main operating switchboard containing all the control switches and the instruments necessary for the operation of the station is located in the center of the operating gallery. A set of two exciter switchboards is located on each side; the main operating switchboard as well as the exciter switchboards are enclosed in an operating booth constructed of steel and wire glass. Three field switchboard panels are located outside on each side of the operating booth. An a.c. and a d.c. light and power switchboard on either end of the operating gallery complete the switchboard installation in the turbine room.

At both power stations switch houses have been provided separate from the main building with the idea of obtaining the best conditions for the installation of high tension switching apparatus and at the same time increasing the safety of operation. At Port Morris the switchhouse is 50 ft. 10 in. wide by 100 ft. long. At Yonkers the switchhouse and the sub-station for that district are combined in one building 37 ft. 4 in. wide by 255 ft. 4 in. long; the switchhouse occupying 147 ft. 8 in. of the length and the sub-station 107 ft. 8 in. In the switchhouses are installed the high tension switching equipment consisting of bus-bars, oil switches, instrument transformers, etc.: also such instruments as are required for the complete equipment of generating stations but which are not essential for the operator. The switchhouse also contains auxiliary boards which allow the main operating switchboard in the turbine room to be put out of service if it should be desirable for the purpose of cleaning and repairs. These boards will also permit the operation of the station should the main operating board become disabled by an accident.

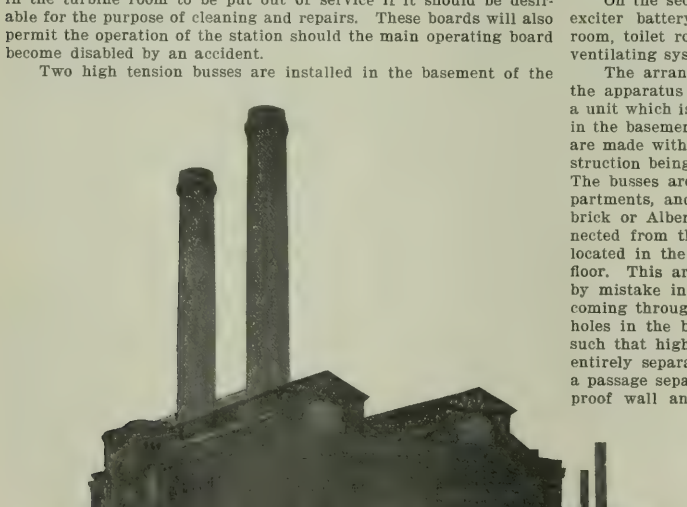
Two high tension busses are installed in the basement of the switchhouses to which the generators are connected by means of a main switch and two selector switches. The feeders are equipped with selector switches only. Overload relays are installed in the generator and feeder circuits, but the generator relays will operate only under very extreme conditions. In the generator circuits, in addition to overload relays, reverse current relays will be installed; these, however, are connected to indicating lamps only, not tripping the oil switches. All relays are of the inverse time limit, bellow type.

All high tension connections and apparatus are located in the basement of the switchhouse and no such apparatus is located on the first floor, except the oil switches to which connections are made from the basement through the floor. The basement is made inaccessible to any but authorized workmen, and by removing the high tension apparatus from the power station itself into a confined space in a separate building the danger of coming in contact with high tension apparatus is reduced to a minimum.

Cable Tower, Transmission Line and Typical Four-Track Roadbed.

On the second floor are located the load despatcher's office, the exciter battery with booster and switchboard, laboratory, storeroom, toilet rooms and the apparatus for the hot air heating and ventilating systems.

The arrangement of oil switches and connections is such that the apparatus belonging to one generator and three feeders form a unit which is entirely separated from the others by fireproof walls in the basement. All connections between oil switches and bus-bars are made with bare copper tubing 1¼ in. outside diameter, the construction being such that practically no insulators will be required. The busses are enclosed in vertical brick and Alberene stone compartments, and all high tension connections will be separated by brick or Alberene stone barriers. The oil switches can be disconnected from the high tension system by means of knife switches located in the bottom of the oil switches accessible from the first floor. This arrangement prevents accidents which might be made by mistake in disconnecting switches from live parts. All cables coming through the duct system from the power house enter manholes in the basement of the switchhouse, the arrangement being such that high tension cables enter the high tension compartments entirely separated. Low tension cables enter through manholes in a passage separated from the high tension compartments by a fireproof wall and are brought up in enclosed chases in the wall, so that they are positively insured against any accidental connection with high tension conductors. The oil switches have a rated capacity of 500 amperes, except the bus-tie switches, which have a rating of 1,200 amperes. The switches are of the motor-operated type, H-3, and have all recent improvements.



Elevation of Yonkers Power House.

All high tension cables and the majority of the single conductor low tension cables are cambric insulated and lead covered, the insulation being $^{10}/_{32}$ in. for high tension cables and $^{7}/_{32}$ in. for low tension cables, with a lead cover of $^{3}/_{32}$ in. Multiple conductor cables for instrument and control wiring have a combined cambric and rubber insulation. Single conductor cables will be used for connecting the generators with the oil switches.

About 1,000 incandescent and 36 arc lamps will be required for lighting the Port Morris power station, and 1,000 incandescent and 42 arc lamps for lighting the Yonkers power station. The amount of power required for operating auxiliary machinery equals 240 h.p. a.c. and 180 h.p. d.c. at Port Morris, and 260 h.p. a.c. and 180 h.p. d.c. at the Yonkers power station.

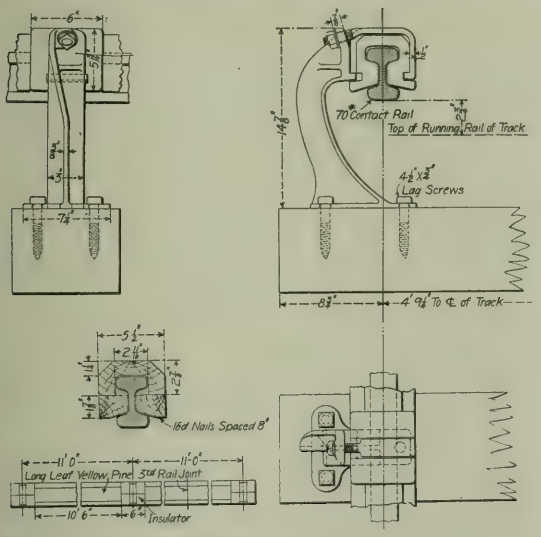
In each power station a load despatcher's office has been ar-

ranged for the proper distribution of power over the system, and in order to give quick relief in case of accident or trouble. Only one of these will be in service at a time. Each load despatcher's office will be equipped with a record board indicating by means of lights and plugs which generators, lines, rotaries, etc., are in or out of service, and which switches are open or closed. An independent telephone system exclusively for the use of the load despatcher, interconnecting both power stations, all sub-stations and the train despatchers in the electric zone will be installed.

The principal contractors on the work are as follows:

Foundations at Yonkers	Walter Butler.
Foundations at Port Morris	D. C. Weeks & Son.
Steel work—both power stations	American Bridge Co.
Superstructure at Yonkers	Butler Bros. Const'n Co.
Superstructure at Port Morris	Thompson-Starrett Co.
Turbo-generators & compl. switch. equipmt.	General Electric Co.
Exciter storage batteries	Electric Storage Battery Co.
Boilers	Babcock & Wilcox Co.
Piping	M. W. Kellogg & Co.
Valves	Best Manufacturing Co.
Stacks	Alphons-Custodis Chim. Con.Co.
Condensers	Henry R. Worthington.
Feed-water heaters	Taunton Locomotive Mfg. Co.
Boiler feed pumps.	Eppinger-Carpenter Co.
Flues	B. F. Hart, Jr., & Co.
Coal and ash-handling apparatus	Exeter Machine Works.
Mechanical stokers.	Westinghouse Machine Co.
Electric traveling cranes	Alfred Box Co.
Light and power equipment	Thompson-Starrett Co.

The 11,000 volt, three-phase a.c. will be fed through high-tension transmission lines to eight sub-stations, where the primary current will be transformed into 660 volt d.c. and fed to the working conductors. The sub-stations will be equipped with rotary converters and with storage batteries. The power houses and sub-stations will be so connected that all sub-stations can be operated from either of the main generating stations. The accompanying map shows the location of the power houses and the sub-stations.


70 Contact Rail
Top of Running Rail of Track
4 1/2" x 3" Lag Screws
4' 9 1/2" To ℄ of Track
160 Nails Spaced 8"
Long Leaf Yellow Pine
3rd Rail Joint
Insulator

Detail of Supporting Brackets and Wood Protection, New York Central Type of Third-Rail.

For the working conductor, or third-rail, the company has adopted the inverted or suspended type of construction, the contact being on the under head of the rail. The rail is made in special rolls of dumbbell cross sections with flattened heads, and will be protected with continuous tight fitting wooden sleeves or blocks which cover the entire surface of the rail except the contact surface. At crossings and in important yards an overhead conductor will replace the third rail, the contact shoes on the motors, even at maximum speed, engaging automatically with the conductors. For a complete description of the third-rail installation the reader is referred to the *Railroad Gazette*, September 1, 1905, p. 198.

The transmission lines will be underground in the immediate vicinity of Manhattan, and further out aerial lines on steel poles will be used. Through Park avenue tunnel and Harlem depression the ducts will be suspended on the sides of the masonry walls of the tunnels. Along Park avenue viaduct the transmission cables will be carried in special construction on top of the side girders. In connection with the new roadbed for four-tracking, the cables will be carried in separate subways on either side, or aerially. The telegraph line will in all cases be carried along the side of the right of way opposite to the ærial transmission line. The underground conduits with splicing chambers and appurtenances for the electric transmission cables will be constructed in duplicate throughout to insure the utmost reliability of service.

Suburban trains will be operated with the multiple unit control system, in general the same as now in use on the elevated and subway lines in New York City. The steel motor cars which will be used in suburban service were described in the *Railroad Gazette*, November 3, p. 424.

All through or express trains will be hauled by electric locomotives south of Croton and White Plains terminals, where the change will be made from steam to electric operation. The terminals will include engine houses, turntables, facilities for coal and water as well as for minor repairs. In short, the requirements of a division terminal for steam locomotives have to be met together with those for electric equipment. For the latter there will be provided repair shops for the overhauling of the electrical equipment, car shops and storage yard for suburban cars, drop pits for the inspection and replacing of motors, and other facilities to meet the needs of the new type of equipment.

The company has ordered for the new service 35 electric locomotives from the General Electric Company and the American Locomotive Company, joint builders. These locomotives will be 37 ft. long over all, 27 ft. total, and 13 ft. rigid wheel base, consisting of four pairs of driving wheels with one pair of pony truck wheels at either end. The locomotives will weigh 97 tons of which 70 tons is on the four driving axles. The Pacific type, the heaviest passenger locomotive of this company, weighs 170 tons, of which 70 tons are on the driving axles. For every pound of effective drawbar pull the electric locomotive weighs less than one-half the steam locomotive, giving a consequent greater weight available for traction with less dead weight and less weight per axle. The impact, due to the reciprocating action of the counterbalanced drivers of the steam locomotive, so destructive to roadbed structures, is wholly absent in the electric locomotive.

Four 600-volt d.c. gearless motors of 550 h.p. each, one on each driving axle, will furnish the power, giving a normal rating of 2,200 h.p., with a maximum rating of about 3,000 h.p., or 50 per cent. in excess of the steam passenger locomotive weighing nearly twice as much. The locomotives will be fitted with the usual bell and whistle signals, electric air compressors for braking purposes, electric headlights, etc. Provisions will be made for heating water for supplying steam for the train heating system. The locomotives are double-ended and controlled from either end so that turning is unnecessary.

The system of multiple unit control has been adopted for the locomotives as well as for the suburban motor cars. This system makes possible the control of two or more locomotives coupled together from the head locomotive, giving absolute unity of tractive effort from a single point of control, a condition impossible with steam locomotive grouping. This system of control, with the possibilities in the variations in speed and power, effected by changing the relation of the motors from four in series through the intermediate steps to four in multiple, allows this one type of electric locomotive to replace and do the varied work of the many classes of steam locomotives in present use. From a switch engine at six miles an hour, the same unit may at will be transformed for express service at 75 miles an hour. One unit with proper motor coupling serves to haul a 200-ton train, and the same unit with another unit coupled will haul a 1,000-ton train. All these combinations of power are adapted to quickly meet the conditions giving consequent economy of operation.

The railroad company has built just west of Schenectady six miles of experimental track equipped for electric operation. Here all appliances are put to actual service tests before their adoption as standards for the work of electrification in the vicinity of New York. The first high-speed test of the electric locomotive was held with eminently successful results on this experimental track on Nov. 12, 1904, in the presence of the Electric Traction Commission and many distinguished guests.

The design and installation of electric equipment and appliances is in charge of the Electric Traction Commission of the railroad company, which consists of Mr. Wm. J. Wilgus, Vice-President of the N. Y. C. & H. R., Chairman; Mr. John F. Deems, General Superintendent of Motive Power; Mr. Bion J. Arnold, Consulting Engineer and Past President of the American Institute of Electrical Engineers; Mr. Frank J. Sprague, Consulting Engineer and Past President of the American Institute of Electrical Engineers, and Mr. George Gibbs, Consulting Engineer, with Mr. Edwin B. Katte, Electrical Engineer of the railroad company, as Secretary to the Commission.

At some points the improvements are well under way, and the company anticipates the adoption of electric power, at least through Park avenue tunnel to temporary terminals north of the Harlem river well in advance of the date fixed by law, June, 1908. This proceedure of electrifying an initial zone to temporary terminals, in advance of completing the entire territory is now under way. The company desires as speedily as possible to abate the smoke nuisance through the tunnel, not only to afford relief to

the discomfort of its patrons, but also to make possible more frequent and faster train service through the tunnel to relieve in a measure the congestion of traffic at the station, and so facilitate the execution of the Grand Central yard improvements.

The entire improvements as outlined, involving an expenditure of some 60 million dollars, are under the direct charge of Mr. Wm. J. Wilgus, Vice-President of the company.

The Cost of Locomotive Operation.

XVI.

BY GEORGE R. HENDERSON.

(*Continued from page 450.*)

FIREMEN.

This cost is almost identical, in its nature, with that considered in Article XIV, page 421, but the rates are less. We shall exhibit rates for firemen on the roads previously illustrated, and so that these schedules may be identified with those for engineers, will simply affix the letter "f" to the number; thus, schedule "1" for engineers and "1f" for firemen cover the same territory.

Schedule 1 f.

Compensation of firemen in passenger service.

Rate per 100 Miles or Less per Day.

	Districts— A.	B.	C.	D.
8-wheel locomotives	$2.10	$2.25	$2.25	$2.10
10-wheel: less than 50 tons on drivers	2.20	2.35	2.36	2.30
10-wheel: more than 50 tons on drivers	2.30	2.45	2.45	2.40
Prairie	2.35	2.50	2.50	2.45
Mogul	2.35	2.50	2.50	2.45
Consolidation:				
Less than 67 tons on drivers	2.30	2.64	2.50	2.45
More than 67 tons on drivers	2.35	2.64	2.50	2.45

Over 100 miles will be paid pro rata.

Schedule 2 f.

Rate per 100 Miles or Less per Day.

	Districts— A.	B.	C.	D.	E.	F.	G.
8-wheel locomotives	$2.30	$2.30	$2.49	$2.39	$2.39	$2.60	$2.30
10-whl.: less than 50 tns on drvrs	2.40	2.40	2.60	2.49	2.60	2.60	2.40
More than 50 tons on drivers	2.50	2.50	2.70	2.60	2.60	2.60	2.40
Prairie	2.60	3.10	3.10	3.00	3.00	2.60	2.40
Mogul	2.60	3.10	3.10	3.00	3.00	2.60	2.40
Consolidation:							
Less than 67 tons on drivers	2.49	2.49	2.60	2.58	2.58	2.60	2.49
More than 67 tons on drivers	2.60	3.10	3.10	3.00	3.00	2.60	2.58

Over 100 miles will be paid pro rata.

It will be here noticed that the variation is different from what it is in the engineer's schedule. In that, the 8-wheel and light 10-wheel engines paid the same rate throughout—here it is different in all but one instance. Again, schedule 2 allowed the same for all engines on district G; here there are four different rates on this district. Very often a rate is made for a certain class of engine on a district upon which it does not run, this being considered a concession; and while it may appear irregular, it does not really affect the cost. Again, the enginemen and firemen belong to separate organizations, and these matters are usually taken up with them at different times, thus causing inconsistencies in the rates. In a general way, it will be noticed that the firemen's pay is, in these schedules, about five-eighths of that for engineers.

On local freights there is an extra allowance of 15 cents per 100 miles. Helper engines entitle the firemen to from $2.53 to $3.10 per day of 12 consecutive hours, with overtime pro rata. If over 100 miles are made within the first 12-hour shift, one-tenth of the daily rate per hour will be paid for the excess, but all work after 12 hours is paid by the hour. These are the rates in mountain territory—on the plains they run from $2.15 to $2.45, depending upon the size of the engine.

In switching service the rate runs from $1.90 to $2.30 per day of 10 hours. If called and not used, 33⅓ miles are allowed, as for the enginemen. These special rules are practically the same as in force for the enginemen.

Schedule 3 f.

Road Service.

Class of Engine.	Passenger.	Freight.	Way Freight.
8-wheel, 18 in. cylinder and under	$2.25	$2.30	$2.50
8-wheel, 19 to 21-in. cylinders	2.35	2.35	2.50
Atlantic type	2.40	2.40	2.70
10-wheel, 18 and 19-in. cylinders	2.50	2.60	2.80
10-wheel, 20-in. cylinders	2.60	2.75	2.90

These rates are for 100 miles or less, and freight mileage over 100 miles is paid pro rata. Switching service is paid $1.95 and $2, and 2,600 miles per month are guaranteed to all assigned men.

Schedule 4 f.

	Passenger. — Un-			Freight — Un-		
Districts	Mountain.	dulating.	Level.	Mountain.	dulating.	Level.
8-wheel locomotives	$2.25	$2.10	$2.15	$2.49	$2.45	$2.45
10-whl.: weight on drivers:						
Less than 50 tons	2.36	2.25	2.25	2.65	2.58	2.58
More than 50 tons	2.45	2.35	2.35	2.70	2.60	2.60
Prairie	2.50	2.35	2.35	3.10	2.70	2.70
Consolidation:						
Less than 67 tons*	2.50	2.35	2.35	2.85	2.60	2.60
More than 67 tons	2.50	2.35	2.35	3.10	2.70	2.70

*Weight on drivers

These rates are for 100 miles or less per day; all over 100 to be paid pro rata.

Schedule 6 f.

Rates per Mile in Cents.

Passenger service	1.79 cents.
Through freight	2.23 "
Local freight	2.36 "

Runs less than 100 miles are governed by a special list. Short runs are treated the same as for enginemen.

Most of the rates for firemen are about five-eighths, or 62 per cent. of the rate for enginemen, except in the last schedule, where they are very little over one-half. The same comments will apply here, on the bearing of these rates to cost of transportation, that were made in article XV, page 450. Generally, overtime arrangements are the same for firemen as enginemen, being usually equivalent to 10 miles an hour as of the rate and classification on which they are employed. Some roads, however, have a fixed rate, as we found for enginemen in a couple of cases. Thus on the road in the west, where the engineers received 36 and 32½ cents per hour, we find that full-rate firemen are paid 22½ cents per hour and junior firemen (first year) 20 cents. On the eastern road quoted, firemen receive 19 cents per hour in passenger service and 22 cents in freight. The methods used in computing overtime are the same as for enginemen.

The other items which were considered in our last chapter, viz., Delayed Time, Constructive Mileage, Pooling and Effect of Speed, need no further examination here, as the same arguments and considerations will apply as well to the left hand side of the engine as to the right. For ordinary estimates and statements, we can take 1⅝ times the amount paid the engineman to represent the wages of the engine crew (engineman and fireman) and use the rules and schedules given in article XV.

Hostling and Turning.

It is customary in this country, for enginemen of incoming trains to leave their locomotives on some designated standing track, where the "hostler" or "engine despatcher" takes it and places it successively by the coal trestle and water tank or stand pipe, filling up the tender, the ash pit, to have the fire cleaned, and over the turntable and into the roundhouse. This proceeding may be modified in some cases, but in general it follows the above schedule. In taking engines out of the house, in some cases this is done by the enginemen, and in others by hostlers; passenger locomotives, having definite leaving times, are more usually taken out by their own crews.

In many cases the wages of hostlers go into a general account of "roundhouse labor," which includes wiping, inspection and various other small charges. The *Railroad Gazette* of Feb. 19, 1904, however, gave considerable data on the various details of roundhouse charges, from which we gathered the following points:

Cost of Hostling per Engine.

An Eastern railroad, from	39 to 54 cents.
A Southern railroad, from	15 to 78 "
A Western railroad, averaged	33 "
Another Western railroad, averaged	80 "

There is a great variation in these figures, no doubt depending largely upon the conditions existing at different points, and the number of engines cared for. As an average, however, we would expect 50 cents to cover the cost of "hostling" a locomotive.

The cost of turning depends upon the facilities with which the terminal is equipped. If the table be operated by hand, as in days (mostly) gone by, the question of balancing and friction of the table under load will be of great importance. It has been no uncommon thing to see four or even eight men pulling around an engine of great weight upon an old table, too weak for the load and too short to permit the locomotive to be balanced upon it. When this is the case (and it too often is) it is usual to call out the wipers, and as often as an engine must be turned these men drop their other duties and man the bar. The exact cost of such an operation must depend entirely upon the number of engines turned a day, and the size of the gang necessary to move the table.

On the other hand, turntables equipped with motors are very expeditious and save time as well as labor. As a rule, one man is continually on duty to manipulate the table, and when the number turned is very large, requiring rapid work, a helper is sometimes employed to "spot" the engines. At the Chicago avenue roundhouse of the C. & N.-W. Ry. as many as 400 engines are turned a day, many not passing into the house, but merely turning for suburban work. It formerly required four men continually on this table, but the application of an electric motor disposed of this gang, and turned the engines in less than one-quarter the time. In fact, the motor handled the engines with so much ease that at one time, when repairs were necessary, a gang of eight men were put on the table in order not to delay the turning of the locomotives, as the motor had set a pace which the four men previously used could not maintain.

There have been various reports on the cost of turning locomotives by hand and power made at different times to the railroad associations. It is generally conceded that the power turn-

ing is cheaper if the number of engines turned is large. The cost of installing a steam, electric or gasolene motor has been stated to run between $1,000 and $1,200, providing that electric current is available; if a dynamo and engine must be purchased for this work it will double the above cost. The Tatlow motor, operated by air from the compressed supply of the locomotive on the table, will cost only about half as much, but if there is no engine on the table, or if the engine be "dead," the table must be turned by hand.

The cost of turning locomotives by power at six points on the Lehigh Valley for one year was reported as follows:

	Horse power.	Engines per day.	Average cost Per day.	Per engine.
Gasolene motor	5	170	$3.78	2.22 cts.
" "	5	110	3.40	3.09 "
" "	5	194	3.55	1.83 "
" "	5	121	3.41	2.90 "
" "	5	46	2.91	6.50 "
Electric motor	20	140	3.99	2.85 "

This shows the cost fairly constant per day at about $3.50.

From the data given above it should be a simple matter for anyone to estimate approximately the amount which it is costing to turn engines at a given point, by knowing the conditions existing at that locality.

(To be continued.)

Time Freight on the Erie.*

The system of handling and keeping a record of the movement of fast freight on the Erie Railroad differs fundamentally from any of the systems previously described as used on other roads. The principle on which it is based is the grouping of cars containing freight of similar classification from one point to another point and making one manifest for the group of cars instead of for each car separately. This simplifies the telegraphing and introduces no other complications.

All freight on this road is divided into four general classifications as follows: Quick despatch, time freight, continuous move-

ERIE R. R. CO.

CARD WAY-BILL.

QUICK DESPATCH AND TIME FREIGHT | TRAIN NUMBER

Total Weight Car and Lading | Initials | CAR NUMBER

..... Ms.

When transferred, cross out above and enter below initials and number of new car, also total weight of new car and lading.

Date of Way-Bill the..... 190

Billed from

Billed to

STOP CAR

At ..... For .....

At ..... For .....

Lading

Final Destination

CONSIGNEE

When consigned "To Order," "Lift Bill of Lading," etc., so state above.

Roads Routed Over		Junction Points Via
	R.R.	
	"	

When destined beyond point billed to, show routing on line below

ROADS VIA

CAR WEIGHED

At

the... ...190

Weighmaster.

Gross.....
Tare
Lading
Authorized Allowance
NET

Fig. 1—Front of Card Way-Bill for Quick Despatch and Time Freight.

INSTRUCTIONS.

1. Agents must see that they are furnished with Way-Bills for all loaded cars received on Card Way-Bills.
2. Stamps must not be used hereon (on either side) unless authorized.
3. When transferred, show under remarks, date, where, why and condition of freight.
4. When any special or additional information must be shown on Card Way-Bills, enter same under Remarks.
5. When specially instructed or classification conditions require it, Billing Agents must fill in below amount of prepaid or collect.
6. Agents at stop-off stations must show in table below stop-off charges to be collected at destination. When stop-off charges are not to be collected at destination, note under "Remarks" that stops were made, showing dates, etc.

Prepaid $.. To Collect $.....

Special Collection to be Made on this Freight on Delivery | Amount

For ..... At .....

For ..... At .....

Special Debit to Receiving Agent, $

REMARKS

CONDUCTORS WILL FILL IN BELOW MOVEMENT OF CAR.

Train Number	Points Between	Date	Hour	Min.	A.M. or P.M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.
	Left				M.
	Arr'd at				M.

Fig. 2—Back of Card Way-Bill for Quick Despatch and Time Freight.

If only 50 engines are turned it will amount to about 7 cents an engine—if 200 be turned less than 2 cents. Where hand power is used, and, say, three men are required, the cost would probably be 4 or 5 cents per engine, assuming that these men are otherwise employed between turnings. It would probably not pay to install a power outfit on less than 50 locomotives turned in 24 hours; for 75 or more there is little doubt as to the advisability of such an expenditure. Where more than one man is constantly employed on this work, to the exclusion of other duties, it will be a paying investment.

The estimated costs of operation per day of 24 hours, based on turning 250 engines, was given by a committee as below:

Electric motor (without special dynamo)	$3.92
Steam engine	4.40
Gasolene motor	3.95

These figures include labor, fuel or current, supplies and repairs, but not interest and depreciation.

ment, and ordinary. Quick despatch freight and time freight are designated under the generic term "manifest freight." Certain commodities are billed for movement in certain trains as shown in the freight train book and the classification into quick despatch, time freight, etc., is made on the basis of the train in which the commodities are to be moved. Quick despatch freight consists of all commodities billed for movement in trains Nos. 77, 78, 80, 87 and 88. Time freight consists of all commodities billed for movement in trains Nos. 75, 76, 85 and 86. Continuous movement freight consists of all commodities billed for movement in trains Nos. 73 and 74. Ordinary freight consists of all other freight not billed for movement in any of the trains specified above.

Trains Nos. 77, 78, 80, 87 and 88 carrying quick despatch freight

*For previous time freight articles, see Sept. 8, Great Northern; Sept. 29, Southern Railway; Sept. 1, Chicago & North-Western (Sept. 22, Chicago Freight Terminals); August 25, Atchison, Topeka & Santa Fe, and Boston & Maine; August 18, St. Louis & San Francisco.

are fast through trains between Jersey City, Buffalo and Chicago in both directions, making the run from Jersey City to Chicago in 52 hours, and to Buffalo in 21 hours. The classification for train No. 77, for example, is as follows: Merchandise cars covered by loading orders. From New York Terminals—carloads of dried fruits and nuts; import onions for Cleveland and points west of Galion. From New York Terminals, Newark, Newburgh, points via N. Y., N. H. & H. connection at Maybrook, Carbondale, Newberry Junction, Binghamton and points via Binghamton, Rochester—carloads of third-class freight and higher for Jamestown and points beyond. From Marion, Ohio.—Boat freight from N. & W. This train leaves Jersey City daily except Sunday at 7.50 p.m., and Port Jervis daily at 12.55 a.m. Cars loaded for this train are collected at the close of the day from the various freight houses and piers around New York harbor and ferried to Jersey City, where the train is made up. This train picks up and sets out merchandise cars at important points along the route, which are to be delivered to or have been received from small stations beyond. It is run in sections when necessary, cars for points farthest west being given preference in making up the first section. Only air-brake cars are received for movement in this train. The other westbound train of this class, No. 87, leaves Jersey City at 7.05 p.m. daily except Sunday with similar classification of freight for Buffalo and points beyond via the Grand Trunk, Michigan Central, Pere Marquette and the N. Y., C. & St. L. Trains 78, 80 and 88 are eastbound freights originating at Chicago and Buffalo, and carrying the same high-class commodities. They leave daily after the closing of the freight houses and arrive in Jersey City about 56 hours later.

The time freight trains Nos. 75, 76, 85 and 86 run on a slower schedule of 76 hours from Jersey City to Chicago and 29 hours to Buffalo. They carry fourth-class carload freight from New York terminals, Newark, Newburgh, points via Maybrook, Dundee, Binghamton and points via Binghamton, Elmira, Corning and points south, and Rochester to points west, and also certain specified shipments of lower class freight from these points. Division and general freight agents at Pittsburg, Cleveland and other important stations are authorized to instruct agents to card waybill for movement in these trains such other commodities as in their judgment may be necessary in emergency cases. All cars shipped in these trains must be air-braked.

Continuous movement trains Nos. 73 and 74 carry fourth and fifth-class freight between all important stations from Jersey City to Chicago. They make the run between these two cities in 96 hours. Cars in these trains are not manifested. When necessary to fill out any of these fast freight trains, cars of the next lowest classification are used, preference being given to long haul shipments first.

Twenty-six of the principal stations on the road are authorized to manifest fast freight as follows: Akron, Bergen, Binghamton, Chicago—51st street, Cleveland, Corning, East Buffalo, Elmira, Galion, Griffith, Hammond, Hornellsville, Huntington, Jamestown, Jersey City, Kent, Marion, Meadville, North Judson, Ohio City, Port Jervis, Rochester, Salamanca, Susquehanna, Suspension Bridge and Youngstown. Each manifest station numbers its manifests commencing with 1 each day. In telegraphing to the superintendent of transportation a record of these manifests, the station calling precedes its call letters by the date of the month and follows by the number of the manifest. For example: The first manifest reported from Jersey City on October 1 would be sent 1-J.C.-1, and the tenth manifest on October 2 would read 2-J.C.-10. The manifest covering cars for the nearest destination is given the lowest number and manifests for succeeding destinations are given successive numbers. For example: Jersey City forwards freight on manifests destined to Binghamton, Elmira and Chicago. The lowest number would be given to the manifest covering the shipment to Binghamton, the next number to the manifest of cars to Elmira and the highest number to cars for Chicago. Where cars are loaded for points off the company's line they are manifested under the same shipment of cars to the junction point. Thus: No. 77 may have 10 cars out of Jersey City for Huntington and four cars to St. Louis via Huntington. The 14 cars would be covered by the same manifest to Huntington.

As soon as cars are ready for movement from any manifest station they are properly card-billed with the card bills shown in Fig. 1 and Fig. 2. These bills are printed on cards 4 in. x 9¼ in., the bills for quick despatch and time freight cars being printed on red cards, continuous movement freight cars on green cards and ordinary freight cars on manilla cards. These card bills accompany the car in transit and are delivered by the conductor to the agent at destination. If the car is set out before reaching destination the card waybill is left at the set out station with the agent and delivered by him to the conductor picking up the car on the following train.

When the train of manifest freight is ready to be made up the yardmaster or agent makes out a manifest form, Fig. 3, for each consignment of one or more cars to the different stations on the line. These are numbered consecutively and give full information

SIGNAL XI.

ERIE RAILROAD. Manifest Freight.

Office Rec'd from | Sent by | Rec'd by | Time Rec'd

M.

Station Date, 190

A—Manifest Number

B—Movement Billed For

C—Manifested to

Initials of Cars	Car Numbers	Contents	Consignee	Final Destination	Time and Date Rec'd from Conn. or Ready for Transit	* WAY-BILLED			* CARS SET OFF SHORT OF DESTINATION OR END OF RUN			
						Date	From	To	Set Out At Station	Time Set Out	Date Set Out	Cause for Set Out If in Bad Order Give Extent of Damage
D	F	J	M	N	O							

*This Information to be Filled in by Conductors Handling.

Signature, _____

Agent or Y. M.

Fig. 3—Manifest Form for Recording Shipment of Fast Freight.

SIGNAL X2

ERIE RAILROAD. Telegraph Manifest Freight Report.

Office Rec'd from	Sent by	Rec'd by	Time Rec'd	Office sent to	Sent by	Rec'd by	Time Sent
			M. TIME FILED M.				M.

From____ 190

To Superintendent of Transportation,
Jersey City, N. J.

Train No.	Engine No.	Departed	For Station	Conductor
A	B	C M.	D	F

WITH THE FOLLOWING MANIFEST FREIGHT.

MANIFEST NOS.		EXCEPT FOLLOWING CARS LEFT AS PER CAUSE GIVEN		
FROM LOWEST	TO HIGHEST	INITIALS	CAR NUMBERS	CAUSE
J	M	N	O	S

Signature,

AGENT OR Y. M.

Fig. 4—Form for Reporting Departure of Manifest Freight.

SIGNAL X3

ERIE RAILROAD. Conductor's Manifest Freight Report.

Office Rec'd from	Sent by	Rec'd by	Time Rec'd	Office Sent to	Sent by	Rec'd by	Time Sent
			M. TIME FILED M.				M.

To Superintendent of Transportation,
Jersey City, N. J.

*From*____ *190*

Train No.	Engine No.	From Station	Arriving at Station	Time Arrived	Date
A	B	C	D	F M.	J

(SHOW TOTAL No.) ____ Cars of MANIFEST FREIGHT taken from starting point of this train were left at end of run, except as follows:

SET OUT		MANIFEST NUMBERS		CAR		CAUSE FOR SET OUT
At Station	Time	From	To	Initials	Numbers	
N	O	S	U	W	X	Y

The following Cars of MANIFEST FREIGHT were "picked up" en route, between starting point of this train and end of run:

PICKED UP		MANIFEST NUMBERS		CAR		LEFT	
At Station	Time	From	To	Initials	Numbers	At Station	Time
AB	AC	AD	AF	AG	AJ	AM	AN

Signature, ____

Conductor.

Fig. 5—Form for Reporting Arrival of Manifest Freight Trains at Division Points.

NO. OF CARS	MANIFEST NUMBER	DESTINATION	READY FOR TRANSIT	MOVEMENT BILLED FOR	DEPARTED FROM			"SET OUTS" AND "PICK UPS"	ARRIVED		DEPARTED			"SET OUTS" AND "PICK UPS"	ARRIVED		DEPARTED			"SET OUTS" AND "PICK UPS"	ARRIVED		
					Date	Time	Train		Date	Time	Date	Time	Train		Date	Time	Date	Time	Train		Date	Time	D

Fig. 6—Form for Keeping Permanent Office Record of Movement of Manifest Freight.

as to the car numbers, initials, contents, destination, etc. They are made out in triplicate. One copy is furnished to the conductor of the train in which the cars covered thereby are to go forward. The second copy is transmitted by telegraph to the office of the superintendent of transportation within one hour after the train has departed. The third copy is indorsed with the train number, time and date cars were forwarded and sent to the agent at destination by train mail so as to reach him before the cars arrive if possible. Separate manifests are always made out for quick despatch and time freight shipments even if the cars go forward in the same train to the same destination. The conductor's copy of these manifests accompanies the card waybills and is endorsed by each conductor on the back with the time received and time delivered to the next conductor taking the train forward. When a car is set out which is only part of the manifest, the manifest goes forward with the remainder of the cars, the conductor endorsing on the face particulars of time, place and cause of set-out. If a number of cars constituting an entire manifest shipment are set out the conductor's blank is left with the agent and properly endorsed with time, place and cause of set-out as before, the conductor of the following train picking up the cars taking the manifest and delivering it with the cars at destination. The agent at destination returns the conductor's copies as received to the superintendent of transportation for recording and filing.

As soon as a train handling manifest freight has departed the yardmaster or agent fills out the blank, Fig. 4, showing the manifests forwarded by that train and the cars left behind, if any. When the manifests run in consecutive order only the first and last numbers are given. For example: From 1-J.C.-1 to 1-J.C.-10, or from 1-J.C.-1 to 1-J.C.-5, 1-J.C.-7 to 1-J.C.-10. If no manifest freight is forwarded the agent writes "None" across the face of the blank and reports the departure of the train as usual. One of these reports is made after the departure of the train from each manifest station along the route and serves as a passing report. This information is telegraphed to the superintendent of transportation within an hour after the train has left.

The conductor's manifest freight report, Fig. 5, is used to report the arrival of trains at division points. If no cars have been set out or picked up the conductor writes "None" across the face of the blank and it is telegraphed in to the superintendent. If cars have been picked up or set out full information is given in the spaces provided and telegraphed by the code letters.

Manifest freight originating at non-manifest stations is card-billed on a red card and forwarded by first train to the first manifest station and the agent there will add the car to one of his own manifests or make out a new manifest the same as if the freight originated at his station. Local merchandise freight for intermediate stations travels in manifest trains to the last division terminal reached before distribution begins and is forwarded from there in way trains.

The records in the office of the superintendent of transportation are not kept by means of a train board but are entered as received on large sheets ruled as in Fig. 6. These sheets are bound in book form for filing. The sheet shows the number of cars in each manifest, manifest number, destination, time ready for transit, train number in which freight goes forward, time of departure and date of set-outs and pick-ups. There are nine columns across the page for recording set-outs and pick-ups for any one manifest. One of these sheets is used for recording the day's movement of manifest freight from each manifest station.

We are indebted to Mr. C. C. Riley, Superintendent of Transportation, for the data from which this article was prepared.

The Incorporation of Labor Unions.

BY HOWARD R. BAYNE.

Among the remedies discussed and advocated by different publicists for the unrestrained ills of labor unions, the incorporation of them has been strenuously advocated as protection to the public against the disastrous results of irresponsible power. The unions do not like the suggestion, and as the recommendation involves, of course, incorporation made compulsory by law, they argue with much force that such enactments would mean deprivation of natural rights and encroachment upon the liberties of the citizen. But if the results were, on the whole, beneficial, the arguments of the labor unions would have to go the way of other arguments occasionally made against the tide of advancing civilization.

At a recent meeting of the American Bar Association, the president in his opening address announced the somewhat startling doctrine that as civilization advances the liberties of the individual become fewer and narrower. The learned gentleman illustrated his meaning by references to laws and ordinances which were unknown to our ancestors but are quite familiar to us. Such as the Health Law, the Game Law, the Factory Law, the Tenement House Law, the Building Code and that large body of unknown and unknowable municipal ordinances, which a citizen gets an inkling of, now and then, in the police court by the illuminating experience of a fine for unconsciously breaking them.

If a hundred years ago, all at once, one of our liberty-loving ancestors had been informed, as we are daily informed, that he couldn't keep his sick son in his own home, that he couldn't shoot his own game on his own premises, that he couldn't run his own factory in his own way, that he couldn't maintain his own tenements as he saw fit, that he couldn't build on his own land as he had planned, we can imagine the indignant astonishment and the choleric protest with which these prohibitions and limitations upon his inalienable rights would be received by him. And yet we in our day have come to think them quite right and to wish and work for even greater, or at least further, encroachments upon the liberties of the individual in the interest and for the welfare of the community at large.

It is quite true, liberty is fullest in barbarism; restraint is greatest in civilization. Strange as it may seem, it is a law that liberty recedes as civilization advances. The converse is equally true that as liberty advances, civilization recedes.

Labor unions, contrary to the common impression, do not furnish an exception to this law. It is true that such bodies originate strikes and strikes are generally productive of that barbaric liberty which enables one to knock down another at will. And labor unions are the result not of barbarism, but of a high degree of civilization.

But the excesses of the unions are no more to be attributed to civilization than the ruin wrought by misdirected power is attributable to steam or electricity. Like every other product of civilization, full of power and energy, the union needs care in handling and regulation in operating.

The union is a phase of industrial development which is neither to be ignored nor combated. Like other combinations it is a result of conditions peculiar to the times. These combinations are not accidental or adventitious. They are growths, natural and useful, from the soil of industry. They are not to be dreaded, but cultivated, trained and regulated to bear their best fruit for mankind. It is no answer to this, that they are not so worked, or that they will continue to be not so worked, for a long time to come. Study and discussion, aided by experience, will do for the union what they have done for other means of elevating mankind and making more effective and useful its energies.

How may we help the union to work out speedily and well its destiny?

This is the question we have got to answer, sooner or later. We may shun it, but we cannot escape it. We may suppress it, but it will not down. The union has come to stay with us and we have got to make the best of it and the most of it. And when we do this, the union will rise and shine. It will take its place among the factors of civilization, working out great results for us all, a very present help in time of trouble. That may be a long time off, but it is bound to come in the end.

It is argued in favor of compulsory incorporation that all corporations, being creations of the state, are subject to its inspection, and that if labor unions be incorporated they will be subject to regulation as other corporations are, and to that publicity of objects and operation to which all corporate bodies must submit. These results might certainly be expected with confidence but the question still remains whether the greatest evils of unions would be thereby rooted out or prevented.

There is attached to the union, in the common opinion, one thing which not only has no necessary connection with it, but is foreign to its natural development and destructive of its mission. And this is violence attending strikes. The strike itself is a useful weapon for defense in the last resort, not for offence at the first opportunity. Violence is not only not essential to the successful issue of the strike, but is distinctly hostile to its efficacy and welfare. Strikes never succeed by reason of violence but in spite of it. A strike is an abrupt and complete suspension of work at the instance of the workmen, occurring by reason of a grievance. Its effect is greatest when on a just occasion it produces paralysis of all operation in the industry where it occurs. Its real power lies in its ability to affect economic results, not those foreign, criminal accompaniments which usually disgrace the exercise of the power. Its influence is greatest when its cause is just and its maintenance is free from violence and crime. A strike is said to be successful when it accomplishes, in whole or in part, a removal of the grievance it was instituted to abate. The influence of a strike is not measured by its success. An unsuccessful strike, justly provoked and lawfully conducted, is far more influential than a successful strike unjustly provoked and unlawfully conducted, because it is supported by public opinion and maintained in a manner consonant with industrial development. Such a strike tells most powerfully in time.

The mission of the union is to secure the highest wage and the shortest day consistent with industrial welfare. Over-stepping this limit, though possible from its power, redounds ultimately not in good but in evil to the union, because any disturbance of sound in-

dustrial conditions operates most unfavorably in the end upon those who as a class support the union. In short, the union approaches its greatest success as it operates along the lines of industrial progress considered from a general and not an individual standpoint.

We may inquire now in what respect would compulsory incorporation help the union, for if it be not for the union a help towards its real mission, it is rather a harm than a benefit to any one else. The answer to this may be that the purpose of incorporation is not aid to the union but protection to the public. In other words compulsory incorporation is advocated as a measure to prevent crime and not for the purpose of advancing industry or improving the condition of the laboring class. Any measure really preventing crime is doubtless commendable unless it is so drastic as to prevent not only crime but progress also.

The question is not whether enactments preventing crime are salutary but whether labor union incorporation will have that effect. Now the first answer is that, historically speaking, incorporation has not heretofore been used for that purpose but has been employed up to this time merely as a means of carrying on most conveniently commercial and industrial enterprises of various kinds. Compulsory incorporation is an untried experiment, but that is not conclusive against the experiment if it promises well enough to be tried.

Incorporation imposes, or may impose, the duty of publicity and fixes or may fix the obligations of union membership. But these do not determine or affect the unknown quantities that we are searching for, how does violence originate, what inspires and directs it, who is responsible for it? Crime is an individual act. No union, corporate or incorporate, ever did or will tolerate formal rules or by-laws, providing for violence in strikes. However much individuals may favor it or do it, they are not so stark mad as to confess it and publish it in the rules of their associations. Criminals do not operate that way.

No provision that we are familiar with in the corporation statutes of any kind would tend to prevent or moderate in any degree violence in strikes.

Strikes themselves are lawful. Incorporation therefore would not affect them. If they are to be controlled, or regulated by a higher power than the union itself, it must be by statute directly bearing on the subject. Whether that may be safely attempted is a matter for discussion. The present theory is rather to leave strikes to be regulated by the union under the restraint of intelligent public opinion. What amendment to this doctrine may be required in the interest of the general public time alone can tell. But whatever else may be useful or necessary, it seems reasonably clear that compulsory incorporation of the union in itself can be of no value or force in preventing or diminishing those excesses of improvidence or those acts of violence which accompany most strikes and deal such deadly blows to the cause of labor.

Sentiment in Favor of Federal Rate Regulation.*

BY CHESTER ARTHUR LEGG.

Realizing that the action of the Senate in pigeon-holing the Esch-Townsend bill to extend the powers of the Interstate Commerce Commission, but arrested and did not kill this movement and anticipating an even more urgent demand for the proposed legislation in the coming session, as a representative of the *Transcript* I traveled throughout that section of the country where the movement seemed strongest, to study at first hand the complaints of the public and the replies of the railroad officials. Starting at Buffalo and Pittsburg as the eastern termini, I worked westward to the cities on the Missouri river, then north to St. Paul and Minneapolis and back through Wisconsin to Chicago. At every place I called upon the representative shippers, large and small, of grain, coal, lumber, food supplies, etc., and heard from them their several complaints. At the same time, desiring to see both sides, I called upon and talked over the whole problem with the men who control the traffic policy upon every large system of railroad traversing that vast area of territory. In every place it was the facts as to the local situation which alone interested me, as I feel that the national demand for this legislation is but the sum total of the sentiment which prevails in each locality throughout the country. Starting out as I did in ignorance of the extent and basis of the movement, I was not in complete sympathy with its progress, but, after considerable thought and observation of the problem at first hand, familiar as I am with its virtues as demonstrated by shippers who by hard experience have come to learn the impotency of the Commission as now constituted and familiar, too, with the lurid pictures which the railroad officials with practical unanimity paint of its dangers, I am thoroughly convinced of the justice, necessity and practicability of the proposed Federal control of railroad rates.

One thought struck me time and again throughout my trip: the great interest the shippers are taking in the question and the comparatively small interest the consumer feels in it, although he is the one primarily interested. The movement among the shippers and their organizations, however, is intense and this is particularly true the farther west one goes. The appeals of the President, the Industrial Commission and the Interstate Commerce Commission have met a hearty response in the petitions of about 300 of the leading commercial and industrial associations in the country, comprising about 1,000,000 shippers and receivers of goods.

The composition of this great movement must also be understood to be appreciated. When one railroad president was asked a few months ago how he accounted for the popularity of the movement, he replied, "Oh! free lunches are always popular." I should like to say that if that gentleman or any other is laboring under the hallucination that it is the "free lunch," or "hordes of discontent" who are supporting this demand, he is making a great mistake. It has behind it the solid, conservative business men and business organizations, boards of trade, etc., in all parts of the country. Among all the men I met and talked with, I did not find one who was actuated in his support of the President's idea by a feeling of hostility to the railroads. I appreciate that there are many people especially among the farming element in the west who are not disposed to deal at all times fairly with the railroads, but this movement is not finding its greatest support from that class. On the other hand, are the railroad officials as sympathetic with the position of the people? I must admit I did not find it so as a general proposition. In Vol. I, page 234, of the recent hearings before the Senate Interstate Commerce Committee, Milton H. Smith, President of the Louisville & Nashville Railroad, says: "The present agitation has been largely prompted and promoted by a department of the Government, aided by persons who gain a livelihood by agitation—by striving to create friction between the carriers and their patrons, in doing which they have not hesitated, in some instances ignorantly, to disseminate erroneous information. Many, perhaps, most of the petitions presented, or filed before the Congressional committees are fakes," etc. This scathing criticism of the present movement may be merely the expression of Mr. Smith's individual opinion, but in its general tenor it represents, I fully believe, the attitude of many railroad officials of the country.

The next feeling that dawns upon one in his study of traffic problems is their immensity—their complexity. As one prominent merchant in St. Louis expressed it, "Any man who starts out to master the details of freight rates and freight traffic will be in the insane asylum before he gets fairly started." The extent of the conflicting interests is something appalling. Let me give a simple illustration: The miller wants the rates upon wheat to be high so as to keep the wheat in this country. The producer and shipper of wheat wants it low so as to allow them to reach out in competition with the other wheat-growing countries of the world. This problem of the relation between the rates on wheat and flour has been an unending source of worry to the traffic official upon the western and northwestern roads. The same holds true of the relative rates between cattle and dressed beef and many other illustrations could be given. Then there is the problem of rate adjustment between cities and between the markets which all of those cities must, or declare they must, reach. Another source of anxiety to the traffic man is the constant rise of entirely new industries and products, the rates of which must be adjusted not only so that the latter can do business, but, so that there will be as little interference with some other competing product as possible. The result is that the traffic man's position is a hard one, but it draws to it the ablest men in this country. One cannot help thinking as he observes the judgment, the tact and knowledge required of the railroad traffic men in this country that if they put into their own business the same energy and zeal they devote to the interests of our railroads, they would be millionaires many times over in a few years. But, as a matter of fact what is true of the traffic department is true of every department of our railroads—in no other business are there so many men of ability and talents working for so little compensation as upon the American railroad.

The railroad rate problem is not the same in the east as in the west; it is not the same to the large shipper who gives to the railroad from 10 to 100 cars a day as to the man who ships seldom and then in quantities from a few hundred pounds to a carload. And in this latter category I do not refer to the difference in the probability of one getting rebates and the other being denied them. With the iniquity of rebating entirely eradicated, there is and there always will be, an advantage in being a large shipper. I merely throw this out as a suggestion here because I shall have something definite to say as to those advantages later. If my analysis of the question is correct, one would expect to find the least sup-

*This article is reprinted from the Boston *Transcript*. Mr. Legg has evidently had personal interviews with large numbers both of shippers and railroad officers, and his work appears to have been done with the determination to present the facts fairly. He concludes that the movement for the regulation of railroad rates by the Federal government is favored by nine-tenths of the shippers in the western cities, and that what they say and do is sincere: that is, that they are not animated by an anti-railroad feeling. Mr. Legg writes from an eastern standpoint, and as he evidently has done his work with care, and insight, his statement of facts constitutes perhaps the most accurate and useful summary that has been made in connection with this subject.

port of the movement among the very large shippers in the large basing cities, the most reasonable advocates of national regulation among the moderate and small shippers of the large cities and the most radical sentiment among the small shippers at the non-competitive points and even at interior competitive points but away from the large cities. This generalization I found to be absolutely true in practice. Let me illustrate: The representatives of the United States Steel Corporation, the International Harvester Company, the Packing Companies, the Sugar Trust and the Minneapolis millers are just as determined in their opposition to the movement as the railroads themselves. And why? Because they are getting concessions? Not necessarily. They are large and prosperous, they have enjoyed their day of "favors" and their rates are the result of conditions in the past. No traffic official would dare raise a rate in the face of their opposition, whereas they feel that under Government regulation this power might not be so secure. They feel that conditions under governmental regulation could not be any better and they might be a great deal worse for them. In the second class there stand no more prominent types than Mr. B. A. Eckhart and Mr. E. S. Conway, both of Chicago, men of light and leading in that city and each firm in his conviction as to the justice of the proposed legislation. In the third class the number is too numerous to pick individuals.

In every city I visited, with one or two exceptions, I found in their commercial bodies some such division of opinion as this; about 10 per cent. of the members—those who control the vast competitive tonnage of that place—are opposed to the movement, and are perfectly well satisfied with conditions as they stand; then probably 20 per cent., composed largely of professional men and men who are not active in the organization, are absolutely indifferent; but the remaining 70 per cent., composed of the shippers who ship in but small quantities ranging from several hundred pounds to several cars a day, are enthusiastic in their support of the movement. This but applies to the cities. Away from the large cities, it appears to me that all the elements are merged into the last.

And there is a reason for this division. Leaving out the question of concessions, rebates and the like, the large shipper comes into close touch with the railroad officials. The traffic men call upon him and see that he is satisfied, and when he is not it is a simple matter for him to arrange an audience with the head of the traffic department, where his complaint is usually remedied without delay. A single illustration occurs to me. In a western city, I called upon a large manufacturer who had been drawing his raw material from a certain section of the country for many years. But, gradually the supply of raw materials there was nearing exhaustion and he was forced to go several hundred miles farther away for it. He could not move his expensive plant; he could not afford to pay a higher rate upon his raw materials than formerly. He went to Chicago, saw the Vice-President of the entire system and came home with the rate upon his raw material properly adjusted. As he told me, "When I get such treatment as that why should I favor a change?" And then the large shipper gets a quicker settlement of his claims than his smaller competitor, his car-service is more often refunded, his shipments when in car-loads are more speedily "set"—all of which to say nothing of secret rates, elevator charges, industrial road proportions and the like influence him to discourage any movement which will deprive him of such advantages. On the other hand, the small shipper as a general rule never sees an official except the local agent, who has no more authority usually to remedy rate matters than the shipper himself. When the big shipper expects a large consignment of goods and they have not arrived, the receiving agent will often "wire" all over the system to hurry them along. When the small shipper asks a similar privilege he is told he must write the agent at the forwarding station as it is against the rules for the receiving agent to trace shipments. No "midnight" tariffs are made for him and most often he ships without knowing what the rate really is. I bring this out to show that aside from anything illegal, there are many apparent reasons why a large shipper in a favored town should oppose the establishment of some form of Federal control of rates and there are many reasons why the smaller shipper sees in it his only chance of justice.

The sentiment is often expressed by railroad men that we have enough law now to correct all the abuses of railroad management, and that under the influence of the Elkins law and the injunction of the United States Court, rebates and discriminations are things of the past. This is but an effort to befog the issue. If I judge the sentiment of the people correctly, they are not interested primarily in rebates, or extortionate terminal, industrial and elevation charges. I say they are not interested primarily in these but in the rates and their relative adjustment. It is the railroads who are making such an outcry upon these abuses because it affects them directly. In fact, many a shipper told me that the more rebates there were the better he liked it. The Elkins law was an out and out railroad measure and it was cleverly used to side-track other legislation looking to the control over the rates by the Federal Commission. If all the rebates, discriminations, extortionate charges for switching and elevation, etc., were completely eradicated, the people would still demand this legislation. The people feel that now that competition is gone in railroad management, the great corrective influence has been removed. They see, or, at least firmly believe they see, five or six men, controlling 75 per cent. of the railroad mileage of the country, sitting in New York and dictating how much the shipper and the consumer shall pay for everything he receives and ships.

That the real crux of the question with the people was not rebates, etc., but was rather a protest against the arbitrary power which now, competition being at end, our traffic officials can exercise, was forcibly illustrated by a western shipper with whom I talked. He said that he wanted to get hogs from a certain place and he went to the traffic officials of a certain line to arrange it. "Oh! we cannot let you draw any hogs from there," said the official. "Why not?" the shipper asked. "Well we have to draw the line somewhere and we might just as well draw it right here." Is it any wonder that that shipper went away denouncing the system which could give men such power? Another illustration: The Frisco system has within a few years got control of the C. & E. I. with its extensive coal interests in Illinois. Upon its main line in Missouri there are also great coal interests which have always supplied the market of St. Louis. Since the absorption of the C. & E. I. the officials, for reasons which appear good to them, have practically forbidden the Missouri coal operators to market their coal in St. Louis, in order to open that city to the Illinois coal. As a traffic official of that system told me in his explanation of this situation, "We can handle the Illinois coal into St. Louis at a less cost and so we are forcing the Missouri operator to seek his market in Memphis, Kansas City and the west."

I sat down with a general freight agent one afternoon before a large map of his system. One of the shippers in that place had complained that the rates for a certain distance in one state were so much greater than the rates for a corresponding distance in another state over the same system. It was all over prairie country, and the cost of transportation did not vary an iota. I located the places upon the map before us and asked the official why there was such a variance. Without a moment's hesitation he replied, "Well, I can get that higher rate in the one instance and I can't get it in the other." I cite these illustrations of many that occur to me to try and show that the real demand of the shippers is not against rebates per se, but against the power which a few men who control our railroad system have of dictating the character and extent of the industry in every section of the country.

This, then, is the real demand of the shipper: that there be some impartial body before which he can lay his complaint, which body after a full and fair hearing of both sides shall have the power to decide what is a reasonable charge for the carrier to exact for the service complained of. What are the answers which the carriers make to the establishment of such a body? They are the same from one end of the country to the other. In fact, with all due respect to the railroad officials I met, and they are the most affable and courteous of men, their arguments impressed me as if they had all been in conference together and had been told to say so and so. Their general line of argument was identical and almost so in sequence.

The first argument that is put forth is that the railroads should have the same freedom of action as private individuals or corporations. Before a recent convention of manufacturers, the President of a southern road said this legislation was "akin to the government saying to the manufacturers that they were charging an exorbitant price for a product and must hereafter charge a lesser price to be fixed by the commission." One would not believe until he hears from their own lips that such views could be entertained by so intelligent a body of men as our railroad officials, but no less than a score of them advanced this as their strongest argument as I sat and talked with them. Their view of it is that "the traffic work is a plain business proposition," by which I understand they mean that as the miller charges less to the one who purchases 1,000 barrels of flour than to the one who buys ten barrels, so the traffic men should be allowed to give a less rate to the man who ships 100 cars as compared to the man who ships one car. The practical application of principles so utterly fallacious is no doubt responsible for the present agitation. It has been a settled policy of our law for several hundred years that all common carriers are amenable to public control. It has been decided again and again by the highest courts in the land that they are bound first to provide adequate facilities; second, to serve without discrimination; third, to serve all who apply, and fourth, to serve for reasonable cost. In the first place, the business of transportation is carried on under special rights and privileges, including, among many others, rights of way obtained by the exercise of public authority. In the second place, railroad transportation is within certain limits a practical monopoly, and in territory which competing lines do not touch it is a complete monopoly. If a mill is situated upon a certain railroad and another is no nearer than

a mile away, there is no business alternative for that miller but to market his product over the railroad at his door. For these great privileges the carrier owes something to the public. This is the power of reasonable public control.

The apprehension is expressed in many quarters, and this is not confined to the railroad men only, that to clothe the commission with the power upon review to decide what is a "reasonable rate," is a dangerous innovation and one certain to result in the disruption of industry and a disastrous reduction in railroad earnings. To this it can be answered that the extension of the powers of the Interstate Commerce Commission as contemplated by the proposed amendment constitutes no innovation in the fundamental laws governing common carriers in this country. Under the proposed amendment the Commission and the people would only have the power to do by direct and practicable action what they now can do in fact, but only through a long drawn-out litigation in the courts. Now, when a rate of $1.25 is complained of and a rate of $1 is declared to be reasonable by the Commission who order the rate of $1.25 changed, the railroads refuse to obey the order. Then the Commission takes the appeal and is sustained. The railroad reduces its rate to $1.24. Then the whole machinery of the law must be set in motion again and can continue until the court refuses to sustain the order of the Commission. This needless waste of time, patience and expense under present conditions can be best borne by the railroads so that in most cases the rates in the above case as an illustration would stand at about $1.20.

The second argument which the traffic officials advance against the proposed amendment is that it will take from the carriers the task of adjusting rates to commercial conditions, as they fondly claim they do, and lodge in a political body the power to make rates and schedules for all the interstate traffic of the country. They graphically describe the impossibility of five or seven men, with no knowledge or experience in the occult science of rate making, attempting to do what now is a task for hundreds with large experience and aptitude in the work. If I heard one railroad president advance this argument I heard a half dozen, "We don't believe there are any five men in the world wise enough to make the rates for this country." Again it is a great misfortune that such attempts are made to befog the issue. Nothing in the proposed legislation can be construed by the wildest stretch of the imagination as a desire to take from the carrier the initial power of making the rates. The situation will remain in that respect exactly as at present. To be sure, in many of the states the law provides that a rate can neither be raised nor lowered without the permission of the State Railroad Commission. The reasons for this drastic legislation it is not now my purpose to consider, but, sufficient to say, no such power is contemplated under the proposed amendment for the Interstate Commerce Commission. The only change desired is one which, when cases similar to those now going to the commission have been fully considered from both sides, will give that body the power to decide what is a reasonable rate, subject always to an appeal by either party to a higher court.

The establishment of any such power with the Commission, the railroad officials all contend will prevent that elasticity of rates so essential to the roads in meeting the changing demands of commerce. Every rate fixed by the Commission would be a maximum rate and when the occasion required it a rate might be reduced to any point the road saw fit and as easily restored. Personally I never heard that rates had to be raised higher than what is reasonable in order to satisfy some emergency.

Another stock argument of those who oppose the new legislation is that it can but result in a distance, or mileage, basis of rates which, it is asserted, would be disastrous to the industrial interests of the country. This fear is expressed by no less eminent an authority than Professor Hugo Meyer, who says: "The conflicts of interests between rival producing regions, manufacturing centers and trading centers are so fierce that no Government that permits itself to be drawn into them can stand up under the sectional feeling thus aroused, unless that Government shall settle those conflicts upon some hard and fast mechanical basis which permits no exercise of judgment or discretion." "These doctrines result in rates being made upon a mileage basis." In this fear it is not possible for me to share. What prevents the Commission after hearing the complaints presented to it from deciding the reasonableness of a rate according to the existing commercial conditions in the same way that now the traffic official decides it? The only difference, it appears to me, would be that whereas the latter decides it so far in the interests of the people as is consistent with the largest revenue to his road, the Commission would be disposed to look at all interests—carriers and patrons as well. This has been true also in actual practice. The people of Spokane, Washington, complained that the rate from St. Paul to that city was a combination of the rates to Seattle plus the local rate back to Spokane. In deciding this case the Commission was not disposed to determine the rate to Spokane upon a mileage basis, but, recognizing the water competition at Seattle, upheld the existing rate to Spokane. In many other cases that could be mentioned, especially in the questions of differentials between ports and cities, the Commission has shown the same tendency to look to commercial conditions forming the basis of the rates complained of as a traffic official would do. Why, with its added power, should it consider them differently?

The statement so often made by railroad men and more often repeated that the railroad freight rates in the United States are lower than in any other country in the world, demands some consideration. In the first place there is no reason why they should not be lower in the same way that passenger rates here should be higher. In a country as sparsely settled as our own, the amount of produce to ship is large, whereas the number of persons to transport is small. This condition is exactly reversed in Europe. The denser the traffic the lower the operation cost, and there should be a naturally lower freight charge here than in Europe. The first obstacle, however, in the way of a satisfactory comparison of rates here and abroad, is a standard of comparison. I was very careful to inquire throughout my investigation both of the traffic officials and shippers their opinion as to the reliability of the "per ton per mile" standard and the great majority were convinced that it was entirely unreliable. The nature of the traffic, whether local or through shipments, high or low in classification and many other factors will affect the "per ton per mile" figures without the slightest change in the rates. It is merely an average upon all the traffic carried, both local and through freight, carload and less than carload, and is obtained by dividing the gross freight earnings by the "ton-mileage" without the slightest regard to rates.

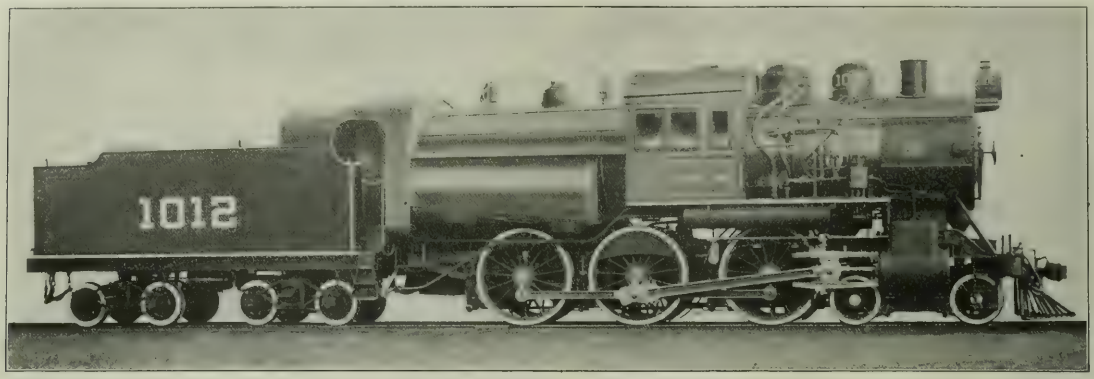
The per ton per mile rate is then no satisfactory standard of comparison. Again the rates in Europe, and particularly in England, include both the collection and delivery of the goods—services which in this country are rendered by the shipper and consignee. But, more important still, the railroad earnings there are figured upon a capitalization ranging from $200,000 to $300,000 per mile whereas in this country the capitalization by the most conservative estimate is not over $65,000 a mile. And again although as the statistics show the rate per ton per mile in this country is about seven to eight mills and in England about two cents, yet the average haul of freight in the United States is about 240 miles, whereas in England it is only 25 miles. And as Mr. J. H. Call points out (p. 2711 of the recent Interstate Commerce Committee report), the cost upon all lines of railroads in the United States for 25 miles is over five cents a ton mile, or, more than twice as high as it is in England when you base it upon the average English haul. Again it should be borne in mind that the bulk of our traffic is raw materials, about $51^{6}/_{10}$ per cent. being the product of the mines, $11^{6}/_{10}$ per cent. of the forests, and $9^{3}/_{10}$ per cent. of the fields; the manufactured or finished product, which is the most expensive to handle, comprising but $14^{4}/_{10}$ per cent. of the traffic; these figures are practically reversed in Europe and therefore any rate per ton mile figures would give an erroneous impression when compared to such a figure in the United States. It might also be added that in European countries the railroads are required to carry the mails and other Government property and to transport Government officials and employees free of charge. For the first service in the United States the railroads surely are paid none too small and are prohibited from doing the latter by a national statute. Again, although it is strenuously contended that wages are higher in the United States than in Europe, the fact must not be overlooked that while in this country there are five employees to the mile at a cost of $2,625 per year, in the United Kingdom there are 18 per mile costing $6,000 per year, and in Russia 15 at a cost of $4,620 per year. I have gone into this subject at length for the single purpose of showing how hazardous at present is any extensive comparison of railroad rates in this country and in Europe.

In my talks with the railroad officials they never failed to speak in a vein of censure of the ungratefulness of the people supporting this movement in that they wished now to deny to those who had so self-sacrificingly jeopardized their fortunes in the projection of our railroads so far in the advance of civilization the rewards of the game. If such an opinion is honestly entertained I am sure that it is erroneous. In the first place a careful study of the situation will soon convince one that the "valiant souls" who so jeopardized their fortunes are not now in control or in possession of our railroads. In the case of almost every large system in the west, with one or two exceptions, such as the Great Northern Railroad, by a process of bankruptcy and reorganization, the railroads have gone out of the hands of the original investors and into the hands of the "philanthropists" who now control them. In the second place, the railroads were built into the west not so much to help future generations and develop the country as to secure the immense land grants, with the invaluable deposits of coal and iron and the forests, and to saddle upon the public a greatly inflated issue of stocks and bonds. But, even at that, the alarm which the railroads have consistently tried to inspire in the minds of the investors is unfounded. The people want to deal fairly with the railroads; all they ask is that the railroads deal fairly with them.

Heavy Ten-Wheel Passenger Locomotive for the Delaware, Lackawanna & Western R. R.

The American Locomotive Co. has recently built five exceedingly heavy ten-wheeled (4-6-0) passenger locomotives at the Schenectady works for the Delaware, Lackawanna & Western R. R. The main interest in these engines centers about the fact that they are, we believe, the most powerful of the type that have ever been built for passenger service. At least we have no record of any with a tractive power as high as 35,100 lbs. The wheels, too, are large for a wide firebox, being 69 in. in diameter.

The total weight is 201,000 lbs., which is 2,000 lbs. more than that of engines of the same type in use on the Lehigh Valley R. R. Other locomotives have been built of greater tractive effort but the weight of this engine is notably small for this effort. In appearance the arrangement of the injectors upon the side of the boiler seems to involve a complication and network of piping; but, if pains are taken to follow the runs from the dome to the check, it will be found that the complication is more in appearance than reality. Among the details of construction, that of furnishing an auxiliary support to the grates is unique and peculiar to the road.



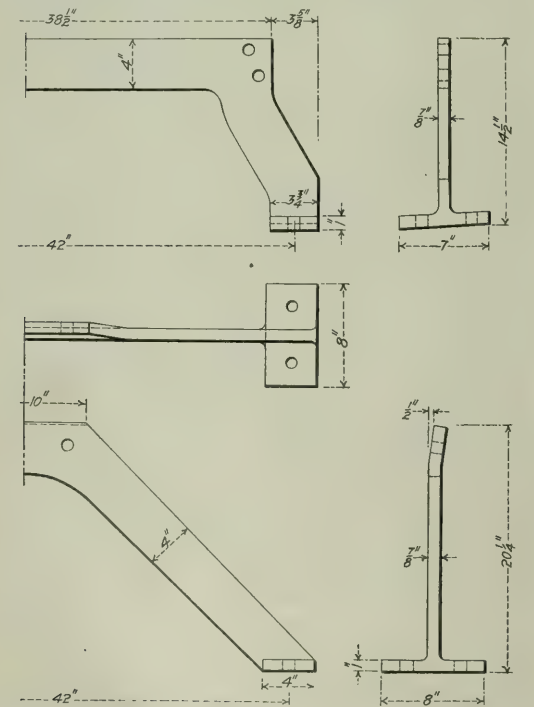
Heavy Ten-Wheel Passenger Locomotive for the Delaware, Lackawanna & Western.

It has been found that, with the wide fireboxes, the weight of the bed of coal is apt to cause them to sag. In order to prevent too great a deflection the auxiliary supports shown at A are attached to the frames. They consist of an arch reaching across from one frame to the other with the upright pieces B fastened to the center. These latter rise to within ⅜ in. of the bottom of the grate frame. This permits a drop equal to the amount of the clearance and prevents it from becoming any more. The reason why the supports are not carried up against the frame in the first place is because it is necessary that some buckle should be allowed the grates under the action of the heat. If the supports held the frames so that they could not come down, the latter would be apt to go up, either at the center or at the ends where they would lift away from the regular brackets and thus create a troublesome condition of affairs. This method overcomes that difficulty and after the settlement of ⅜ in. has taken place the grates are held firmly in position.

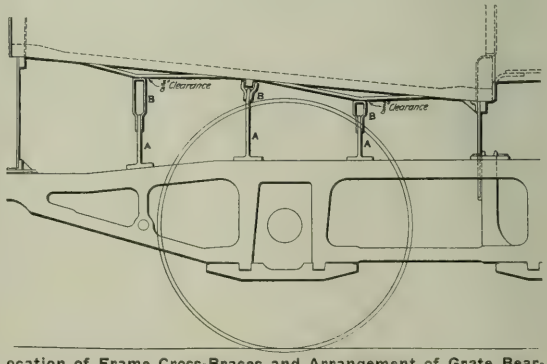
The following are the principal dimensions of this engine:

Cylinder diameter	22½ in.
Piston stroke	26 "
Wheelbase, total	25 ft. 6 in.
Wheel base, driving	14 ft. 4 "
Weight, in working order	201,000 lbs.
Weight, on driving wheels	154,000 "
Weight, of engine and tender	321,000 "
Tractive power	35,100 "
Heating surface, tubes	3,156.3 sq. ft.
" " firebox	221.7 "
" " total	3,378.0 "
Grate area	94.8 "
Axles, main driving journal, diameter	10 in.; length 13 in.
" truck journal, diameter	6½ in.; length 12 "
" tender, journal, diameter	5 in.; length 9 "
Boiler, type	Straight top.
" outside diameter, first ring	75⅝ in.
" thickness, crown, back and side sheets	⅜ in.
" thickness, shell sheets	13/16 in.
" thickness, tube sheets	⅝ in.
" thickness, water spaces	4 in.
" type of crown staying	Radial
Steam pressure	215 lbs.
Tubes—No.	398; length 15 ft. 3 in.; diameter 2 in.
Valves, travel	5½ "
" lap (steam)	1 in.; (exhaust) 1/16-in. & 1/32-in.
" lead in full gear	1/16-in.
Wheels, driving, diameter	69 in.; truck 33 in.

The engine is equipped with the Westinghouse-American high-speed brake applied to both the driving and forward truck wheels. The tender has a steel frame built up of 10-in. channels and plates



Details of Frame Cross-Braces and Grate Bearing-Bar Supports—D., L. & W. 10-Wheel Locomotive.



Location of Frame Cross-Braces and Arrangement of Grate Bearing-Bar Supports as Applied to the Heavy Ten-Wheel D., L. & W. Locomotive.

and is fitted with the D., L. & W. hood at the front end. The capacity of the tank is 6,000 gallons of water, while 10 tons of coal can be carried in the fuel space.

Improvements at the Moncton Shops of the Intercolonial Railway of Canada.

The Intercolonial Railway of Canada is preparing plans for new locomotive shops, which are to be erected at Moncton, N. B. The cost of the new buildings alone it is estimated will be upward of $500,000. Moncton is the headquarters for the Canadian Government Railroads and most of the repair work is done at this point. In addition to the Moncton shops other repair shops are located at various points on the lines between Montreal and Halifax, Truro to the Sidneys, and Moncton to St. John, as well as one on Prince Edward Island. The present Moncton shops were erected more than 30 years ago. The locomotive department, in which is contained the motion shop, the machine shop, the boiler shop, a brass finishing shop and a brass foundry, is all under one roof. The ground floor of this building covers an area of about 403 ft. x 95 ft. The majority of the machines in this building are of modern design but cannot be worked to advantage owing to lack of space. The present erecting shop is 210 ft. long by 138 ft. wide, and locomotives are placed on the pits by a transfer table operated by compressed air which runs through the center of the entire length of the shop. The proposed new erecting shop will be equipped with a heavy electric crane and will be of modern construction throughout. The old roundhouse, which is 225 ft. in diameter, has already been converted into an annex to the erecting shop and contains the tender shop and a tin shop. An addition of 100 ft. by 63 ft. has also been added to the old blacksmith shop, which originally measured 156 ft. x 54 ft. The furnaces in this shop are operated by under feed draft, and the equipment, including steam hammers, etc., is of modern design. The car shops have also been considerably improved by an addition of 300 ft. by 75 ft. Until recently they consisted of a paint shop, 500 ft. by 75 ft., and a freight car shop, 200 ft. by 75 ft. The wood working machine shop which was a single story structure of 236 ft. by 75 ft., has had another story added to it and an additional 250 ft. added to its length, making a first class car repair shop. There are upwards of 6,000 panes of glass in the building, thus affording exceptional lighting facilities. In the upper story of the shop the finer wood work, such as cabinet work, etc., is done. The heavier wood working machinery is on the ground floor. A new engine room has also been provided for this shop in which is installed a 300 h.p. Robb cross-compound engine which replaces a 100 h.p. engine formerly used. The entire plant has been supplied with power from a number of old locomotive boilers which were placed in various parts of the shop. These have been replaced by a new boiler house 50 ft. x 60 ft. by 75 ft. high, in which are installed four double Babcock & Wilcox boilers. The present electric plant is operated by two 275 h.p. engines, but the capacity of this plant will be more than doubled. A Pintsch gas plant and a large modern coal handling and ash handling plant are also operated in connection with the Moncton shops. The proposed improvements, which include the new locomotive shop and upwards of $100,000 worth of new machine tools, are expected to be in working order by June, 1906.

Hydrostatic Tests of Locomotive Boilers.*

BY GEORGE WAGSTAFF,
Supervisor of Boilers, N. Y. C. & H. R.

Much has been written on this subject by the Government and insurance companies. A great number of these writings make a distinction between inspection and hydrostatic test of boilers. The subject cannot be divided, as an inspection without a test would not give sufficient evidence that the boiler was substantial to carry the pressure assigned to it; hydrostatic test without inspection would be useless, consequently it will be necessary to consider inspection and hydrostatic test together.

The object of the hydrostatic test is to ascertain if the boiler is capable of sustaining some given pressure, and also to test the joints as well as the quality of workmanship.

The only means we have of ascertaining with any degree of certainty the safety of a boiler, is by the application of pressure, which should be under conditions as similar as practicable to those of actual work. Let a boiler be ever so carefully designed and constructed according to the best knowledge acquired by careful research and long experience in the strength and disposition of its materials, and let every plate be tested before it is put in; there will still remain an element of doubt as to the actual strength of the boiler, since the material may have sustained injuries in the process of construction which may have escaped detection. In the case of a new boiler, even by a first-class maker, to say nothing of original and hidden flaws in the plates, bars, angle irons and castings, there is always a possibility of defects such as bad welding, careless riveting, plates burnt in flanging or cracked in bending, and many other defects that may be traced to the want of skill or reckless negligence on the part of the workman.

Many cases of dangerous defects which the strictest scrutiny of the completed boiler would fail to detect, have been brought to light by the hydrostatic test combined with careful inspection. The following may be given as examples: In a new boiler the rivet holes in some of the shell plates, instead of being about $^{13}/_{16}$-in. in diameter, were discovered to have been repunched and made 1-in. by $^{13}/_{16}$-in. in order to get the ¾-in. rivets through the holes in the adjoining plate. The section of the adjoining plates through the line of rivets was thereby reduced 14 or 15 per cent. more than necessary, and the strength was further diminished by the presence of incipient fractures produced by the reckless use of the drift. The difficulty, or rather impossibility, of keeping the joint tight in testing by hydrostatic pressure led to the discovery of these defects which were certainly dangerous.

In another case, the gusset plates of a boiler were found to be put in between the double angle irons on ends, with the material between the holes and the edge of the plate nearly cut away. Such a defect would not be apparent to the eye, being completely concealed, nor to the ear if tested by sound, yet its presence was revealed by the bulging of the plates on testing the boiler with water pressure.

These two cases indicate the possible unreliability of the mere internal inspection of a finished boiler, and show that boilers should always be carefully inspected during construction, as well as when completed and ready for work.

The locomotive boiler does not admit of anything like proper examination. The expense of removing the tubes alone would forbid a periodical examination of the shell of the boiler, and the water spaces around the firebox are almost entirely out of sight, consequently a thorough examination is out of the question. In all cases there is only one means of testing the strength of the boiler, and that is the application of pressure.

We would not consider it practicable to allow a boiler to go through any of our shops for general repairs without having a hydrostatic test. This test to be applied before the boiler is covered so that any defects that may be found by such a test may be properly taken care of.

When we consider that a locomotive boiler is constructed with a factor of safety of between 4 and 5, it would be impossible to injure the boiler in any way by testing it at a pressure of 25 or even 50 per cent. above its rated working pressure.

The laws of the State of Massachusetts on inspection and testing locomotive boilers give the following, adopted June 1, 1901, by the Board of Railroad Commissioners under the provisions of Chapter III, Section 218, Revised Laws:

1. All boilers for locomotives before going into service must be subjected to a hydraulic pressure of not less than 25 lbs. per square inch in excess of the maximum amount to be carried when in service, and in no case less than 150 lbs. per square inch.
2. The water must be heated to near the boiling point.
3. This test must be repeated at least once a year.
4. The Superintendent of Motive Power, Master Mechanic or some other proper agent of the company will attend in person. He will remain outside while an assistant will examine the firebox from the inside.
5. A record of all tests must be made, giving dates and anything worthy of mention, and a report of the same must be made to the Board on or before the 1st day of February, annually, covering the preceding calendar year.
6. Special examinations of the stay-bolts of locomotives in service must be made not less frequently than once in three months.
7. When these examinations are made, all the water must be drawn from the boiler, so that the vibration of the sheet may indicate any unsoundness of the stay-bolt when it is struck with a hammer. When stay-bolts are drilled this test may be omitted.
8. All stay-bolts applied after this date, with the exception of crown-sheet bolts, and bolts behind frames, must be drilled from the outside 1¼ of an inch deep and 3-16ths of an inch in diameter.
9. No locomotive shall continue in service with a broken stay-bolt in the top row, or with two or more broken bolts contiguous in any part of the firebox.
10. Steam gages must be tested immediately before hydraulic pressure is applied, and must be tested at least once in three months thereafter.
11. These regulations supersede all regulations heretofore made by the Board.

That the hydrostatic test is a convenient method of testing the tightness of the work on a new boiler cannot be gainsaid, and hence its almost universal adoption, in conjunction with inspection to a greater or lesser degree, in the passing of new work. As a detector of leakages it has at least no rival, and its application enables faulty caulking to be made good before the boiler has left the works, and before a leak has time to enter on its insidious career of corrosion. It will be evident that if the test be applied with this object to a new boiler, the pressure should range to some point in excess of the working load if such a test is to be of any practical value.

The foregoing has dealt with the testing of new work. If such stringent means must be taken to insure a good substantial boiler, we ought to be willing to confess that it is necessary to repeat this operation at least once each year, as a locomotive boiler does not get any younger, but older and consequently weaker. A periodical test at a

*A paper read at the September meeting of the Central Railway Club.

pressure of at least 25 per cent. above the working load is necessary and practicable.

Mr. West (N. Y., O. & W.).—Reports of the Hartford Insurance Company deal almost exclusively with stationary and other than locomotive boilers, and I do not believe any such percentages of defects would be found if the inspection were made on locomotive boilers. I am not in favor of increasing the hydrostatic pressure to any such percentage as is advocated by Mr. Wagstaff. I do not believe any man who has watched the hydrostatic pressure would find the defects in the same place as when tested by steam and I do not believe that the strains or expansions of boilers which are due to a hydrostatic pressure have anything to do with a steam pressure. We test our boilers two and three times; first, with a hydrostatic pressure; and frequently we will find 15, 20 and as high as 40 broken stay-bolts after they are fired up. The boilers do not expand the same with cold water or even with warm water as they do under the high pressure of steam. I believe 25 lbs. above the working pressure is sufficient and covers the requirements of any law with any sense.

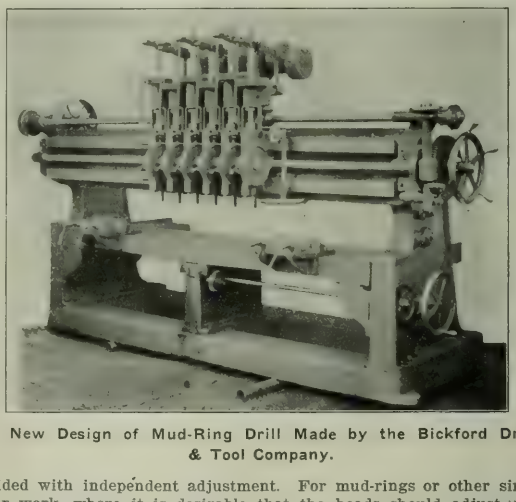
Mr. Ball (Lake Shore).—Mr. West lays too much stress on the ill effects that might result from hydrostatic pressures, even by going up as high as 25 per cent. of the boiler pressure carrying capacity. The boilers that we are designing to-day have a factor of safety of from 4 to 5. Our boilers I believe have 4½. Within the elastic limit of the material you could very easily subject the boiler to a pressure of 25 per cent. in excess of the working pressure and not strain the materials anywhere near the elastic limit. It may be that 25 lbs. in excess of the working pressure is sufficient, but I really do not believe there would be any harm or detriment to the boiler from using 25 per cent. if thought desirable.

Mr. James (Lehigh Valley).—It seems to me that 25 per cent. hydrostatic pressure over the working pressure should not materially injure a boiler. I feel, however, that for ordinary working conditions a test of 25 lbs. excess pressure is sufficient and in our testing of boilers we carry out that rule. A locomotive boiler on our road must be tested yearly. It must have all coverings removed, and when the test is made it is put under the closest scrutiny of the best boiler inspector we have. During the working of the locomotive the boiler is tested every month, and our system of records is such that if it is not done the question is asked, "why?" In the matter of stay-bolts, the question has been brought up of drilling a small hole as a matter of safety. I do not see myself why a hole $^{3}/_{16}$ in. in diameter for a ¾-in. bolt or larger is too large. It does not materially reduce the factor of safety of that bolt. It is very important to have a certain sized hole in the bolt for the very reason that at times stay-bolts will break. They break so slowly and so insidiously that if the hole is small the sediment fills up faster than it has a chance to show. I think that is why a hole of $^{5}/_{16}$-in. diameter is considered small enough and safe enough for a drilled bolt. As to the question of not testing drilled stay-bolts, I cannot agree with that. I think that all bolts in a boiler, whether they are drilled or not, should stand a stated periodical inspection. In my experience I have seen drilled bolts that have been stopped up through using bad water or other condition. If a bolt is drilled, it is a very good safeguard, although it is not always a sign because it does not leak, that it is not broken. We cannot pay too much attention to our locomotive boilers as they are working under present conditions. Years ago a boiler was worked about one-third of its time, the other two-thirds remaining in the house simply under low pressure, but to-day our locomotives are working 18 hours or more of the 24. The life of a boiler, therefore, under present conditions, will not exceed probably one-third what it did a number of years ago.

Mr. Williams (D., L. & W.).—In building locomotive boilers it is of the greatest importance that we use care in getting the seams properly fitted together and the holes true—good rivets, good boiler plate, and good workmanship are the things that go to make up a first-class boiler. After we get the boiler together it is equally important to make the test. Twenty-five per cent. above the working pressure is what I would call a very moderate test pressure for a new boiler. After the boiler is put in use it begins to grow old at once. It begins to depreciate in strength, not very fast, of course, but nevertheless it begins to depreciate and the extent of depreciation each year depends a great deal on the care that the boiler received while in the hands of the boilermakers and the engine and engine-house men. After a boiler gets to be say ten years old I think it is more necessary to test it with a hydraulic test and even more necessary to increase that test pressure above what it would require when the boiler was new. The older the boiler gets the more liable it is to show weakness and as that liability increases the test should be given more systematically and if anything a little greater pressure used. It might be possible that a seam would be depreciated in strength to within 18 per cent. above the working pressure. If it was, the 25 per cent. excess would develop the weakness. Braces might be cracked and broken within pretty close to the strength required to stand the working pressure. The 25 per cent. increase would break them entirely off and the weakness would be discovered. A large number of stay-bolts in a group might be fractured nearly through and not be discovered by the boilermaker in the hammer test and if fractured below the 25 per cent. excess limit, the test pressure would crack them entirely off. It is customary with us, after the hydraulic pressure is put on and completed, to have the boilermaker's hammer test given the stay-bolts again, to see if any of them have broken entirely off during the test; also test the braces as far as we can in the boiler head. On the Minneapolis & St. Louis we used 40 per cent. in excess of working pressure and thought that was none too great. That, I believe, is the government requirement. We had one boiler give away in the gusset sheet during the test. I think that was due to the fact that we were testing then with cold water and I do not think it would have given away if we were testing with warm water, but the fact that it gave away showed the weakness of the construction of the boiler, and we removed the old sheets and applied new sheets to the four boilers which we had of that type, which were built at the same time. I would recommend that the 25 per cent. be the minimum limit we use and as the age of the boilers increases we should test them more frequently. Once a year is all right for a boiler from one to eight years old. They should be tested twice a year after that age.

A New Mud-Ring Drill.

We illustrate herewith a new mud-ring drill which the Bickford Drill and Tool Company, of Cincinnati, Ohio, are just placing on the market. The chief characteristic of this machine is that while it was designed especially for mud-ring drilling, it is equally well adapted to all operations of multiple drill work. Instead of the heads sliding on an auxiliary rail as in the ordinary construction they adjust directly on the main rail, which enables them to be spread to any desired center distance, each head being provided with independent adjustment. For mud-rings or other similar work, where it is desirable that the heads should adjust collectively, the heads are clamped together by means of two quick-acting nuts which fix the center distance between spindles at 7½ in., 8 in., 8½ in. or 9 in., as may be required. A dial on the worm wheel in the upper corner of the right-hand head shows the distance through which the heads are moved to the right and left. The speed and feed changes are obtained by means of change gears which are held in position by spring plungers, thus enabling the operator to change quickly from one speed or feed to another without lessening the available power of the machine. A dial on the large worm-wheel at the right shows where to set the dog to trip the feed at any desired depth. The spindles are 1 13/16 in. in diameter. They have a vertical movement of 12 in. and work to a maximum center distance of 26¼ in. The table has a transverse movement of 24 in. and receives between housings with a 12-foot rail 10 ft. 6 in. Driven by a constant speed pulley the power is never less than that obtainable from a 5-in. double belt running at 1,696 f. p. m. The net weight of the machine is 17,500 lbs.



A New Design of Mud-Ring Drill Made by the Bickford Drill & Tool Company.

The management of the Italian Southern Railroad, which was not taken over by the state with the other Italian lines, asks for bids from all countries for supplying locomotives and passenger and freight cars to the amount of about $10,000,000.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX., No. 21. FRIDAY, NOVEMBER 24, 1905.

The *Railroad Gazette*, a magazine that has considerable to say against government control of railroad rates, suggests that the government ought to quit talking about rates and take measures to reduce the loss of life in railroad accidents. To use the stock railroad argument on the rate question, this is certainly socialistic, and an invasion of the rights of private property. Reasoning a la Parry we may say that from government interference with railroad accidents it is but a step to legislation to keep farmers from driving kicky mules and small boys from going in swimming. To legislate for the prevention of railroad destruction of human life is certainly not less socialistic not to say anarchistic in principle than to legislate against railroad destruction of commercial life via the rebate, the discrimination, or the exorbitant rate.—Lincoln, Neb., *State Journal*.

Very well, neighbor, but how is it in Lincoln? Do they legislate against revolver practice in the streets, or is that looked upon as being equally socialistic with statutory regulation fixing the price of groceries? Does any body of men in Lincoln concern itself with the enforcement of statutes designed to prevent fires and the spread of contagious disease, or would such a body lay itself open to the charge of anarchy? We ask these questions, not in a cynical spirit, but because we want you to believe that the protection of human life is an office of Government. So far as rate regulation is concerned, permit us to point out that we are heartily in favor of legislation which will prevent rebates and discrimination; the legislation we are opposed to is the kind that could not possibly prevent either one of these evils. As a shining example of a bill warranted to hit everything in sight, except the target, we commend to your attention the document introduced last spring by Messrs. Esch and Townsend.

A little more than a year has gone by since the President of the New York, New Haven & Hartford Railroad Company forecast as a sure thing in the future of his corporation not so very far remote, "interchangeable" electric traffic between his now great trolley system and electrified steam lines. Stated in its briefest terms his prophecy forecast a centralizing of urban trolley traffic at stations, entrainment, and redistribution at other stations; so that a passenger taking the car at his door in one city could be delivered over the electrified steam line at the "doorway of destination" in another city. The first step in this project is now shown by the announcement that only a dispute with the Hartford authorities as to the kind of rail to be used stands in the way of interchangeable traffic in that city. The plan is to exchange traffic at East Hartford from an electrified steam line reaching to the city of Rockville, Conn., and the distributed traffic covering Hartford where the New Haven Company owns the extensive connecting trolley system. As a pioneer venture toward the greater union of the present steam and trolley lines such an event would be of import anywhere. In the case of the New Haven Company it bulks larger, not merely because of Mr. Mellen's utterance, but because of the size and location of the street railway systems which he has annexed. It has grown in a year and a half from 43 single track miles to about 588 miles. It reaches to Worcester, Springfield and Pittsfield in Massachusetts, and to New Haven, Hartford, Norwich, New London, Meriden, Middletown, Willimantic, Putnam and Stamford in Connecticut—in all 12 cities with a present population of about 550,000, and in all but one or two of which the New Haven has absolute control of the local trolley systems. Here are conditions remarkably favorable for the "bunching" and "distribution" experiment. And even if they were somewhat less favorable locally we could probably trust the boldness of Mr. Mellen to make the test on his great electric systems, which is showing an almost phenomenal increase of earnings this year as compared with last, when it "washed" the investment and went some $75,000 beyond. A singular twist it is, in railroad annals, which has thus brought what was a few years ago the most old fogy railroad company in the country to the front of the electrical advance. With such a progressive record it seems incredible that the corporation will flout public safety and oppose electric standardization at its New York terminal.

Standardization of the location of the conductor rail for direct current electrification is of such considerable economical importance that it would indeed be regrettable if variations were made to an extent which would prevent free interchange of equipment. This we believe to be true not only as to neighboring roads but also for the whole country, for we cannot now foresee the ultimate growth of interchange of electrically operated cars and trains. Our esteemed contemporary, the *Railway Age*, has properly called attention to this matter in describing the Long Island standard and the New York Central standard, but it is misled in concluding that, "it is evident that the effort to standardize the location of these rails has been abandoned." The error is a natural one and is due to the confusing methods of measurement used by different engineers in describing the position of the conductor rail. One will give the horizontal distance from the gage line of the track rail to the center of the conductor rail; another, the center to center distance between the two rails, and there are apparently all the possible variants from these two methods. Indeed, one

authority insists on giving the horizontal distance from the center of track to the center of the conductor rail. We do not criticize our contemporary for being misled under such circumstances, and call attention to the matter only for the purpose of preventing a wrong impression. It is a fact that so far as the location of the conductor rail is concerned on the Long Island and on the New York Central there is nothing to cause embarrassment in interchange of equipment. The center of the New York Central's conductor rail is 28¼ in. from the gage line of the track rail. On the Long Island the inside of the head of the conductor rail is 26 in. from the gage line of the track rail; therefore, so far as this horizontal distance is concerned the clearances are near enough alike. The reason for the peculiar statement of measurement made by the Long Island is that they were forced to use, as conductors, rails of different sizes, and therefore the gage line measurement seemed to be necessary. The Long Island road uses a top contact conductor rail. The New York Central uses an under contact rail (described in the *Railroad Gazette* for September 1, page 199); a most ingenious and promising method of preventing loss of life, and, we are assured, easily adaptable to interchange with the cars of the Long Island road.

As might have been expected, President Mellen, of the New York, New Haven & Hartford Railroad, since his attention has been called to the details of the subject, does not propose to allow his company to remain or to be placed in a wrong position with reference to the electric operation of his trains at the Grand Central terminal in New York. We have never believed it to be possible that this able, experienced railroad officer could be for a moment in doubt in any question involving his duty to the public in furnishing the safest and most convenient transportation under the new conditions which are to prevail at the New York terminal. The only danger, as we see it, is now the limitations of time. We have asked Mr. Mellen a specific question, as follows: "Do you intend to use in the New York Central suburban terminal fireproof cars in motor car trains, with a multiple unit system of motor control?" Mr. Mellen replies, "The New Haven road will do whatever is necessary for the accommodation of the public patronizing its lines, and its equipment will conform to the New York Central standard, with such improvements as have been made in electrical traction subsequent to the placing of the New York Central's orders." This reply is an assurance which should satisfy every one, and should place beyond doubt the duty so imposed upon the New Haven's engineers. Mr. Mellen was also asked to give his opinion on the kind of electric locomotives ordered for the New Haven electric service and the feasibility of using these locomotives when taking their power from the direct current line between Woodlawn and Grand Central Station. In reply, he points to the following quotation from a letter written by the Chief Engineer of the Westinghouse Electric & Manufacturing Company:

"It is interesting to note that these locomotives have been pretty generally referred to as 'Single-Phase' or 'Alternating.' We, among ourselves, have used these terms and are perhaps responsible for the nomenclature. In reality, however, the equipment of these locomotives is simply a high-class direct-current arrangement adapted for operation on alternating current as well. The motors are not primarily designed for alternating current and adapted for operation on direct-current, but knowing the problem which we had to meet, they were in reality designed for the very highest class of direct-current service, and they will operate successfully on alternating current. In accomplishing this result, the fundamental features which make for a good direct-current railway motor have not been slighted, but on the contrary they have been amplified in order that the motors may work successfully on alternating current. We may take it as a fundamental condition in this class of work that in order that a motor work successfully on alternating current, it must be an extremely good direct-current motor."

"In other words," said Mr. Mellen, "we desire to secure an option between the direct and alternating currents."

A PROMISING STEEL TIE.

Three serious objections have in general been raised to all the forms of steel ties so far proposed: First, they are conductors of electricity and require insulation for electric track circuits. Second, they are so rigid that rails break under heavy traffic. Third, they cost too much. The York process for rolling steel ties from old rails, which is described elsewhere in this issue, seems to have met two of these objections. It is cheap and elastic. The method of insulation is a problem for the signal engineers to work out as they have done in the case of rail joints and switch connections. They have a free hand in this case.

Under the heavy axle loads of modern locomotives the track must deflect to some extent and if the ties are rigid then the rails must bend or break. This has been the experience in this country. On one road where Carnegie steel ties were tried, 60 rails broke. In Europe, where steel ties have been in use for many years, this trouble has not been met; probably because the axle loads are comparatively light and permit a form of elastic tie which has been generally adopted. This bending and crushing under the rails was the cause of the removal after a short time of some experimental ties of this "Post" type which were laid about 20 years ago in this country and failed completely under the heavy traffic. Nearly all of the recently proposed forms for steel ties have gone to the opposite extreme in stiffness and rigidity, most of them being I-beam sections with wide flanges having a large section moment. Where such ties have been laid in the track the result has been rail failures instead of tie failures.

Theoretically a perfectly bedded tie is a constrained beam uniformly loaded by the upward pressure of the ballast on the bottom side and having two points of support under the rails. Imperfect tamping may greatly increase the bending moment at the center, and it is essential that a tie should have some spare strength to endure imperfect track work. The rail also acts as a constrained beam supported at intervals and carrying concentrated loads under each wheel. The complicated internal stresses and external reactions set up produce the wave motion which if resisted by the rigidity of the supports increases the internal stresses enormously, and under the combined effects of heavy loads, hammer blow and impact results too frequently in broken rails, especially where the rails are made as now by the United States Steel Company, with an eye single for tonnage and little regard for quality. Some elasticity is necessary but not by the sacrifice of vertical strength in the tie which in effect is the same as center binding with all of its bad results on the track.

The form of tie shown in another column has a concave bottom flange and seems to be designed on the right principle. The curved bottom flange acts as a broad semi-elliptical spring which can be given any desired arch and be made to flatten out under any given maximum axle load. The action of such a flange under successive wheel loads would not resemble the pumping action of a wooden tie which rises and falls in the ballast, for the shape of the flange tends to force out the ballast under each deflection until a perfect flat bed is formed on which the tie rests under load. The flange is rolled from the rail head and the enormous reduction of metal together with the low temperature at which the finishing passes are made increases the elastic limit and ultimate strength of the metal to a point equal to if not exceeding many brands of spring steel. Some elasticity could be given in the top flange as well if it seemed desirable, as the curve can be rolled equally well on either or both top and bottom. Whether or not this would entirely overcome the difficulty of breaking rails remains to be seen by actual trial. It looks promising.

The last objection of excessive cost can be met with calculations of cost per year in track based on actual figures of first cost and life of steel and wooden ties, which would show that the cost per year per lineal foot of track according to the formula of Mr. S. Whinery (*Railroad Gazette*, Nov. 11, 1904, p. 537), would be 5.9 cents for wood ties costing 60 cents apiece and 5.8 cents for steel ties made by this process. No meritorious steel tie which we have yet seen can be laid in the track for less than $3 each, and some that have been proposed cost as high as $4.50 each. These costs are prohibitive, even considering the life of the steel tie to be as much as 35 years or more. The commercial proposition to the railroads with the York process is to exchange one ton of steel ties and fastenings for two tons of rail scrap of anything over 56-lb. section and in any length or condition of wear. Rail scrap is a drug on the market in many localities since the general introduction of the continuous process of making open hearth steel from hot metal from the blast furnace with the consequent falling off in the demand for heavy melting stock. Present quotations are $15 a ton delivered in Pittsburg, and in most markets some distance from the steel district the price is as low as $10 or $12 a ton. A ton of steel ties weighing 160 lbs. each would cost therefore about $28, or $2 apiece, with fastenings. If we assume a life of 25 years for steel ties and eight years for wooden ties, 15 cents as cost of removing and replacing each and allow a scrap value of 90 cents for the wornout steel tie at the end of its life, we can calculate the annual cost of the steel tie and the cost of new wooden ties to give an equivalent annual cost. The annual cost of the steel tie per linear foot of track on this basis is 5.8 cents, and the cost of new wooden ties on an equivalent basis would be

58 cents. These figures are conservative and if they err it is in favor of the wooden tie for any reduction in the value of scrap or increase in the length of life of the steel tie would lower the maximum economical cost of wooden ties which on the assumptions made is less now than the cost of hardwood ties in many parts of the country.

If a railroad using 500,000 ties a year or more were to figure on building and operating a mill for its own use the cost would be still farther reduced. One of the most economical features of the process in this respect is the fact that such a plant could be installed wherever a supply of fuel and old rails could be had regardless of the supply of raw material, ore, pig iron, blooms or billets. The farther from the steel district the more economical the product, owing to the saving in transportation.

The estimated annual production of steel rails for 1906 is 3,000,000 tons, of which probably two-thirds will be used for replacements. If one-half of the rails taken up were available for re-rolling to ties an annual production of 12 to 14 million ties would be possible. The supply of old rails would always exceed the demand for new ties.

THE PANAMA CONTRETEMPS.

It is not an easy nor a gracious task to pronounce judgment upon the conclusions of the Advisory Board of Engineers regarding the best type for the Panama Canal in advance of the appearance of its forthcoming report, or reports, for it is supposed that there may be several. Neither is it permissible here to segregate the members of the board, as the daily papers seem to be doing, and assign reasons for the actions of the respective groups. The situation is indeed serious and disappointing to those who have been hopeful of a speedy solution and final settlement of this long reaching problem, but it is one on which more light is needed before an intelligent measure can be had of the relative values of the conflicting opinions which evidently exist in the minds of the members of the board. That light can only be shed by a clear statement of the existing physical facts upon which the differing views are predicated and for that the public must perforce await the reports.

It is amazing that this condition of uncertainty should obtain after all that has been done and said and thought regarding the question of a canal at Panama, continuously for the last thirty years or more, to go no further back; but the fact that it does exist is significant of the diversified and intricate nature of the problem. Looking backward we find at every turn the same conflict of opinion regarding the question of level, but apparently as the different stages of the matter have been reached the difficulties have but multiplied. We find that in 1879 a majority of the engineers constituting the International Congress of Paris, who came from various countries, including the United States, decided upon the Panama route for the express reason that in their judgment a canal at the sea level was essential and could not elsewhere be built. In the absence of definite data, it was then assumed that the canal could be cut "a' niveau" across the Panama Isthmus at a not excessive cost; it was well known that nowhere was there another location where the idea could be even entertained. Subsequent developments have shown that the sea-level plan, such as it was, had not the support in the congress of those best qualified by experience to determine the question, but there was no other treatment proposed for Panama at that time, it being vaguely generally understood that a high-level canal, with locks, besides being thought undesirable for other reasons, was impracticable because of the supposed impossibility of controlling the Chagres river floods at the higher level and the absence of suitable sites for the dams and locks, and other structures that would be required.

Thus the sea-level idea prevailed, and on that basis the work was taken up and carried on by the first French company, now known as the Old Panama Canal Company, to distinguish it from its successor, until 1887, when the plan was so far modified as to provide for what were termed "temporary locks," to surmount the Culebra divide by means of a high level. It is interesting to recall that these locks were seriously proposed to be built of iron and so designed as to be removable later without disturbing the navigation when the canal should be ultimately brought down to the sea level, an idea that at this moment is being brought forward as a new and feasible solution, by one of the engineers who has contributed to the more recent discussion of the subject. When the old Panama Canal Company went to smash in 1889, after upward of $400,000,000 had been squandered in the undertaking, no progress had been made on the lock project, but in 1894 the new Panama Canal Company took over the work and prepared plans for a permanent lock canal, with a summit level of about 100 feet above the sea level, afterwards modified as an alternative by lengthening and lowering the summit level to 66 ft. But up to the time of the United States intervention the question as to which of the two summit levels should be chosen had not been determined nor had any work been actually entered upon other than excavation applicable to either. In 1901 the United States Isthmian Canal Commission, after rather more than two years' investigation, reported that the most feasible and practicable route for a ship canal across the American isthmus was the Nicaragua route, but in 1902 the same Commission reported in favor of the Panama route, the new Panama Company having in the meanwhile reduced its selling price from $100,000,000 to $40,000,000, at which price the purchase was subsequently made. In its report the Isthmian Canal Commission rejected the sea-level idea and provided for a lock-canal with a maximum summit level of 90 ft. above mean ocean level.

This called for a high dam at Bohio as its dominant feature, together with six locks, and other important structures. Following upon the recommendation of the Isthmian Canal Commission, the Congress of the United States in 1902, as every one knows, passed an Act providing for the purchase of the new Panama Canal Company's rights, and on February 29, 1904, the President appointed the Panama Canal Commission to take charge of the work. This Commission did not adopt the plan above outlined (or any other, in point of fact), but proceeded to make further examinations of the physical conditions, and as a result its Engineering Committee reported early in the present year a recommendation for "A sea-level canal with a bottom width of 150 ft., a minimum depth of water of 35 ft., and with twin-tidal-locks at the Pacific end, at a total estimated cost of $230,500,000." Shortly after this report was formulated the Panama Canal Commission was reorganized, and the question of what type of canal should be adopted was submitted by President Roosevelt to the Advisory Board of Engineers, whom he had appointed for the purpose. This brings us to the present moment, and to the completion of the cycle of engineering opinion, the recommendation of the majority of this second International Congress of Engineers, as it in substance is coinciding, in 1905, with that made by the first one in 1879 that there should be a sea-level canal at Panama.

Another curious fact about it is that both the first plan proposed and the last depend alike for their successful execution upon the proper placing of a high masonry dam at Gamboa to impound and regulate the flood discharges of the upper Chagres. This project was abandoned by de Lesseps, it is said, because no suitable foundation for the dam could be found, whereas the Engineering Committee of the Panama Canal Commission has stated that "The practicability of certainly and satisfactorily controlling the floods of the Chagres by so simple and economical method as the (proposed artificial) Gamboa Lake and its outflow channels * * * makes the construction of a sea-level canal * * * far more available than has heretofore appeared possible."

Turning to the plan for the lock canal, we find that it, too, depends for its practicability upon a high dam at Bohio. Much discussion of a technical nature has already been entered into by engineers concerning the possibility of securing a safe foundation at the proposed site. It has been demonstrated by numerous borings that the rock formation, if indeed any there exists, lies too deep below the water level to be available with any approved known engineering method, and the practicability of the lock plan now turns upon whether an enduring structure of the kind required can safely be built upon and in the previous strata which underlie the site. This is indeed a vital question, and one that imperatively demands further elucidation than has yet appeared in any published report. Similar doubts have been entertained and expressed regarding the foundations of the locks which it has been hoped might be dispelled through the studies of the Advisory Board, but that hope, in the face of the divergent opinions, must be deferred.

It is a most serious dilemma which now confronts the Government; on the one hand is the inevitable conclusion, from which there can be no escape, that unless suitable foundation for all the important structures can be proved to exist, in advance of the actual design and execution, such as will insure the permanency of the established water levels as well as the enduring structural safety and efficiency of the canal, the lock plan must be abandoned as being visionary and precarious; on the other hand, lies the probability, almost, indeed, amounting to a certainty, that the sea-level plan will

require an unknown increase in cost and indefinite delay in time of completion. No halfway measures will suffice, and no chances can be taken in dealing with a work of this kind with its consequences so far reaching and portentous, for the commerce which the canal is to serve and which will spring into existence because of it, will be for the most part absolutely dependent upon it, and if after creating the commerce the canal should fail or become inoperative, dire commercial disaster and widespread trade ruin would result. These are truisms which seem to find no lodgment in the minds of the canal enthusiasts.

But there should be no hesitancy about the course to be pursued. Instead of boasting about "making the dirt fly" and leading on the country with baseless hopes of a speedy completion, the whole energy of the authorities should be directed to the determination of the one question of the practicability of building an enduring lock-canal. If the data already at hand are not sufficient to establish the required facts beyond the peradventure of a doubt, they should be supplemented, at whatever cost, before proceeding further. If the results reached prove this point, they will also suffice to accurately estimate the quantities and cost of construction. Not until these latter points can be cleared up will it be worth while to even attempt to decide which of the two types is theoretically the better or which in the end the more costly. All this will, of course, mean more or less delay for the present, but will undoubtedly save time in the end, as well as money, and reduce to a reasonable certainty what is now but a mystery of the dreamers. To take what appears to be a step backward, though really it is not, requires courage, but when prudence and wisdom and common sense and economy all demand it, the Government should call a halt.

Railroad Gross Earnings in September.

The gross earnings of most roads during September show even more favorable increases than they did in August. The general prosperity of the country was on the increase and the movement of crops was beginning to have an effect in increased traffic in general merchandise which comes as soon as profits are taken on crops. Some of the central roads, notably the Wabash, and the Cleveland, Cincinnati, Chicago & St. Louis, show decreases compared with their August earnings, due to the fact that their figures compared with those of a period last year when the passenger traffic was unprecedented owing to the World's Fair at St. Louis. Six roads of the trunk lines show gross earnings of $30,711,044, an increase of $2,921,600, 11 per cent., over the figures for September, 1904. This is a greater rate of increase than was shown last month and is perhaps accounted for by the increase in the amount of building materials, especially structural steel, carried. The eastbound trunk line movement of grain from Chicago and points near Chicago during this month amounted to 5,743,000 bushels, which is over 2,000,000 bushels heavier than the same movement in 1904. Of the Southern group, the gross earnings of nine roads were $17,612,631, an increase of only $89,430, 1 per cent. The yellow fever at New Orleans had still worse effect on traffic in September than in August. Certain individual roads in this group, however, show substantial increases, due to the great activity in the manufacturing towns of the South and also to the fact that the net overland movement of cotton amounted to 18,729 bales, over 4,000 more than in 1904. The coal roads continue the good showing of the previous month. Ten roads report gross earnings of $18,913,481, an increase of $2,394,706, 15 per cent. The anthracite situation was strong and the movement heavy. Shipments of anthracite during this month amounted to 5,082,232 tons, as compared with 3,967,600 tons shipped during the same month last year. The iron and steel activity also helped many roads in the coal region. The production of anthracite and coke pig iron in September was 1,898,873 tons, an increase of 546,196 tons. Seven of the granger roads show gross earnings of $20,066,140, an increase of $1,897,191, 10 per cent. An indication of the large business done by these roads is the number of cars handled by the Lake Superior Car Service Association, the figures being 38,079 cars, as compared with 34,716 cars handled during September, 1904. At the five great interior markets the live stock receipts during this period were 3,266,729 head, comparing with 2,997,235 head last year. At twelve interior markets during this month, the total grain receipts were 86,035,987 bushels, an increase of over 1,000,000 bushels. These lines also participated in the heavy traffic of manufactured articles to points west of Chicago, which was about 15 per cent. greater than in 1904. The southwestern roads did not make quite such a good showing as in August. The floods in this region seriously hampered some of them. Five roads in this group show gross earnings of $14,269,705, an increase of $741,449, 6 per cent. The trans-continental roads show the largest per cent. of increase. Five of them report gross earnings of $30,757,235, an increase of $4,376,977, 17 per cent. These roads, with their through traffic, naturally get the benefit of the good results in all the other groups of roads. The accompanying table shows the gross earnings for September, 1905, and the increase over the figures for September, 1904, of 46 roads:

	September, 1905.	Increase over Sept., 1904.
Atchison, Topeka & Santa Fe.	$6,457,832	$301,491
Atlantic Coast Line	1,892,798	163,133
Baltimore & Ohio	6,947,896	499,046
Buffalo, Roch. & Pitts.	865,816	67,182
Canadian Pacific	4,872,575	651,699
Central of Georgia	1,018,740	93,572
Central of New Jersey	2,159,760	325,010
Chesapeake & Ohio	2,000,285	281,394
Chicago & Alton	1,045,339	*222,820
Chicago & North-Western	5,766,336	379,712
Chicago Great Western	845,884	133,326
Chicago, Milwaukee & St. Paul	5,261,887	571,750
Chic., Rock Island & Pacific	4,719,385	601,504
Chicago, St. Paul, Minn. & O.	1,278,848	57,853
Cin., New Orleans & Tex. Pac.	694,090	54,552
Cleve., Cin., Chic. & St. Louis	2,072,137	*78,360
Colorado & Southern	681,322	142,627
Denver & Rio Grande	1,742,260	217,261
Erie	4,431,612	407,590
Great Northern	4,955,650	1,057,856
Hocking Valley	589,445	40,332
Illinois Central	3,960,057	*380,650
Interoceanic of Mexico	464,299	*8,718
Lehigh Valley	2,972,475	471,695
Louisville & Nashville	3,547,393	213,753
Mexican Central	2,178,652	257,230
Mexican International	494,134	18,353
Minn., St. P. & S. S. Marie	1,148,461	375,866
Missouri, Kansas & Texas	1,845,950	73,172
Nash., Chatt. & St. Louis	869,135	11,546
National R. R. of Mexico	1,094,909	198,186
New York Cent & Hud. River	8,106,297	855,756
New York, Ontario & Western	655,980	61,531
N. Y., Susq. & Western	246,486	38,181
Norfolk & Western	2,398,545	390,586
Northern Pacific	5,837,842	1,141,063
Penn. Lines, East of Pittsburg	11,602,439	1,988,300
Philadelphia & Reading	3,509,358	691,484
Pitts., Cin., Chic. & St. Louis	2,335,747	195,163
St. Louis & San Francisco	3,542,341	6,898
St. Louis Southwestern	712,519	*53,347
Southern	4,456,360	166,719
Southern Pacific	8,881,660	744,709
Union Pacific	6,209,508	781,650
Wabash	2,162,812	*446,849
Yazoo & Mississippi Valley	461,739	*181,848
Total	$136,562,230	$12,886,404

*Decrease.

October Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of October, printed in another column, contains accounts of 24 collisions, 24 derailments, and five boiler explosions. Those accidents which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

Date.	Place.	Killed.	Injured.
1st	St. Paul, Minn.	1	5
14th	Springfield, Ill.	1	3
15th	Seaton, Ill.	5	0
16th	Fresno, Cal.	3	0
20th	Caliente, N. Mex.	2	3
21st	Fort Scott, Kan.	0	30
22d	Eckley, Colo.	1	0
26th	Fairfield, Ia.	4	15
30th	Sheffield, Mo.	13	46

The cause of the disaster at Sheffield, Mo., killing 13 persons, was given in the press despatches as a loose rail, but later accounts report the officers of the road as declaring that the fault was neither in the rails nor in the wheels; that more likely it was a defect in the tender, either in the curve plates or in the unequal distribution of its load. But whatever the primary cause of the derailment, there appears to be no question that all of the fatal injuries happened to passengers riding in the smoking car, and that this car was crushed between a heavy baggage car in front of it and a heavy chair car behind it—which lends support to the assertion that the smoker was an old and comparatively weak car, while the other two cars were heavy and strong.

The next largest death list was that of the derailment at Seaton, Ill. This was not a passenger train, but five men were killed. Two of the five lived several hours, one of them being terribly scalded; and all this from what cause? Apparently from the lack of suitable fences or of efficient track-watching—or possibly from excessive speed. In many train accidents there is much discussion as to what is the most suitable preventive, but there can be no need of explanatory discussion here. Either providing good fences or driving cattle away would be a most prosaic proceeding, but all the King's inspectors could suggest nothing better. The payment of premiums to enginemen for care in not running over animals is well enough so far as it goes, but at best it can be only a palliative. As long as cattle have access to the track the only safety is in very low speed. Passenger trains sometimes escape disaster by their very high speed, but when a 1,200-lb. cow is lying down on the track, not every cow-catcher can be trusted to pick her up, however high the speed may be.

The Fairfield collision, killing four and injuring 15, once more illustrates the risks of the "American despatching system."

Two passengers were killed in a rear collision on the Canadian Pacific near Ignace, Ont., October 30.

The number of electric car accidents reported in the newspapers

in the United States in the month of October was 23, in which four persons were killed and 190 injured. One of these accidents was a rear collision in the subway at Boston Oct. 28, on a line well equipped with block signals and automatic train-stops. Many passengers were injured. It appears that the motorman of the leading train, having found difficulty in starting forward, started back a little distance; but the distance was not little enough, for he set back so far that he fouled the block section next in the rear.

Modification of Air-Brake Law, August, 1906.

The Interstate Commerce Commission, reporting on the facts gathered at its hearing of November 2, has issued an order, prepared by Commissioner Cockrell, requiring that the minimum percentage of air braked cars to be used in trains, under the Safety Appliance law, shall be increased from 50 per cent. to 75 per cent.; and the date when this order shall go into effect is fixed as the first of August, 1906. The number of freight cars in service October 1 was 1,790,113, of which 1,564,396 were equipped with air brakes. These totals are a little larger than those given in the incomplete table issued by the Commission, November 2, and reprinted in the *Railroad Gazette* of November 10, page 447. The report of the Commission says that from the best information obtainable the number of private freight cars in use in this country is 111,122. Practically all these are air braked, making the total number of air braked freight cars now in use 1,675,518.

In the United States Court at Chicago on Monday last Judge Bethea decided against the Interstate Commerce Commission in its suit to compel compliance with its order requiring the railroads bringing live stock to Chicago, from the Missouri river and from St. Paul, to desist from charging more for live stock than for dressed beef. The decision which the commission here sought to enforce was issued January 7, last, and was reported in the *Railroad Gazette* of January 27, General News section. In the argument of this case before the Court at Chicago, President Stickney, of the Chicago Great Western, one of the defendants, presented a detailed study of the cost of carrying live stock on his road, and the substance of this study is published in another column of this issue of the *Railroad Gazette*. The report of the decision now at hand gives none of the reasons set forth by the Court; and Mr. Stickney's notes and observations do not deal with the whole question; but they are entertaining in themselves. They aim at only one point—to convince the court first, that it would be fair to charge a higher rate per hundred pounds for carrying live stock than for carrying fresh or salted meats, and, second, that he has not done so; and being thus restricted his essay leaves the reader asking questions. With the enormous quantities of ice now carried—with cured as well as with fresh meats—the old principle that live stock carrying is a more costly service comes dangerously near being wiped out of existence—a fact which furnishes one more evidence that times change. Even in the matter of speed, Mr. Stickney's road, it seems, doesn't hustle any more with cattle than with lard. Still he omits one fact which must in the long run increase the cost of moving live stock trains—the necessity of giving them preference over other trains. This really is an injury to the "dead" traffic carried by those other trains, and the rates on the "dead" traffic ought to be correspondingly lowered, at the expense of the live stock traffic. On the other hand, one of Mr. Stickney's items in the cost of live stock traffic will be thought by some too large—the cost of carrying the drovers. If it really is an essential element of the business that a man go to Chicago with every two cars of cattle, it is perhaps fair to charge a reasonable fare for carrying him and carrying him back; but as the stock-pass is in part a sop thrown by the railroads to the shippers, to keep them good natured, rather than a legitimate element in the business, the passenger service might well be estimated more nearly at the actual cost, which is probably much less than $6.50. Charging for return haul of all of the stock cars also seems a trifle "steep." Loads ought to be found for some of them. However, these comments, like Mr. Stickney's estimates, lay no claim to thoroughness. We merely call the reader's attention to some entertaining figures.

Work on the Manhattan Bridge over the East river, New York, has again been stopped, this time by an injunction issued by a Supreme Court judge at the instance of a taxpayer restraining the city from awarding the contract to the Pennsylvania Steel Co., the one bidder at the time the bids were opened some months ago. The plaintiff alleges that the specifications were so drawn as to exclude other prospective bidders because of their inability to meet the rigid requirements for the nickel steel or high carbon steel to be used in the superstructure or stiffening truss. The judge in his opinion says:

"What justification is offered for such an unsatisfactory and costly method of specification? The hope is held out that during the two years before the material is needed experiments and actual results may show the superiority of nickel steel over high carbon steel. But who is to decide which is to be used? The city claims that its engineer has the right to decide which of the two shall be ultimately used. The case is open to doubt. It is clear that the city seeks to make a wasteful contract based on specifications which are not sufficiently definite to afford an opportunity for fair competitive bidding."

It is evident that the learned judge is overwhelmed by the unintelligibility, to the layman's mind, of the specifications in question and is somewhat lacking in a clear understanding of the present status of nickel steel for engineering structures. The specifications on which bids were asked are a model document, clear, precise and far from being excessive in their requirements, either for nickel steel or the alternative high-carbon steel. Bidders had the right to submit bids for either material. The court holds that the plaintiff in his argument for an injunction showed that nickel steel would cost $779,000 and high-carbon steel $559,800. The successful bidder preferred to furnish nickel steel for the very good reason that it will soon have a plant in operation for turning out that material in large quantities for the Blackwell's Island Bridge. Had other contractors had such a plant or been prepared to furnish high-carbon steel of the required quality and quantity there would perhaps have been other bids submitted on one or both bases. As regards the uncertainty of nickel steel proving a satisfactory material for structural work where maximum strength with minimum weight is required little needs to be said. The Blackwell's Island bridge, now building, is ample justification for specifying this material in other structures of equal magnitude. This suit and injunction look suspiciously like a "nigger in the woodpile." There is evidently some motive back of it other than the personal objection of a dissatisfied taxpayer.

*Poor's Manual,** appearing again in its familiar form, leaves little new to be said about the excellent annual compilation of railroad statistics, having as its only defect the fact that so much time is required in the preparation of the matter that it is nearly a year old when presented. The tabular matter in the first part of the volume always affords interesting comparisons; figures showing the preponderance of bonds over stock in the year's new capitalization, which formed the basis of an editorial in our issue of Nov. 10, were quoted from the advance sheets of the Manual. The great gains in passenger traffic during recent years are also well shown in the tables, although when the entire system of the country is considered, freight has fully maintained its percentage of gain. We have previously taken occasion to point out that the rapid growth of the country should each year tend to increase the relative importance of passenger, as compared with freight traffic. Where population is very dense per mile of track, as in England, or in the territory served by the New Haven road, the two branches of traffic maintain almost a parity, instead of the wide divergence in importance that at present exists in this country as a whole. Yet in spite of the congested passenger traffic in certain parts of the country, it is worthy of note that freight earnings to-day actually constitute a larger percentage of gross earnings than they did 30 years ago. Thus, in 1875, earnings from passenger traffic constituted 27 per cent. of the gross earnings of the railroads in the United States, as reported in *Poor's Manual*. In 1880, this percentage had fallen just under 24, with an increase of 17 per cent. in the mileage of the country during the five years. From 1880 to 1885 the mileage increased 46 per cent., and in 1885 the ratio of passenger earnings to the total was 26 per cent. Since 1885 the returns may be tabulated as follows:

	Per cent. Avg. annual increase in mileage.	Per cent. Passenger earnings to gross earnings.		Per cent. Avg. annual increase in mileage.	Per cent. Passenger earnings to gross earnings.
1890....	6.4	25	1902....	2.0	23
1895....	2.0	24	1903....	3.5	22
1900....	1.4	22	1904....	2.0	23
1901....	2.0	22			

NEW PUBLICATIONS.

Multiple Telegraphs. By A. C. Crehore, Ph.D., Mem. A. I. E. E. New York: McGraw Publishing Co. 6 in. x 9 in., pp. 124. Price, $2.00.

The author of this book is an electrical expert of long experience and an extensive experimenter in synchronous and other multiple telegraphs; and this work is an account of what he has done in obtaining independent telegraph circuits by the use of direct and alternating currents on the same wire, and in the use, for telegraphing, of synchronous rotation of two bodies at distant points. His arrangement for using direct and alternating currents on the same wire is called the duplex-diplex system. He describes in detail the arrangement of such a system on the railroad wires of the Pennsylvania Lines West of Pittsburg between Pittsburg and Toledo, and also between Cambridge, Ohio, and Crestline. This line has been in use over three years. The duplex-diplex cannot be worked quite so long distances as the polar duplex, but it

**Poor's Manual of Railroads;* 38th annual number, covering 1904. 1,620 pp. Poor's Railroad Manual Co., Publishers, 68 William St., New York. Price, $10, including delivery.

has the advantage that two messages may be sent simultaneously in the same direction, and the receiving operator can break the sending operator. The two independent circuits of the duplex-diplex system may be treated as if they were two separate wires, and rented or leased to independent parties. No artificial line is required for this system and stations may be inserted anywhere in the wire without putting in a repeater station.

Handbook of Cost Data. By Halbert P. Gillette. New York: Myron C. Clark. 1905. Leather, 610 pages. Price, $4.

There is a distinction between "costs" and "prices" which many engineers and business men fail to recognize. Prices of material can be obtained anywhere at any time, but the cost of a piece of work is a very different thing. The price of material is only one small item in the cost. There have been many compilations of prices of material, so-called cost of excavation or building, etc.; and these have a certain value to the engineer and contractor in estimating the cost of a new piece of work. They all lack, however, an intelligent analysis of the component items, and therefore are of comparatively little use unless supplemented with a wide knowledge of practical work and years of experience. And too, prices vary from month to month in the same and different localities.

The author of this handbook has gone deeper into the subject of estimating costs of engineering works. An authority himself with every facility for collecting data covering a wide range of work, he has condensed in this volume the experience of practical men, the actual costs and prices of doing contracting work, and has analyzed these costs in a thorough and complete manner. The section headings give an idea of the subjects covered. They include cost keeping and preparing estimates; costs of earth excavation, rock excavation, roads and pavements, stone masonry, concrete construction, water works, sewers and conduits, piling and timber trestles, erecting buildings, steam and electric railroads, bridge erection, railroad surveys and miscellaneous structures.

The first chapter on cost keeping and preparing estimates is well worth careful study by any young engineer or contractor, for it is carefully written and contains just such information as cannot be found in text books on the practical details of this important preliminary to engineering contracts. More delays and actual monetary losses can be incurred by hasty and erroneous estimates than by any other conditions affecting the work, and the rule of thumb is not a safe and "good enough" method. The materials for the other chapters have been gathered largely from the author's personal experience and from data published in recent issues of the various engineering papers. Numerous examples are given of detail costs of works in different sections of the country, and wherever possible the figures have been supplemented by a brief description of the methods used on the work.

The Building Estimator. By William Arthur. Second Edition. Omaha, Neb., 1905. Published by the Author. Cloth, 186 pages. Price, $1.50.

This little book was first published in 1904 and has since been added to and revised by the author in places where it seemed deficient. It outlines in detail the estimates necessary for figuring the cost of a complete building from cellar to roof, giving quantities, costs of materials, cost of labor, etc. Most of the examples have been taken from buildings erected under the author's observation, but the detail costs are sufficiently representative of conditions obtaining elsewhere throughout the country to be of value outside. Complete estimates are given for frame engine houses for railroads, and several pages are devoted to the cost of railroad shop buildings and other structures.

Theory of Structures and Strength of Materials. By Henry T. Bovey, Professor of Civil Engineering, McGill University. New York: John Wiley & Sons, 1905. Fourth edition, reivsed and enlarged. Cloth, 981 pages, 943 figures. Price, $7.50.

It is not necessary to review at length Prof. Bovey's text book on Framed Structures. His work has long been a standard in many colleges and a constant reference book for many practising engineers. In its new and enlarged form it is brought up-to-date by the introduction of examples of modern engineering works throughout the discussions in the text. About 130 pages of new matter have been added and the number of figures increased from 515 to 943. This in itself speaks for the amount of work which has been done in revising the book.

High-Tension Power Transmission. Published by the McGraw Publishing Co., New York, 1905. Cloth, 466 pages. Price, $3.

In 1902 the American Institute of Electrical Engineers appointed a committee of five members to collect data on the electric transmission of energy at high voltage and present it to the Institute in the form of a report and through individual papers. In this volume the various papers and discussions before the Institute relating to high-tension transmission have been collected and arranged in co-ordinate form. The papers have been reprinted from the *Transactions* of the society by special permission, and in this shape they form a valuable addition to engineering works relating to the modern method of transmitting energy great distances.

TRADE CATALOGUES.

Locomotive Castings.—Illustrations of Hunt-Spiller gun iron locomotive castings, such as journal boxes, brake-shoes and wedges, cylinder packing and bushings, piston valves, false valve seats, girders, crosshead shoes, eccentrics and straps, rocker boxes, etc., are shown in a pamphlet published by the Hunt-Spiller Mfg. Corporation, South Boston, Mass. This metal has a tensile strength of 35,000 lbs. per sq. in., and is of very close grain and has exceptionally fine wearing qualities which make it particularly desirable for locomotive work. W. B. Leach, General Manager of the company, was at one time connected with the Boston & Albany.

Union Pacific Motor Cars.—Union Pacific motor cars numbers 1 and 2 are described, with photographs and drawings of the newer car, in a folder just issued by the road. The description includes a record of trial trips and regular service in which the cars have been used. In its second trial run on September 22, motor car No. 2 covered several miles at the rate of 63.2 m.p.h.

The Chicago, Burlington & Quincy is distributing a folder of 15 pages devoted to Colorado as a winter resort. It is illustrated with large half-tone engravings from photographs and sets forth in detail the advantages and desirability of this region in the winter season.

Belt-Type Direct Current Machines.—Large sizes of belt-type d.c. motors and generators are described in Bulletin 61, issued by the Crocker-Wheeler Company, Ampere, N. J. Outlines of these machines accompanied by tables of general dimensions are also given.

CONTRIBUTIONS

"Praise from Sir Hubert."

Atlanta, Ga., Nov. 15, 1905.

To the Editor of the Railroad Gazette:

I have just been reading the last issue of the *Railroad Gazette*, and feel like saying something to show my appreciation of its make-up and the character of the articles printed. What could be neater, cleaner or plainer than the pictorial description of the article on the Improvements of the New York Central & Hudson River? It seems to me that careful perusal of its columns from week to week is almost equivalent to a liberal education for any one who wishes to be well informed on railroad matters, and almost invaluable. The clean cut, plain, common-sense statements and liberality of view in its editorials particularly impress me. Especially so in the one referring to Mr. John F. Wallace in the issue referred to. I do not know him personally, but it has seemed to me that if ever a man of merit was unjustly treated, he was. Yet he has proved himself to be too much of a man to let the "slings of outrageous fortune" prevent his aiding the Advisory Board of the Canal Commission with his valuable information in reaching their decision, and the *Railroad Gazette* is certainly to be commended for speaking plainly about the matter.

BENJ. THOMPSON,
Mem. Am. Soc. C. E.

Honeycombing Flue Sheets.

Omaha, Neb., Nov. 13, 1905.

To the Editor of the Railroad Gazette:

I have read with interest your editorial note in the issue of October 27 calling attention to the formation of honeycomb on flue sheets of locomotives burning Illinois and Iowa coal with automatic stokers. We have had considerable experience, particularly on our Kansas division, with the honeycomb or clinker forming on our firebox plates, especially the back flue sheet. In my opinion, the automatic stoker has nothing to do with the clinkering of the flues or the firebox plates. It is entirely in the coal; this formation is a part of the coal. Owing to our engines on this division having small grate area and consequently small exhaust nozzles in order to burn the coal mentioned, the small nozzles create a high velocity of air drawn through the grates, which carries this substance from the fire to the flue sheet. With a wide firebox and larger exhaust nozzles, this does not take place to such an extent. This substance will cover the flue sheet in going from 30 to 40 miles. To remove it, the fire door is opened, blower put on, and a rush of cold air striking the clinker hardens it so that it can be knocked off. Where an automatic stoker is used the scraper cannot be used and an engine would fail on account of this clinker covering the flue sheet and shutting off the draft.

We have tried sand in fireboxes to prevent this formation, but with no beneficial results. At the present time we are experiment-

ing by giving the ends of the flues and flue sheet a coating of plumbago and oil, before the engine leaves the roundhouse. We find that, when the ends of the flues are new and smooth, this clinker does not adhere as readily as after the flues have been in service a few months and the ends become rough. In view of this fact, it has been suggested that the coating of oil and plumbago will have a tendency to keep this surface smooth and prevent the clinker from adhering.

W. B. M'KEEN, JR.,
Superintendent M. P. & M., Union Pacific.

Handling Fast Freight in England.

In connection with the series of articles we have printed on the time freight systems of representative American railroads, it is of interest to glance at the extraordinary and extravagant development of that type of traffic in England. As far back as 1885, when Hadley wrote his "Railroad Transportation," he spoke of the fact that merchandise freight could be collected from the shipper in the afternoon and delivered at almost any large point south of the Scotch line early the following morning. So far as the main principles involved are concerned, there has been no radical change during the last 20 years, but in the working of the traffic, in the face of sharp competition, the service has been polished up to a degree of facility and of expensiveness which strikes the American observer as quite extraordinary. Broadly speaking, the British railroads are not troubled by competition in rates, although in certain specific cases, as, for example, the passenger traffic between Glasgow and Edinburgh this statement must be modified somewhat.*

But on the main trade routes, as, for example, between London and the north, there is the sharpest kind of competition in facilities. What competition in facilities does in this country is well shown on the roads working between Chicago and St. Paul and Minneapolis. In England, however, the development at the expense of the carrier has been much greater, particularly in handling freight. There are three main routes from London to Scotland, the London & North Western, which combines with the Caledonian to furnish a through service; the Midland and the Glasgow & South Western, forming the central route, and the Great Northern, North Eastern and North British, forming the east coast route. Although, in general, these lines serve the west, center and east of England, respectively, they nevertheless compete at many points and have additional rivals of their own; as, for example, the Great Western and the Great Central. The result is that the London & North Western despatches from its Broad Street Station in London about 28 fast freight trains every afternoon and evening. These trains, in their unity and in the way they are handled, suggest a passenger service rather than a freight service. Their length is quite uniform, consisting of either 24 or 25 goods wagons. The traffic handled includes about everything except coal, brick, iron, and other heavy articles, but merchandise predominates, with the result that three tons per wagon of paying traffic is considered a first rate load. The Great Northern despatches 16 of these trains every night, each train made up of 24 wagons, so that the net paying load per train is only 72 tons, and this is adhered to in practice quite strictly. Each one of these trains has its regular place in the loading sheds, which also suggests the working of a passenger service.

At the Broad Street Station the cars are handled individually by lines passed around hydraulic capstans, over tracks making right angle junctions in the shed, with a turntable at each junction. The capstans are conveniently located, operated by a foot lever, and revolve at a high speed, and a crew of two men handle the cars with great skill and rapidity. Loading and unloading is done on two floors, and the cars are raised and lowered on hydraulic lifts without confusion or loss of time.

Perhaps no more graphic exhibit of the nature of English freight traffic could be shown than the accompanying statement of the business done at a large goods station on a single day selected as characteristic.

STATION R. X.
Consignments and Packages in One Day.
Received.

Description of traffic.	No. of consignments.	No. of Packages.	Weight Tons, of 2240 lbs.	Average Per consignment, lbs.	Average Per package lbs.
Meat	206	6,082	337	3,669	40
Fish	81	2,233	31	842	30
Ale	1	95	18	40,320	429
Goods	2,574	24,002	499	404	46
Total	2,862	32,412	886	692	61

Forwarded.

6,201 consignments.
23,067 packages (total weight 906 tons).
Average weight per consignment, 297 lbs.
Average weight per package, 88 lbs.

The interesting corollary to these figures is that a large proportion of the 32,412 packages received had to be delivered before eight o'clock in the morning, while the 23,067 packages forwarded were, for the most part, receivable after four o'clock in the afternoon.

On another day, from this same station, when a total of 823 tons of goods were sent out, 718 tons were loaded direct for delivery at 161 stations, and 105 tons were sent to 105 "transhipment" stations for delivery at 528 points! Of the stations served direct, only 21 received consignments of over seven tons; the remaining 140 received 439 tons of freight in consignments smaller than seven tons.

The Great Northern undoubtedly handles its merchandise traffic faster than any other line in England at the present time. The 16 nightly trains are sent out at an average speed, including stops, of 40 to 45 miles an hour. On the North Western the speed of these trains is somewhat less, say, 35 to 38 miles an hour, and the same is true on the Great Western, which competes sharply with the North Western for part of its traffic. As a result of this type of service, which has been accelerated and improved with each succeeding year, the business methods of the local tailor or draper have gradually changed their character, and only small stocks are carried. For example, a customer in Sheffield orders a suit at his tailor's from the sample; the tailor telegraphs to London for the cloth, and if he receives his order by four or five o'clock in the afternoon, he gets the cloth delivered at his shop by his opening hour the following morning.

To handle traffic in this way is, of course, extremely expensive for the railroad companies, but the rates charged are proportionately high and the best opinion at the present time seems to be that this abnormal traffic is profitable. The average rate received for this fast freight for the average haul is not far from a sovereign ($4.86) a ton. This, of course, includes collection and delivery by the railroad company. Southbound traffic arriving in London in the early morning hours is switched on to the Metropolitan and District underground line and brought from the main receiving stations at the north of London to the freight depots east of the City. Here it is received in the company's own vans for immediate delivery, which is, of course, facilitated by the small loading of the cars. In former times rather more use than at present was made of the great public trucking companies in London, such as Pickford's. The railroads now find it cheaper to handle their own goods, but call on the trucking companies for help in times of emergency, on an agreed rate.

In view of the light weight of these fast freight trains and of the speed at which they are run, it is not surprising to find that they are frequently handled either by regular passenger locomotives or by a type approximating the regular passenger type. The fastest freight trains of all are those carrying fish, chiefly from the east coast receiving points, such as Grimsby and Hull, to the markets. England is a great fish-eating country, and the importance of having the fish delivered in the quickest possible time is fully realized; hence the fish trains running in the early morning hours are in many cases the fastest trains on the road, passenger or freight, and will maintain a schedule of 60 miles an hour or faster. These trains carry a special system of designation and are kept intact for the trade.

It is obvious that with the short hauls and fast running there is but little need of the complicated time freight accounting which is required in this country. On a characteristic English line the general superintendent receives each morning a telegram describing the movement of each of his fast trains on the night before. This telegram is usually quite simple, because the traffic is but little subject to delays and breakdowns. The trains move with great punctuality and the ordinary record is simply that the enumerated trains as specified have been despatched from enumerated points and have arrived at London. The exceptions are so few in number that they can be handled at once and cleaned up without any further formality.

Assuming the tare weight of each of these merchandise goods wagons as being in the vicinity of 5½ long tons, it will be seen that the weight per train is not far from 228 tons of 2,000 lbs.

The heavy freight trains, carrying brick, coal, iron, etc., are also despatched considerably faster than the corresponding trains in American service, though far lighter. The Great Northern has in some cases hauled mineral trains, as it calls them, weighing 1,000 tons of 2,240 lbs., but these are very uncommon and are not attempted on most of the lines. The London & South Western considers 400 tons as its practical maximum and handles these trains at 20 miles an hour, average running, including stops, with six-coupled engines; and 400 tons is in general pretty good measure for British mineral trains, except for special runs on the great coal roads, the Lancashire & Yorkshire and the North Eastern, and for occasional experimental developments like that on the Great Northern. Large cars, except under extraordinary circumstances, are evidently an unprofitable specialty in England at present. On the line of the London & North Western alone, at the present time, there are nearly 100,000 private owned colliery wagons in use. The company can insist that these be safe, serviceable, and not ridiculously small (from the English standpoint), but cannot

*The distance from Glasgow to Edinburgh over either of the competing lines, the North British or the Caledonian, is approximately 60 miles, and the single third-class fare at the prevalent rate would be about 5s.; as a matter of fact it is only half a crown (2s. 6d.).

require the owners to use big cars. The mineral tariff usually covers haul alone, without including vehicles, and the private wagons and private loading facilities govern the traffic.

The discussion of heavy freight, however, does not properly come within the scope of the present paper, except so far as is necessary to show that practically everything except traffic of extreme bulk and low value is included in what we would consider the time freight designation. On lines such as the London & South Western, which have a less exacting competition, only a few fast goods trains are run, two or three each day carrying the meat and fish, fruit, etc., at about 40 miles an hour; and the standard train, as on the other lines, consists of about 25 cars hauled by an engine with wheel arrangement often corresponding to our Atlantic type, weighing 80 to 90 long tons, including tender. On this line draperies, etc., are hauled in the general goods train, as distinguished from the mineral trains. These general goods trains consist of about 40 cars with a total weight of about 400 tons, and they are hauled at approximately 35 miles an hour with only one or two stops between London and the West. All of these trains preserve their schedules, the main difference from the lines to the North being that a much smaller number of fast freights are worked, while the intermediate traffic is carried in mixed freight trains.

On the southern lines, such as the South Eastern & Chatham, where the goods business is secondary, consisting chiefly of continental merchandise which has crossed the Channel, and of the out-haul to the towns along the line, only one or two fast trains are run each day, and these are extremely small, pulling out with from five to 15 cars, so that the average paying load per fast freight train would not be much more than 30 tons per train. These trains run about 40 miles an hour and general freights, as on the South Western, carry the balance of the traffic in 400 ton trains, gross load, at about 35 miles an hour. Mineral trains on the South Eastern & Chatham also maintain about this speed and are usually quite light. The important consideration is to keep them out of the way of passenger trains.

What the competition in facilities which has brought about these developments will lead to, no one can tell. English railroad managers are quite agreed in their belief that only a tiny fraction of the shipping public has really any vital interest in the over-night deliveries that are arranged at such cost. On the other hand, it may be said that freight rates have scarcely been reduced in the last 30 years, and it is presumably more profitable to the companies to haul their traffic in uneconomical train loads and haul it fast, at high rates, than to increase the loading and lower the rate.

The Fades Viaduct.

BY E. OMMELANGE.

The Fades viaduct which is being built across the valley of Sioule river near Vauriat, France, will be the highest railroad bridge in the world. It is one of the engineering structures on a branch line from Saint Eloy to Pauniat (Puy du Dome), in Central France. The total length of the bridge is 1,446 ft. 2 in., and it consists of three masonry arch approach spans and three latticed girder deck spans. The level of the rail is 434 ft. 7 in. above the bed of the stream. The steel spans are of unusual length for the type of truss used, the center span being 472 ft. 5 in. over end pins and the two flanking spans each 378 ft. long. The masonry towers are also remarkable. The bridge will cost about $560,000, of which $200,000 has been spent on the masonry piers and abutment arches and the remainder for the steel work.

The two tower piers are of granite masonry laid in parallel courses and are 303 ft. high above the foundation, which rests on solid rock. They are rectangular in section with parabolic facings, the reduction in dimensions being from 38 ft. 3 in. x 72 ft. at the base to 18 ft. x 36 ft. under the capitals. The piers are hollow and have two shafts rectangular in section rising to the top and connected under the capitals by a circular arched opening. The narrow dimension of these shafts, 6 ft. 6 in., is constant for the full height, but the long dimension decreases with the height. The walls thus have a thickness of from 15 ft. $9^3/_{16}$ in. to 6 ft. ¼ in. on the narrow faces of the pier, and from 21 ft. 3 in. to 11 ft. 9¾ in. on the wide faces. The coping at the top is 9 ft. 10 in. high and projects out 2 ft. 11 in. from the faces of the shaft. It is supported on brackets and fillets which give a finished appearance to the immense pillars.

The west approach is formed by two circular masonry arches of 45 ft. 11 in. span. The end piers are 16 ft. 5 in. thick at the springing line, and the intermediate piers 9 ft. 2 in. thick. The outer pier is 264 ft. 9 in. high from foundation to springing line and the inner pier is 76 ft. high. The approach arches are 32 ft. 2 in. wide over parapets. A buttress is built up on the outer face of the approach pier to serve as a seat for the superstructure. It is 6 ft. 6 in. wide and 29 ft. 6 in. long at the top. The east approach has only one masonry arch of the same dimensions as the piers and arches of the west approach.

The superstructure is 1,230 ft. long divided into two shore spans of 379 ft. and a central span of 472 ft. It consists of two parallel latticed deck girders 38 ft. 2 in. deep spaced 21 ft. 11 in. apart, center to center of chords. The top and bottom chords are built up of plates in a box section and the double lattice rods are inclined at an angle of 45 deg. The two girders are braced laterally with diagonal and cross-braces. The top chords carry the floor system and the bottom chords carry a fixed footbridge for inspection and maintenance purposes.

The floor system consists of I-beams spaced 2 ft. 4 in. apart and resting on the top chords of the trusses. A steel plate floor ¼ in. thick is laid over these and the rails are laid on the plates. The floor is designed to carry a locomotive or cars in the event of their leaving the rails and wooden guard rails are laid outside the track rails to keep the engine or cars in the center of the structure should a derailment occur.

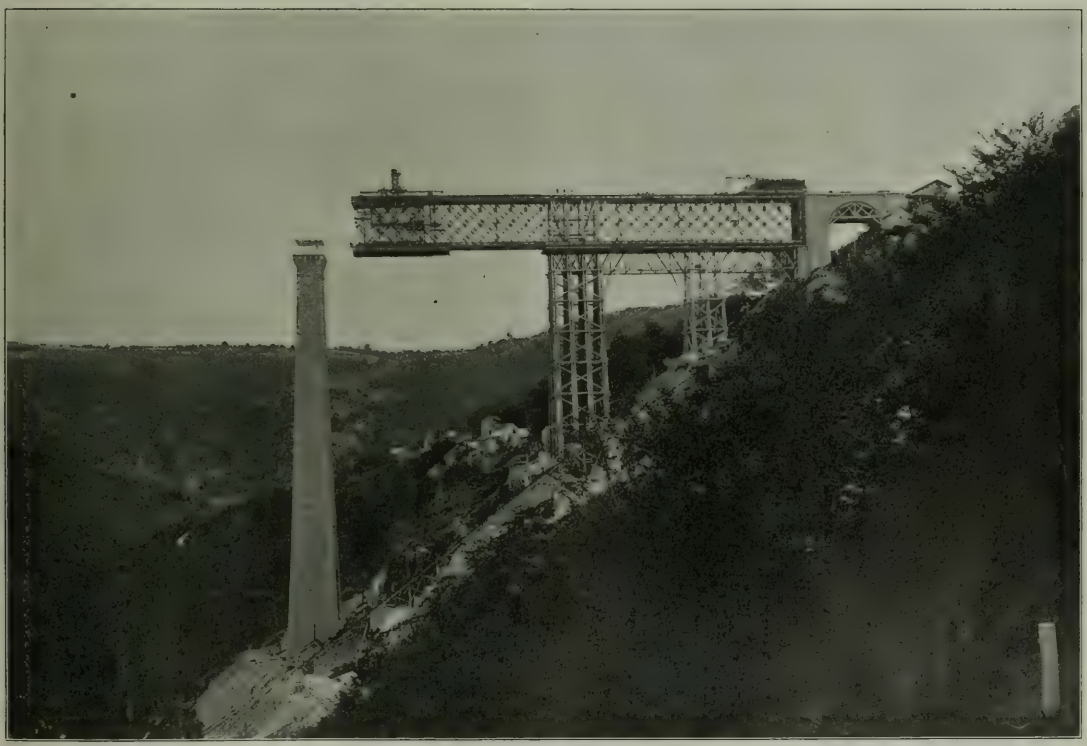
The superstructure was designed to carry a dead load uniformly distributed of 4,220 lbs. per ft. and a live load of two 77-ton locomotives followed by a train of 20-ton coal cars. The coal cars are 25 ft. 2 in. long and are carried on four wheels with axles spaced 10 ft. apart. The maximum axle load of the cars is 16 tons. Wind pressure was taken at 34.8 lbs. per sq. ft. of vertical surface for the loaded bridge and 55.3 lbs. per sq. ft. for the unloaded bridge. These pressures were assumed to act only on the actual vertical projection of the trusses. The full wind pressure was assumed to act on the windward truss and the simultaneous pressure on the leeward truss was less by that fraction of the full pressure equal to the ratio of exposed truss surface of one truss to the total area of the rectangle represented by the top and bottom chords. The wind pressure on a train was assumed to act on a vertical surface 9 ft. 10 in. high with its bottom edge 1 ft. 8 in. above the rail. The maximum wind effect was found to be 941 lbs. per lineal ft.

East Pier of Fades Viaduct.

The pier carrying the fixed end bearing is further required to resist the braking effort of the full train load. It was assumed that the maximum train load with full complement of automatic brakes would be 330 tons, which would give, with a braking coefficient of 0.20, a retardation of 66 tons. The maximum compressive stress in the piers due to full dead and live load and wind load is 200 lbs. per sq. in. Calculations to determine the lateral deflection of the piers at the top due to wind load and braking load showed that this would be only about ¼ in. under the most severe conditions.

The end bearings of the trusses are of the usual pin and roller

The Sioule River Valley and the Fades Viaduct.



Erecting East Shore Span of Fades Viaduct, Showing Falsework and Traveler.

type. The fixed bearing is mounted on the east pier. Those on the west pier and the two abutments are movable.

The erection of the superstructure has been carried out from the east bank. A scaffold floor supported on two towers and half the length of the shore span was built up to the level of the bottom chord of the truss and half the truss erected. The remainder of the first span was erected with a traveling cage carried out on the truss as the erection proceeded. The inshore end was counterweighted with 200 tons placed next to the abutment. A similar method will be followed with the west shore span. The center span will be erected with a traveler by anchoring to the inshore spans. Most of the field riveting is being done with pneumatic hammers, but in a few inaccessible places hand riveting has been used.

Improvements of the New York Central & Hudson River Within the Electric Zone.*

The new Grand Central yard, Park avenue tunnel changes, Port Morris Branch improvements, Marble Hill cut-off, four-tracking and electrification have been described in previous articles (*Railroad Gazette*, October 20, November 3, 10 and 17). This article, which concludes the series, will describe the new terminal building which will be erected on the site of the Grand Central Station.

Preliminary studies for the new station were developed on the basis of a structure suitable for revenue producing qualities as well as for railroad uses, following substantially the lines of a modern high office building. This plan was later discarded, however, as sacrificing to commercial uses, features of great importance for railroad requirements, and as being less adapted to treatment appropriate for a great railroad terminal.

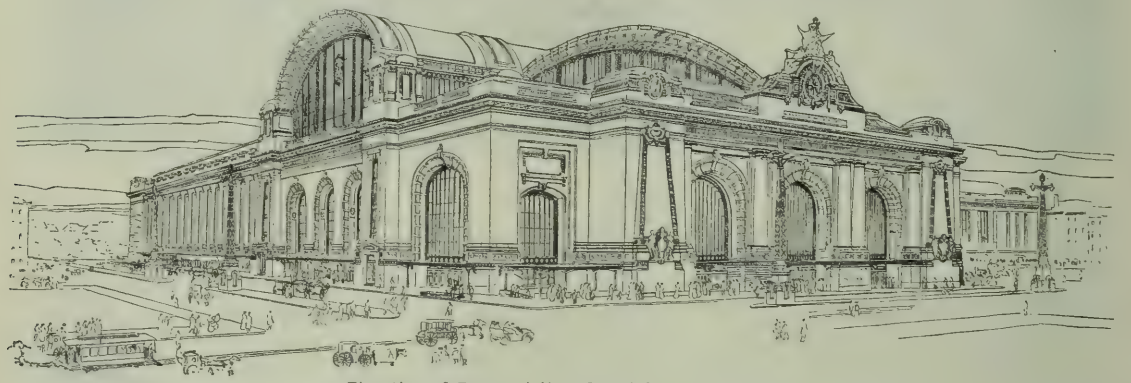
The accepted design embodies a monumental scale of treatment. Rising only to a height of 170 ft. above the street, the structure as a whole appears low on account of the tremendous scope of the plan, which covers an area equivalent to about 3½ city blocks. The main entrance on the Forty-second street facade, symmetrical with the center line of Park avenue, presents three arched entrances of proportions commensurate with the general scale, flanked by huge pylons on which appear appropriate inscriptions, the whole surmounted with a heavy ornate cornice which extends unbroken around the entire building. Over the center arch is an immense ornamental clock which is surmounted by a group of statuary. The Vanderbilt avenue facade provides similar treatment for the main exit, the three arches being symmetrical with the center line of Forty-third street and being surmounted by a grand arch sprung from the flanking pylons and spanning the entire exit. This arched roof is carried for the entire width of the main building from Vanderbilt avenue to Depew place, forming a roof to the main concourse, and intersected in the center to effect a magnificent groined dome over the center of the concourse.

The station will be set back about 40 ft. from the line of Forty-second street and 70 ft. from the line of Vanderbilt avenue, and island walks with tall electroliers will follow the existing street lines, thus giving spacious carriage approaches to the main entrance and exit.

From the main entrance from Forty-second street passengers enter the ticket lobby, a hall 90 x 300 ft., at the street level, extending the entire width of the main building, with vaulted roof. The outgoing baggage room along Depew place is in direct communication with the ticket lobby and is thus convenient to passengers for checking baggage after tickets are purchased. Beyond the ticket lobby and on the same level is the gallery or mezzanine floor surrounding and overlooking the express concourse 15 ft. below and approached from the gallery by four grand staircases, each 25 ft. wide. This concourse is on the same level as the express tracks, about 15 ft. below the street grade. It will be 160 ft. by 470 ft. and over 150 ft. high, and will be the largest in the world. Passageways of generous dimensions have been provided, connecting both ends of the concourse by means of subways with easy grades, with Madison and Lexington avenues, the exits on these avenues being just north of Forty-third street. A passageway is also provided connecting the west end of the concourse directly with the Rapid Transit Subway Station in Forty-second street. The main exit from the station is at the west end of the concourse, opening directly to Vanderbilt avenue opposite the public carriage stand, or to the company's cab stand below the street level.

North of the main concourse and on the same level, are the express platforms in the main train room. This train room is 500 ft. wide by 400 ft. long, extending from the west side of Vanderbilt avenue to the east side of Depew place, and north to Forty-fifth street. It contains 24 tracks and 13 platforms, 15 to 18 ft. wide, the longest of which extends to Forty-ninth street, a distance of nearly 1,500 ft. The low vaulted roof of the train room is supported along the platforms by columns which also carry the building over the train room. On the same level and to the rear of the express concourse is the general waiting room under the ticket lobby. Adjoining the express concourse and the main waiting room, are the usual retiring rooms, cafés, restaurant, parcel room, barber shop, telephone and telegraph facilities, etc. The main waiting room and express concourse with adjoining rooms and the express train room, occupy the entire area, about 15 ft. below the street grade, from Forty-second to Forty-fifth streets, between the west line of Vanderbilt avenue and the east line of Depew place, 720 by 460 ft.

From the express concourse grand staircases descend to the lower level or suburban concourse, with separate waiting, retiring rooms, etc., which are on the same level with the suburban platforms. The suburban concourse is about 80 by 300 ft. and from it passengers can pass directly forward to the suburban platforms, or to the rear to the passageway leading directly to the Rapid Transit Station in Forty-second street. There will be provided also separate entrances and exits to and from the suburban concourse, leading by inclined passageways directly to the street, and obviating the necessity of passing through the express concourse to the main entrance or exit. The platforms in the suburban station are 500 ft. long.

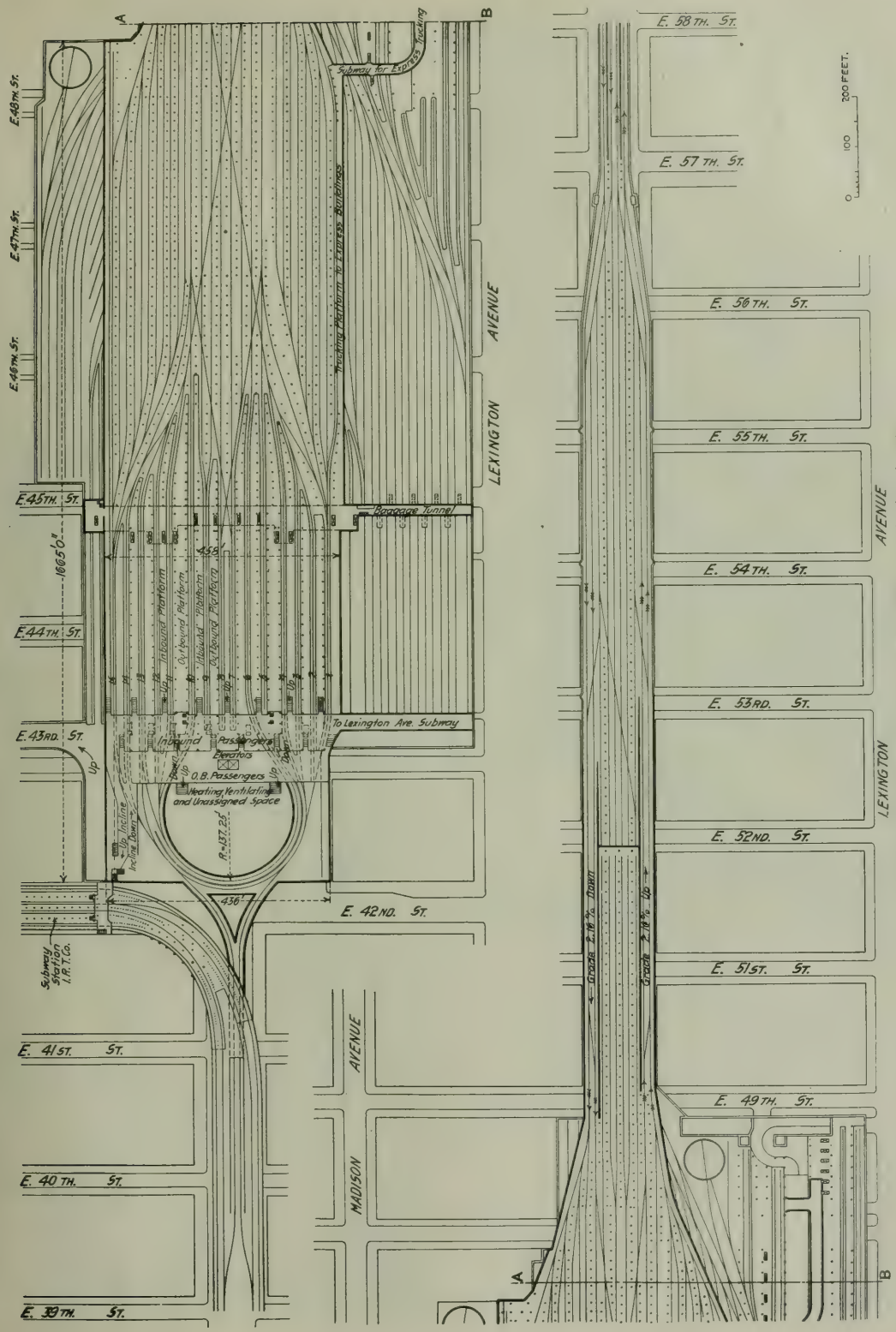


Elevation of Proposed New Grand Central Station.

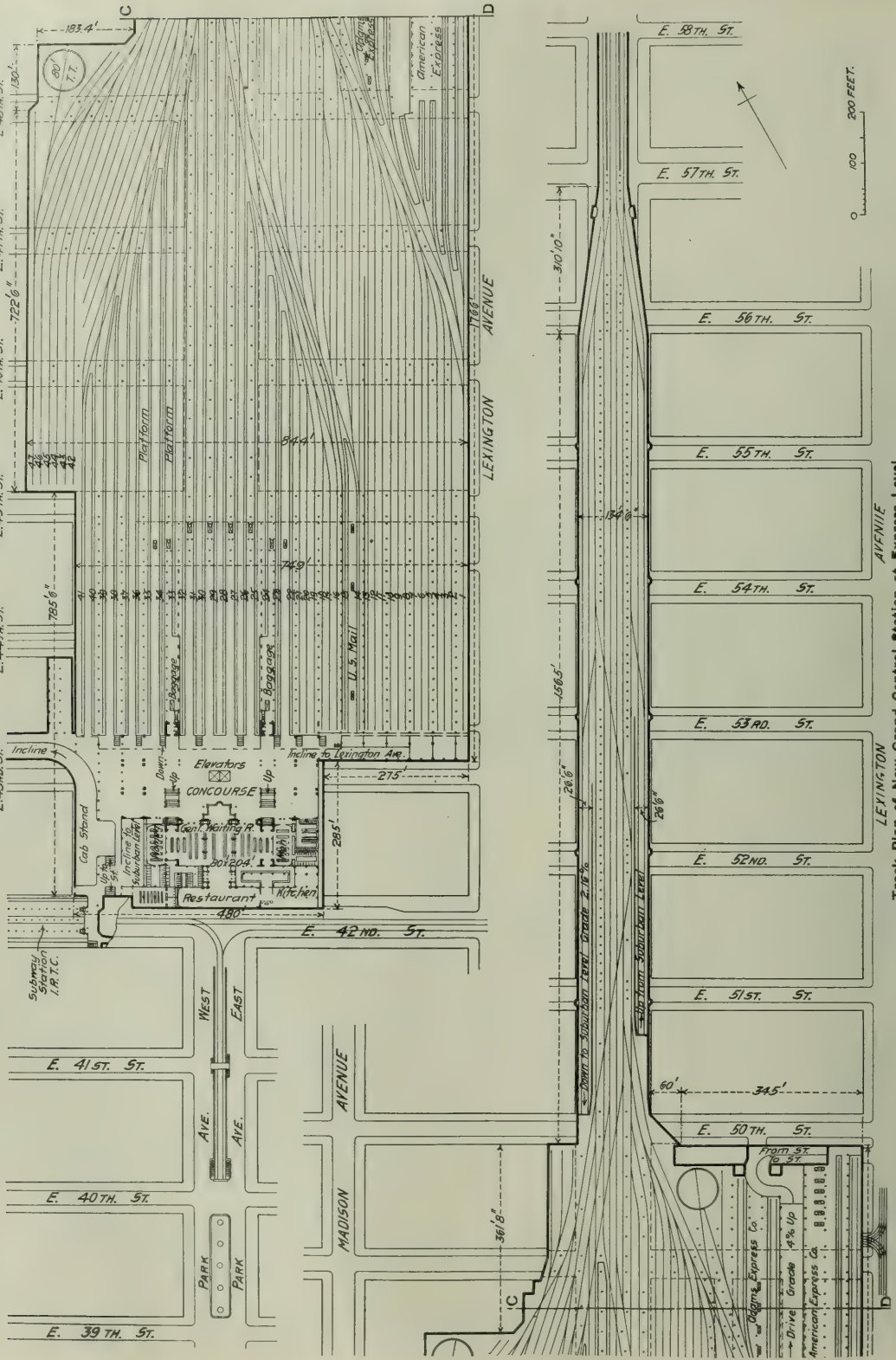
The suburban station comprises 16 platform tracks. Each track is served by two platforms, one for loading and one for unloading, so that every alternate platform throughout the entire width of the station is used exclusively for incoming or outgoing passengers. The stairways and passages leading from the concourse to the suburban platforms are so arranged as to be used exclusively for outgoing passengers, thus obviating all confusion, the incoming platforms leading directly to the waiting room, the subway station or the exits.

The baggage rooms will be located slightly above street grades, and will have a continuous street frontage for wagon service, of about 1,300 ft. The incoming baggage room will be along Vanderbilt avenue from Forty-third to Forty-fifth streets, and the outgoing baggage room along Depew place from Forty-second to Forty-fifth streets. The two baggage rooms are connected at the extreme north end of the station building by a baggage concourse at the same level, passing over the tracks and along the south side of Forty-fifth street. Consideration was given to the automatic conveyor system for handling baggage from the train to the baggage rooms, with a view to its possible adoption. The conclusion was reached, however, that admirable in itself, the system was not well adapted to Grand Central Station requirements, on account of the

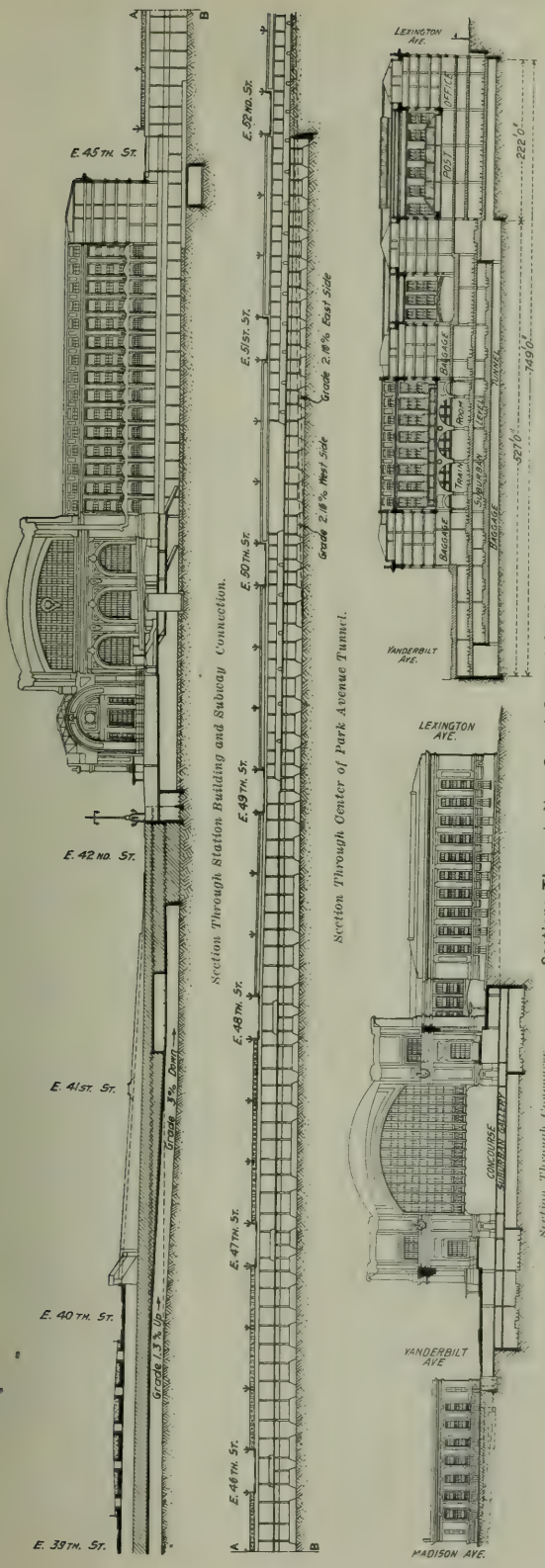
*By G. R. Wadsworth, late with the New York Central.



Track Plan of New Grand Central Station at Suburban Level.



Track Plan of New Grand Central Station at Express Level.



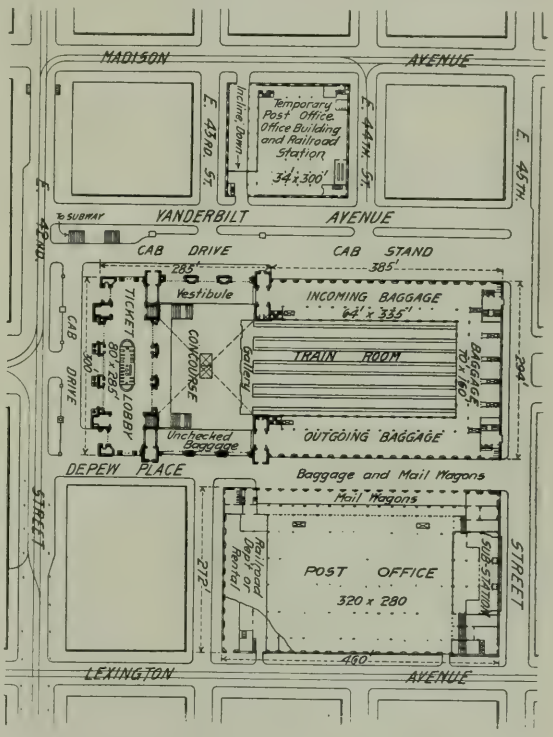
Sections Through New Grand Central Station.

consequent sacrifice in the number of tracks in the train room, or in the width of the platforms, in order to provide suitable space between the tracks in pairs for the conveyors. Baggage will be trucked on the passenger platforms, but away from the passenger concourse, to elevators connecting each platform, both in the express and in the suburban station with the overhead baggage concourse. Certain elevators serve jointly the express and the suburban platforms immediately below.

The company's cab stand will be on a level with the express train concourse, and occupies a space 100 x 200 ft., immediately under the street surface of Vanderbilt avenue at the end of the concourse. The cab stand is reached by an easy incline from Madison avenue just north of Forty-third street. The public carriage approach for arriving passengers is on Vanderbilt avenue, opposite the main exit.

It will be noted that the main exit as well as the inbound baggage room is on the west side of the station, providing for right hand operation of trains with the new electric service.

Over the main train room and the baggage rooms, from the main concourse north to Forty-fifth street, for the full width of the station, will be the railroad offices. This portion of the building will have a street frontage of about 1,000 ft. on Vanderbilt



Plan of Station Building at Street Level.

avenue, Forty-fifth street and Depew place, with connecting buildings over the train room, between which will be ample light wells serving the double purpose of lighting the offices as well as the main train room. The design for the office quarters provides six stories over the baggage and train rooms, giving a total available office area of 250,000 sq. ft. exclusive of corridors. The main entrance to the railroad offices will be on the Forty-fifth street facade opposite the center of Park avenue.

An interesting feature of the new station will be the new post-office on Lexington avenue between Forty-third and Forty-fifth streets, the Lexington avenue facade centering on Forty-fourth street, which will be closed between Lexington avenue and Depew place. The post office will in reality be separated from the station proper by Depew place, but in effect the two structures will be one. The post office building will rise over the mail and storage tracks of the terminal yard which extend south along Lexington avenue to Forty-third street, there being two tracks with intermediate platforms 18 ft. wide by nearly 600 ft. long, given up exclusively to United States mail service. From this mail platform special elevators rise to the main working floor of the post office, which is slightly above the street grade of Lexington avenue, a room 200 by 400 ft.

A Study in the Cost of Carrying Live Stock and in the Cost of Car Service.*

The division of rate which the lines east of the Missouri river accept for transporting live stock, and the division of the rate accepted for transporting the products of animals as they now exist, are in line with the holdings of the Interstate Commission, viz.: that the rates per cwt. on live stock should probably be less, but in no event should they be more, than the rate on the products of live stock, as shown by the following schedule of rates which have existed for several years on cattle, hogs, packing house products and fresh meats from the market towns of Kansas City, St. Joseph and Omaha to the market town of Chicago—i.e., from market to market: Cattle, from 14 to 22 cents; hogs, from 16½ to 22 cents; packing house products, 20 cents; fresh meats, 20 cents.

The rate on both cattle and hogs is the actual difference between the rates from the point of origin to Chicago, and the short rates from points of origin to the Missouri river, which gives varying rates from the Missouri river markets to Chicago on live stock. The rate on the product of animals is a fixed rate, but based upon the average of the varying rates, in effect the same principle.

It is now my purpose to show by analysis that such divisional rates are not equivalent rates, based on the cost of carriage, but that the live stock rates are too low, and that as a matter of fact live stock rates, based on the cost of carriage, instead of being less per cwt. should be more per cwt. than the rates on the products of live stock.

For convenience, I will use the average of the varying rates on live stock, which would be 18 cents per cwt. on cattle and 19¼ cents per cwt. on hogs. It costs as much to haul a ton of car as a ton of its load, and as live stock is hauled in cars whose average weight on the Chicago Great Western line is 27,500 lbs., and the product is hauled in refrigerator cars having a weight, including ice, of 41,000 lbs., and as the average load of cattle is 21,513 lbs., of hogs only 16,635 lbs., of packing house products 31,632 lbs., and fresh meats only 22,414 lbs., these varying weights of car and load must be taken into consideration. Then there are certain burdens which pertain to the transportation of live stock, which do not pertain in the same degree to the transportation of the products, which must also be taken into the account before the true comparison of cost can be made. In the analysis, I will speak of these unequal burdens first.

The packing house products and fresh meats are not hauled in cars owned by the railroad, but in refrigerator cars owned by the packers, and the expense which is most talked about is the mileage paid for the use of the refrigerator cars. In order to understand this mileage arrangement, it must be borne in mind that the mileage paid covers the use of the car and its interest account, and the entire cost of renewals and the cost of repairs to such refrigerator cars "necessitated by ordinary wear and tear in fair service." In addition to the mileage, the railroad company pays "for damage done to any of the cars by unfair usage, derailment or accident," which on the Chicago Great Western in the year 1905, averaged one mill per mile. The mileage paid is one cent per mile, making the total payment for use of car, renewals and repairs 1.1c. per mile. The packers own these cars; they load them and unload them, and cars not required for use between Chicago and Missouri river points can be used in distributing packing house products over other lines. So the cars are loaded and unloaded promptly and kept almost continuously in motion, which enables them to make a much larger daily mileage than it is possible for railroad companies to make with their own cars. It is probable that the average mileage of these refrigerator cars is, approximately, 100 miles per day, while the average mileage of railroad cars of all descriptions is known to be about 22 miles per day, and the average mileage of stock cars is less than 22 miles per day. On account of superior administration, the packers make a profit (although not as large as is generally supposed) from the ownership of such cars, by leasing them on the terms mentioned. But (as I will show later) no railroad could make a profit on such terms. No railroad could maintain such superior administration, because, not owning the output (merchandise shipped from packing houses), or controlling its routing, one day it would be called upon to furnish a large number of cars, the next day few or none, with no way to tell in advance on what days the demand would be large; so that in order to supply the largest day's demand a great many cars would stand idle on the days of smaller or no demand.

This proposition seems to be corroborated by the movement of stock cars, the actual loading and unloading of which consumes no more time than the actual loading and unloading of packing house products, and therefore it would appear that stock cars could be kept as continuously in motion between markets in the through stock transportation as the packers' refrigerator cars. But this is not the fact, for the reason, among others, that the amount of stock to be moved between such points is not, like the packing house products, approximately a constant quantity day after day. Some days and some months there is a large demand for cars; other days and in other months practically no demand whatever. Evidently the railroads must own cars enough to supply the largest demand. And as the railroad companies have no control over the routing of such live stock, they cannot tell in advance whether the live stock which is to be moved will be routed over their line or over the line of their competitors, so they can never tell in advance what the demand for cars will be from day to day. Therefore, a large number of stock cars are standing empty frequently for days, and even weeks, in succession, awaiting loads.

How irregular this movement is may be shown by the records of the Chicago Great Western Railway Company. The actual movement for last year of live stock from the South St. Paul stock yards to the Chicago stock yards was: July, 62 cars; August, 264; September, 240; October, 222; November, 195; December, 45; January, 57; February, 26; March, 17; April, 208; May 47; June 17; total 1,400 cars. More than half—726 cars—moved in the three months of August, September and October, most of which was live stock direct from the ranges. The total shipped from South St. Paul to Chicago during those three months [by all roads] was 7,374 cars. This stock came into South St. Paul from the west—some days 500 cars, some days none—and after its arrival commenced the scramble between the different railroad companies for its further shipment to Chicago. In the scramble the Great Western got about 10 per cent.

The shipments were just as irregular in respect to days of shipment as by months. The first day of August the Great Western got 13 cars; in the next six days six cars, or an average of one car per day; in the next day it got 17 cars; the next day 23 cars; the next 13 cars, and in the following three days none; and so on during the month.

The enormous waste, due to such irregular and uncertain movement, may be seen from the following astounding statement of facts:

The Chicago Great Western moved during the last fiscal year an aggregate of 15,134 cars of live stock an average distance of 197 miles, an average of less than 42 cars per day. It owns 686 stock cars, which would seem to be enough to move 42 cars per day an average distance of 197 miles. But, as a matter of fact, it had to rest, from private car lines, cars to move 54 per cent. of said live stock. That is to say—686 cars, under existing conditions, will move only an average of 19.74 cars of live stock per day an average distance of only 197 miles, equal to only 5.8 miles per day per car.

These stock cars were rented under the same conditions, in respect to repairs, maintenance and mileage, as the refrigerator cars, except that the mileage paid for stock cars was six mills per mile instead of one cent per mile. The cost of a stock car is about $600, while the cost of a refrigerator car is about $1,200.

Knowing that we were able to rent these cars at six mills per mile, and supposing that the private car lines found it profitable, in my testimony before the Interstate Commerce Commission, based upon this fact, without much investigation, I estimated that it cost the railroad companies in interest, depreciation and renewals about six mills per mile for the use of their own cars. But upon examination of actual accounts I find that the actual cost is much larger.

I find that the average cost of labor and material only of repairing the total freight equipment of the Chicago Great Western is about four mills per freight car mile. I am able to find data in only one report of the larger railroad companies, which I have been able to examine, upon which to make the same calculations, which gives practically the same result.

If it costs the private car lines as much to make their repairs it is evident their profits are not excessive.

There are conditions, however, pertaining to the private stock car mileage, which tend to increase their average daily mileage and therefore reduce the average cost per mile of repairs. For illustration: The stock cars which were rented by the Chicago Great Western were largely the cars which had been sent to be loaded at the western ranges, making long hauls—partly over the Great Western lines and partly on the Pacific lines—during the season of range stock movement, hence their average mileage would be larger than the average daily mileage of the railroad company's stock cars. And then between Chicago and the east they get long runs, which make larger daily average mileage than the railroad stock cars, and to this extent the cost of their repairs per mile

*In the trial before the United States Court of the suit of the Interstate Commerce Commission vs. the Chicago Great Western and other roads, to compel compliance with an order of the commission concerning the rates on live stock, and on meats, Mr. A. B. Stickney, President of the Chicago Great Western, who testified concerning the practices on his road, presented an analysis of the relations of the rates on live stock to those on the products of live stock, based on the cost of carriage. The present article contains the main part of Mr. Stickney's statement and argument. His purpose, it will be seen, was to show that while the rates from Kansas City, etc., to Chicago on live stock are less than on fresh and cured meats, there would be good reason for making them as high as, or higher than the rates on the manufactured product. Incidentally he gives an interesting statement of the factors which made up the cost (on his road 1.23 cents per car per mile) of freight car service.

should be less than the cost of repairs of stock cars owned by the railroad companies per mile.

Much has been made of the mileage of 1 cent per mile paid for the use of refrigerator cars, which is regarded as excessive; and it is, apparently, assumed that live stock hauled in the railroad company's own cars bears no such burden. This is a mistake. When the railroad company transports freight in its own cars, instead of paying the fixed amount per mile for the *use, renewal and repairs* of the car, it pays the interest on the cost of the car, and it pays the expenses, whatever they may be, of renewals and repairs.

Now, I will state the account of the Chicago Great Western of these burdens in respect to all of its freight [see table at foot of page], it being impossible to distinguish between live stock and other freight, because its stock cars are used to some extent in other than live stock shipments.

Its freight car equipment has cost $5,583,425.75 of actual cash. The interest on this amount for one year at 5 per cent. is $279,161.25. As there are no cars in use in the United States to-day which were in use 25 years ago, it is fair to estimate the lifetime of a car at, say, 25 years, which would make the annual depreciation 4 per cent., which, on the above cost, is equal to $223,337. The amount expended for labor and material only, in repairs of freight cars during the fiscal year, was $307,211.90. In order to make these repairs, and the repairs on its locomotives, etc., the railroad company must have expensive shops and tools, and some proportion of the interest on the cost, and the depreciation and repairs of the shops and tools, is a burden properly chargeable to this account. The actual cash cost of the principal shops and tools has been $603,043.88. Five per cent. interest on this amount, and 5 per cent. for depreciation and repairs upon the shops and tools, which is probably less than the actual cost, would be $60,304.38. Say, 20 per cent. of this amount is chargeable to freight cars, $12,060.86. In order to make these repairs, and the repairs on its locomotives, etc., the railroad company must carry a large stock of material, and some proportion of the interest on the stock thus carried is chargeable to the cost of repairing freight cars. The average stock of material carried for such repairs is $486,386.18, and it is estimated that 60 per cent. of this stock is for freight car repairs, or, say, $291,831.60. The interest at 5 per cent. is $14,591.55.

In order to make repairs to freight cars every company must have side tracks at all its division points and many of the principal stations, specially devoted for standing freight cars for the purpose of being repaired, and used for no other purpose. The entire interest and cost of maintenance of these special side tracks constitute a burden chargeable to freight cars. Many of these side tracks, and indeed most of them, occupy land which has cost at the rate of $5,000 per acre, and some of it as much as $20,000 per acre. In addition to this land occupied by the side tracks there must be vacant, equally high priced land adjacent for piling repair material, and storage houses. The Chicago Great Western has plants at 10 such stations, and minor plants at other stations. I have not had time to get the exact mileage and quantity of land consumed by these special side tracks, but I think an estimate of 10 miles of track and 60 acres of land, in the aggregate, would not be too high an estimate. Reckoning the cost of the side tracks at only the cost of the rails and ties, $5,000 per mile, and land at $5,000 per acre, the actual cost would be $350,000. The interest at 5 per cent. and say nothing of the cost of repairs, would amount to $17,500. There are minor items, such as lighting and heating shops, fire insurance on both shops and cars which, in the aggregate, amount to large sums, but are distributed through the accounts in such a way that it is not easy to marshal them, and therefore in this calculation we make no account of them; and thus we find that the entire annual burden of these major items amounts to $853,862.56.

The Chicago Great Western collected from other companies during the year for the use of its freight cars while on their line, in excess of the amount which it paid to other companies for the use of their freight cars on its line, the sum of $163,141.14, which, being deducted, leaves the aggregate burden upon the freight business of the Chicago Great Western Railway Company, for the use of its own freight cars during the fiscal year ending June, 1905, at $690,721.42.*

The mileage of loaded and empty freight cars of all classes owned by the company and by other railroad companies, after deducting the miles run by private car lines, amounted to 56,705,351 car miles. Dividing this quantity into the total burden ($690,721.42) makes the actual cost, per freight car mile, 1.23 cents for *use, depreciation and repairs of its own cars*, against the 1.1 cents paid to the packers for the *use, depreciation and repairs of refrigerator cars*. This extraordinary result is rendered more extraordinary by the fact that the average cost of the railroad car is $563.86, while the average cost of a refrigerator car is $1,200. The high per-mile cost for the use of the railroad cars is the result of the small mileage which such cars make under existing conditions, averaging about 22 miles per day of 24 hours.

There are other burdens upon the transportation of live stock which do not pertain to the transportation of packing house products. Live stock is loaded to be delivered at the market before the close of the market hours. If, for any reason—which can by any means be construed as the fault of the company—the stock is not delivered before the close of the market hours and the market declines the next day, a claim for damages is made against the railroad company. The damages paid on this account during the fiscal year 1905, by the Chicago Great Western amounted to $24,366.45, equal to an average of $1.61 per car.

The railroad, on this through live stock business, pays for loading the car at the stock yards on the Missouri river, which constitutes a burden on the live stock business, from 50 cents to $1 per car, without any corresponding burden on the packing house business, as the refrigerator cars are loaded and unloaded without expense to the railroad company. The railroad is also compelled to clean live stock cars at an expense of from 50 cents to $1 per car, without any corresponding burden upon the packing house product business, as refrigerator cars are cleaned by their owners.

During the hot weather the product has to be re iced once in transit, but the expense is paid by the shipper. During the hot weather the live stock is sprayed with cold water several times in transit, the whole expense of which is paid by the carrier. It is difficult to state the exact cost, but 25 cents per car is probably a close approximation.

In addition, in the shipment of live stock, the shipper is entitled to free transportation for one passenger for each two carloads shipped, from the point of shipment to Chicago on the train which carries the stock, and free return ticket on first class passenger trains. Estimating the value at one-half regular rates, it would amount to $6.50 per car.

The principal burdens per car upon the through shipments from market town to market town, which are not alike on live stock and their products, can now be marshaled on the basis of a 500 mile haul from the Missouri river to Chicago, as follows:

	Cattle.	Hogs.	Packing house products.	Fresh meats.
Use of car	$6.16	$6.15	$5.50	$5.50
Damage on account of delay	1.61	1.61	.....	.....
Loading (average)	.75	.75	.....	.....
Cleaning cars (average)	.75	.75	.....	.....
Icing and spraying	.25	.25	.....	.....
Passenger service	6.50	6.50	.....	.....
Total	$16.01	$16.01	$5.50	$5.50
As most of both classes of cars must be returned empty, it is perhaps fair to add the return use of cars.	6.15	6.15	5.50	5.50
Total	$22.16	$22.16	$11.00	$11.00

It has already been stated that the average rate per cwt. on cattle is 18 cents; on hogs, 19½ cents; and on their products is 20 cents; and that the aggregate of the unequal burdens is $22.16 per car on live stock, and $11 per car on their products. I now testify that the average pay load on the Chicago Great Western of cattle is 21,513 lbs.; of hogs 16,636 lbs., and the average weight of the Chicago Great Western stock car is 27,500 lbs. The average pay load of packing house products is 31,632 lbs.; of fresh meats 22,414 lbs.; and the average weight of refrigerator cars in which they are hauled, including non-paying Ice, is 41,000 lbs.

Based on these figures, the weight hauled and revenue per car received, and net rate per cwt. received for hauling the load and car, is found to be as follows:

	Cattle		Hogs		Pkg. house products.		Fresh meats	
	Wght. lbs.	Rev. $	Wght. lbs.	Rev. $	Wght. lbs.	Rev. $	Wght. lbs.	Rev. $
Pay load	21,513	38.72	16,636	32.02	31,632	63.26	22,414	44.82
Car	27,500	.....	27,500	.....	41,000	.....	41,000	.....
Total	49,013	38.72	44,136	32.02	72,632	63.26	63,414	44.82
Deduct unequal burden*	.....	22.16	.....	22.16	.....	11.00	.....	11.00
Total weight hauled and net revenue per car received	49,013	16.56	44,136	9.86	72,632	52.26	63,414	33.82
Net rate per cwt. received upon t'l pounds hauled	.....	3.39c	.....	2.24c	.....	7.19c	.....	5.3c

*As above.

The analysis shows that, based on the cost of carriage, the tariff rate on fresh meats should be higher than the tariff on packing house products, to be strictly and mathematically correct. But in making the contract which has controlled the tariff rates on packing house products and fresh meats for some years, and will control them for some years to come until the contract ex-

*Cost of Use, Renewal and Repairs of C. G. W. freight cars for one year:

Interest on cost ($5,583,425.75@5%)	$279,161.25
Depreciation, 4 per cent. per year	223,337.00
Repairs (material and labor)	307,211.90
Interest and depreciation, shops and tools	12,060.86
Interest on stock of repair material	14,591 55
Interest on cost of repairs, tracks and grounds	17,500.00
Heating, lighting, fire insurance (not considered)	.....
Total	$853,862.56
Deduct credit balance of interchange car service	163,141.14
Net cost of car service on C. G. W.	$690,721.42

pires, in the haphazard by-guess way in which rates are usually made, a uniform rate of 20 cents was made on both products.

As the tariff rates per cwt. on live stock are less than the tariff rates per cwt. on the product, and as the analysis shows that the rates received for the one service which is alike in both —the simple hauling—of the live stock from market to market is materially less than the rates received for hauling the products, and as this is the only principle which this action was brought to establish and enforce, these facts should entitle the case to be dismissed.

The local rate—the rate charged on animals that are picked up at local stations and hauled to Chicago, from the Missouri river to Chicago, 500 miles, is alike on both cattle and hogs, 23½ cents per cwt. There are no similar local rates on the products of animals, because the products are not picked up from station to station.

The local rate on live stock—although higher per cwt. than the amount received on packing house products—is, as a matter of fact, when based on the cost of hauling, lower than the packing house rate. All of the special burdens which have been stated as applying to live stock shipments from markets to markets, apply to local shipments, except the loading of cars at stockyards at the Missouri river, which was given at 75 cents per car. Deducting this 75 cents from the total burden, leaves as the burdens which have been enumerated on live stock $21.41 per car.*

In addition, the railroad company is obliged to furnish stock pens at each station where stock is loaded, for no other purpose than the shipment of live stock. These stock pens represent, in the aggregate, a very large investment, and the interest on their cost, and the cost of repairs, is an additional burden peculiar to the local shipment of local live stock. It is not easy to fish out from the voluminous construction accounts the actual cost of these stock pens, but I happen to have data which gives a practical basis for such an estimate. In 1903 I built a line from Fort Dodge, Iowa, to Council Bluffs, a distance of 133 miles, on which 22 stock pens were built, and their actual cost was $31,284.88, an average of $1,422.04 each. This does not include the cost of paving the floors, which will have to be done later, at an average cost of, probably, $1,000 each, an expenditure which the company has already made on many of its older pens. The Chicago Great Western has 240 stations where there are stock pens. At an average cost of $1,422.04 each, without considering the cost of paving such floors as have already been paved, the aggregate investment would be $341,289.60. Five per cent. interest on this amount, and 5 per cent. for renewals and repairs, would amount to $34,128.96 per annum—or, upon the shipments during the year 1905 of 15,134 cars, would amount to $2.25 per car. In addition, these stock pens have to be periodically cleaned by the railroad company; stock cars have to be sent, practically one at a time, to the pens to be loaded, which delays trains and adds materially to cost of transportation. It is impossible to state how much, but a low estimate would be 25 cents per car; making the total special burdens on local shipments of live stock $23.91 per car.

Now, the former analysis shows that the 20-cent rate on the products of animals, after deducting the burdens, leaves a rate of 7.19 cents per cwt. for simply hauling the load, plus the weight of the car. Evidently, a rate on cattle, which, after deducting the burdens, would give the same rate of 7.19 cents per cwt. for simply hauling the load of cattle, plus the car, would be the mathematical equivalent of the 20 cent product rate. The average weight of a carload of cattle being 21,513 lbs., the weight of the car being 27,500 lbs., the two together would weigh 49,013 pounds.

7.19 cents per cwt. on 49,013 lbs. is	$35.24
Add to this the special burdens	23.91
Makes a revenue per car of	$59.15

which must be collected on the 21,513 lbs. of cattle constituting the load, equal to 27.5 cents per cwt., which is 4 cents more than the local rate on cattle. By the same mathematical process, the hog rate which would be equivalent to the 20 cent products rate would be 33.5 cents per cwt., which is 10 cents more than the local rate on hogs.

If the comparison is made with the lower rate, which the analysis shows the 20 cent product rate gives on shipments of fresh beef 5.3 cents instead of 7.19 cents, the mathematical equivalent of the lower rate is 23.19 cents on cattle and 28.43 cents on hogs.

The Interstate Commission, in the decision of this and other cases, seems to think that from some supernatural reason, which it is unable to understand or explain, in all cases the manufactured products of all material should bear a higher rate per cwt. than the raw material from which it is manufactured. As a matter of fact, the manufacturing of many materials produces a product more bulky, which makes the carload less, in proportion to the weight of the car, than the car load of the raw material. When such is the result, based on the cost of carriage the manufactured article should bear a higher rate per cwt. than the raw material. Such is usually the case when, say, iron is manufactured into machinery. But when pig iron is manufactured into bar-iron or rails the bulk is not increased, and such a supposed rule should not obtain. So when live stock is changed into its products the bulk is not increased, but, in fact, is decreased, and consequently the product should bear a lower rate per cwt., based on the cost of carriage, than the live stock.

Relative rates between the raw material and the manufactured product, based on the cost of carriage, is a problem of facts and pure mathematics, and there is nothing occult or supernatural pertaining to the problem. It is unfortunate that the men who make the tariffs of rates are not mathematicians, instead of fairly good guessers. They guess that if one rate is so much, another rate, in order to be relative, should be about so much.

In my opinion, it is entirely possible to construct a tariff mathematically, on the basis of adding to the terminal expenses and special burdens of each class of shipments, practically constant quantities for the cost of hauling, which would be symmetrical and equitable and satisfactory both to the railroads and the people. And that schedules of such rates could be printed in a form which would be so easily understood that any man of ordinary ability, by inspection of the schedules, could tell for himself the legal rate upon any shipment which he might desire to make. The present Interstate Law requires such schedules to be made by the railroads, and if the railroads fail to make such schedules the law requires the Interstate Commission to prescribe the form and compel the railroads to adopt the form thus prescribed. But in this respect both the railroads and the commission have failed to comply with the law.

The rate of speed at which freight must be moved is an important element affecting the cost of transportation, but as the Chicago Great Western road's live stock and products are generally carried in the same train, and, generally speaking, practically the same rate of speed is required in the transportation of live stock and its products, it is not a factor in this analysis.

Mr. Stickney presented one other table, designed to show that the rates charged by his road do not discriminate in favor of the western live stock markets as against Chicago. In the year ending June 30 last the number of cars of live stock, both through and local, was 15,134, of which 9,842, or 65 per cent., went to Chicago. But considerable numbers were carried to St. Paul, Omaha and St. Joseph, and some of these from places more than 150 miles east of those points. To St. Paul the number of cars was 1,048, each carried an average distance of 66 miles; to Omaha 1,038, average distance 43 miles; to St. Joseph 2,884 cars, average distance 62 miles, and to Kansas City 322 cars, average distance 250 miles. Of through live stock to Chicago the C. G. W. carried 1,400 cars from South St. Paul, but aside from this the total through shipments from market to market aggregated only 137 cars.

*Burdens on local live stock traffic:

	Per car.
As in preceding statement ($22.16 less .75)	$21.41
Interest and depreciation, stock pens	2.25
Cleaning pens, etc.	.25
Total	$23.91

History of the Walschaerts Valve Motion.*

BY M. J. BOULVIN,
Professor at the University of Ghent.

Egide Walschaerts died on the 18th of February, 1901, at Saint-Gilles, near Brussels, at the age of 81 years. His mechanism, which is so original, has been adopted for many years in most of the countries of Europe and has been wrongly attributed to Mr. Heusinger von Waldegg. He was born January 21, 1820, at Malines, which place became, 15 years later, the central point of the System of Belgian Railways. The line from Brussels to Malines was opened in 1835, and this event decided the career of young Walschaerts. Three years later, at the exhibition of products of Malines, there appeared some remarkable models executed by him, and described as follows in the catalogue:

No. 19. M. E. Walschaerts, Jr., student of the Municipal College:

a. A stationary steam engine of iron (the main piston having the diameter of 4.5 c.m. or 1.77 in.).

b. A working model of a locomotive in copper to the scale of 1/20 of the railway locomotives.

c. Section of a stationary steam engine.

d. Model of a suction pump and of a duplex pump.

e. Glass model of an inclined plane.

Minister Rogier was so much struck by it that he had Walschaerts enter the University of Liege, but his studies were interrupted by a serious illness, and were never completed. We find traces of him at the National Exhibition in Brussels in 1841. The report of the jury mentions with praise a small locomotive constructed entirely by Walschaerts, and a steamboat 6.50 meters long and 1.75 meters wide, which was capable of carrying 16

*Translated from Revue de Mécanique by Lawford H. Fry.

men and traveling (so the report says) at 4 leagues an hour on the canal.

The boiler of this little boat was of a new system invented by the constructor. The jury does not give further details. Walschaerts received the silver medal.

In 1842 Walschaerts was taken into the shops of the State Railway at Malines as a mechanic. Machine tools existed only in the most rudimentary forms, and the store rooms were badly provisioned. The lack of organization in the shops rendered a man of Walschaerts' abilities particularly valuable, and at the end of two years he was made shop foreman at Brussels. Although he was only 24 years of age he had already shown the qualities which make an engineer, which should have carried him in a few years to be the technical head of the motive power department. It is humiliating to be compelled to say that he remained shop foreman throughout his life.

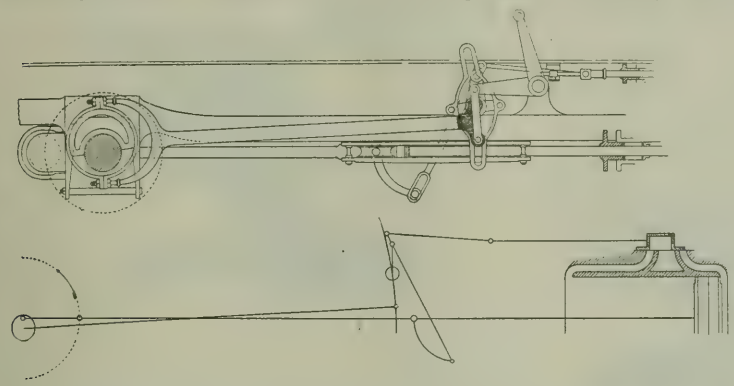


Fig. 1—Walschaerts Valve Motion—Belgian Patent, October 5, 1844.

The first locomotives came from England and had not been in service for more than ten years when Walschaerts was made foreman. The railroad was growing rapidly and it was necessary to increase the forces and to acquire experience. Walschaerts was not content with the duties incurred in these difficult circumstances, but began his career by the invention of his system of valve motion.

On October 5th, 1844, Mr. Fischer, Engineer of the Belgian State Railways filed for Egide Walschaerts an application for a patent relating to a new system of steam distribution applicable to stationary steam engines and to locomotives. This Belgian patent was issued on November 30th, 1844, for a term of fifteen years. The rules of the department did not allow a foreman to exploit a Belgian patent for his own profit and this explains probably the intervention of Mr. Fischer, who has never claimed the slightest part, material or moral, of the invention.

On October 25th of the same year Walschaerts took out a patent in France for the same invention. There also exists among the documents left by the inventor, a contract signed at Brussels in 1845 by Demeuldre, from which it appears that he undertook to obtain a patent of importation into Prussia for the new valve motion, subject to an assignment by Walschaerts of half of the profits to be deducted from the introduction of the new valve motion in this country. It is probable, however, that this contract was never carried out.

The design attached to the Belgian patent is reproduced in Figure 1 herewith. In this primitive arrangement the link oscillated on a fixed shaft, in regard to which it was symmetrical, but it had an enlarged opening at the center so that only at the ends was it operated without play by the link block, which was made in the form of a simple pin. There was only one eccentric, the rod of which terminated in a short T carrying two pins. The reverse shaft operated the eccentric rod and maintained it at the desired height. For one direction the lower pin of the T engaged in the lower end of the link, and to reverse the engine the rod was raised so that the upper pin engaged in the upper end of the link. The angle of oscillation of the link varied with the position of the pin in the link, and this oscillation was transmitted by an arm to the combining lever, which was also operated by the crosshead.

The central part of the link could not be used for the steam distribution, as it was necessary to enlarge it to allow for the play of the pin which was not in operation. It may be asked why the inventor used two separate pins mounted on a crosspiece on the end of the eccentric rod instead of a single pin on the center of the rod which would have served for both forward and backward motion without requiring the center enlargement of the link. It must be borne in mind that the raising or lowering of the eccentric rod by the reverse shaft was equivalent to a slight change in the angular advance of the eccentric. Consequently with the link of a sufficient length to keep down the effect of the angularity it was necessary to reduce as much as possible the movement of the eccentric rod. Notwithstanding its differences the mechanism described in the patent of 1844 is in principle similar to the valve motion with which every one is to-day familiar, and which the inventor constructed as early as 1848, as is shown by a drawing taken from the records of the Brussels shops, on which appears the inscription "Variable expansion; E. Walschaerts' system applied to Locomotive No. 98, Brussels, September 2, 1848."

Figure 2, taken from this drawing, shows the valve motion as we know it to-day. For although it is true that the link and the combining lever are usually placed in a different position so as to shorten the eccentric rod and the valve stem, yet the design of the locomotive often requires an arrangement similar to that shown herewith. The system which Mr. Heusinger von Waldegg invented in 1849, and which he applied in 1850 to 1851 differs only in a few insignificant particulars from that shown in Figure 2. Walschaerts had therefore preceded him.

There are now innumerable systems of steam distribution and the progress made in kinematics has greatly facilitated their development. At the time, however, of Walschaerts' work there was only one system of valve motion which was at all extensively used, namely that of Sharp, with two eccentrics with forked rods. The link attributed to Stephenson was invented by Howe in 1843, and it is doubtful whether Walschaerts had ever seen it. A problem which nowadays appears very simple was for the investigators of that time extremely complicated, and the man who discovered the most correct solution which has yet been put forward merits unreserved admiration.

Notwithstanding his work at the Brussels shops, where he built, with limited equipment, several new locomotives, Walschaerts did not lose sight of the problem of steam navigation, and appeared at the National Exposition at Brussels in 1847 with a screw yacht which ran successfully. The propeller had several blades, each one with only a small part of the thread similar to those of the modern screws. Walschaerts had invented this arrangement himself, without knowing of the results obtained by

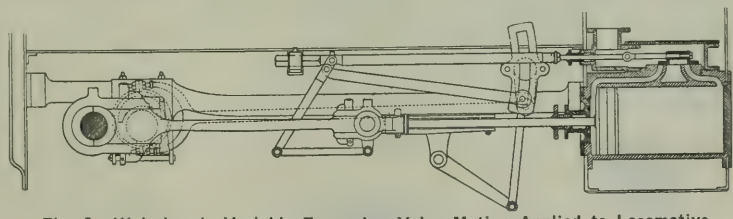


Fig. 2—Walschaerts Variable Expansion Valve Motion Applied to Locomotive No. 98, Brussels, Sept. 2, 1848.

Normand with the Corse in 1841 or 1842. Locomotive practice had taught him the intimate correlation which should exist between the engine and the boiler and in this machine he made use of a boiler of high power which attracted much attention. A similar machine was built a little later by the Couillet Co., as is shown by the plan drawn up in 1853. This machine is compact and light. The documents which remain do not mention the pressure or the speed. It was non-condensing, and in all probability the exhaust steam assisted the draft.

During the years which followed Walschaerts' activity was given entirely to his duties as foreman and it is difficult to determine his part, which was valuable though anonymous, in the design of the railroad equipment. He is credited with the differential throttle in which the opening of an auxiliary slide on the back of the main slide assisted the opening of the valve. He also designed a brake with shoes acting on the rails which was used for a long time in switching locomotives and in which the principle of a lever acting near its dead point was applied in an ingenious manner.

It was very remarkable that his initiative spirit did not suf-

fer from his long services under an administration with so much complicated routine. It is possible that he found a stimulant in the adoption of a large number of his ideas by the Great Central Belgian Railway and in encouragements which, without making him rich, kept his intelligence on the alert. He took an important part for many years in the design of the motive power of this railroad, which was rendered the more difficult by reason of the difficult profile of the lines terminating in Charleroi and by the heavy traffic to be handled. The design of the freight locomotives for heavy grades, built in 1862 for the Great Central, belongs entirely to Walschaerts. The Company built more than one hundred locomotives from the original plans without making any important alterations. These locomotives have not been without their influence on the Belgian shops in which they were built. They have left behind them traditions of which traces are found in a large number of engines exported to various countries of Europe.

The York Process for Rolling Steel Ties from Old Rails.

The York steel tie shown in the accompanying illustrations is single-piece, rolled in a special mill from old and worn-out rails of any weight. It is cheap, elastic and should have a long life, judging from the experience with steel ties in other parts of the world. In Europe nearly four million Post steel ties are in use, some of them having been in track nearly 30 years. The Post tie, which is in the shape of an inverted trough, and is pressed

Fig. 1—Sections Rolled from Old Rail.

from a steel plate, has been tried in this country on the New York Central, but without success on account of poor design and insufficient strength under the rail seats, which caused the ties to crush down under the heavy shocks. More recent ties in this country have been designed as a constrained beam and, theoretically, uniformly loaded upward on the bottom surface by the pressure of the ballast with two points of support under the rails. This has resulted in a modified I-beam section having a large section moment and vertical stiffness with minimum cross-sectional area and weight. A number of such sections have been designed and some experimental orders have been placed for them. The I-beam section, however, as at present made requires either an expensive process of rolling for a one-piece tie on account of the wide thin lower flange necessary, or the equally objectionable punching and riveting for a built-up tie using a light I-beam with symmetrical flanges or an old rail for the top member and a thin

Fig. 2—Steel Tie Section Rolled from Rail Shown on Left.

broad flat plate on the bottom to give the necessary bearing surface in the ballast. The original Buhrer ties put in on the Lake Shore & Michigan Southern were built up in this manner from sections of worn out 65-lb. rail. These have given satisfaction in the track as ties, but they cost too much and are so rigid that rails break in cold weather. The inventor's original idea was to re-roll old rails to the required section with a wide bottom flange, but no rolling mill process was then perfected whereby the mass of metal in the head of the old rail could be made to assume the shape wanted. The Carnegie rolled tie, which has recently been put in the track of several railroads in experimental quantities, has a base 8 in. wide, but the process of longitudinal rolling on the side requires a billet of even greater dimensions in the square for the reduction to the finished shape. This, of course, makes the process of rolling an expensive one and one which can only be carried out at a large modern steel works.

The York process of rolling is a radical departure from any previous rolling mill practice, and enables almost any desired section to be made from either the head or bottom flange, no matter how badly worn or unsymmetrical the scrap stock may be. Fig. 1 shows a few of the many structural shapes which can be rolled from the rail shown on the left. Figs. 2 and 3 show the forms of ties which may be rolled, one with a flat bottom and the other with a concave bottom, giving the tie itself elasticity in the ballast under heavy loads. Any desired variation in shape or dimensions of these sections can be made to suit the ideas of designers. The preferred section is that with the wide flat bottom, 9 in. across the bottom flange which with 65-lb. rail is rolled

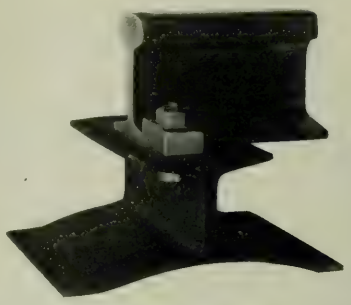


Fig. 3—Steel Tie with Elastic Concave Bottom.

to ¼ in. thick at the edges, 4½ in. across the top and 4 in. high. The bottom flange is formed by rolling out the head and the top flange for the rail seat is formed from the bottom of the rail. No work whatever is done on the web and the height of the section is reduced only by the amount of reduction in thickness in the rail head. The bottom flange can be rolled out to any width or thickness, down to ⅛ in. at the edges. The section thus obtained has the requisite bearing surface in the ballast, ample strength against vertical crushing under the rail loads, maximum moment of resistance to vertical bending under the action of the tie as a constrained beam and minimum weight. An 8-ft. tie of worn 65-lb. rail weighs 160 lbs. The concave bottom section designed to give the tie vertical elasticity without vertical bending can be modified by rolling the top flange concave and the

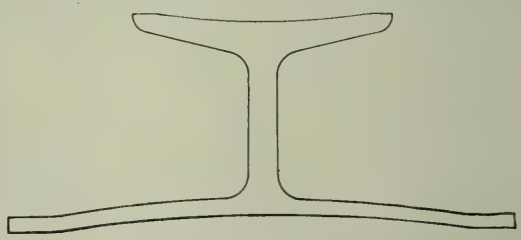


Fig. 4—Tie Section with Top and Bottom Flanges Curved.

bottom flange flat. Or, both flanges can be rolled concave as shown in Fig. 4. Fig. 5 shows a symmetrical tie section rolled from a rail, the head of which has been worn one-third away on one side.

The mill in which these sections are rolled is a lateral rolling mill with a single top roll and reciprocating platen or bed which moves under the roll at exactly the same speed as the periphery of the roll. For rolling 8-ft. or 8-ft. 6-in. ties the mill is made 10 ft. between housings. A number of lengths of rail are placed in loose forming blocks on the platen and these are automatically locked tight against the rail webs before beginning rolling. The only part of the rail which is subjected to any physical work is the flange projecting above the forming blocks which is rolled out sideways uniformly throughout the length of the section. This method of rolling permits the production of innumerable sections from almost any form of scrap stock. The top surface of the forming blocks can be given any desired shape to produce a flat or tapered bottom surface, corrugations, round or square corners, straight or rough edges to the flange, recesses at any point on the flange; in fact, every conceivable form. Similarly the top surface can be formed or indented in any way by suitable projections or depressions cut in the roll. The sections shown in Fig. 1 give some idea of the possibilities of the mill in rolling and form-

ing shapes which cannot by any manipulation be made in a longitudinal mill where, on account of the difference in periphery speed of different portions of the rolls, certain narrow limits are imposed on the relative thicknesses of the webs and flanges and on the amount of draft to enable the piece to clear the rolls.

Aside from the advantages of universal rolling, this method has the important feature of greatly improving the quality of

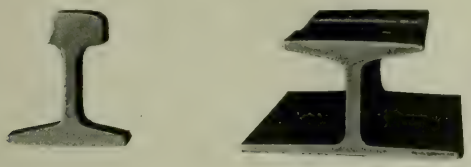


Fig. 5—Steel Tie Rolled from Worn Rail, Showing Grooved Rail Seat on Top Flange.

the metal. In rolling steel rails the web and bottom flange receive the most physical work in the mill and are finished much colder than the comparatively large mass of metal in the head. The head, therefore, is the weakest part of the rail. When an old rail is rolled in the York mill, the head is given the greatest amount of physical work and the finishing passes can be made at a black heat. The quality of the metal is thus greatly improved both by the amount of and temperature at which the rolling is done.

By manipulation of the roll the metal can be made to flow in either direction as the platen passes under it. A worn rail head can thus be rolled out into a thin flange with the metal symmetrically distributed on both sides of the web. The surface under the roll can be curved slightly by a reduction on the last pass or finished straight and level by making one or two light passes at the end without reducing the thickness. If a decided curvature

Fig. 6—Reduction of Metal in Head of Rail to Form Bottom Flange.

is required the proper form must be given to the forming blocks. No new problems in roll-turning are involved, as the rolls can be made the desired shape and chilled without difficulty as can the wearing surfaces of the forming blocks. One mill has a capacity of 500 tons of finished material a day.

A number of interesting features have been combined in the York steel tie which have not been touched upon previously. The section shown in Fig. 3 has a shallow groove rolled in the top surface under the rail in which the rail rests and is prevented from moving sideways on the tie. This feature prevents all shear of the fastenings and at the same time takes away only a trifling part of the resistance to vertical shear under the rail. To prevent the tie from moving laterally in the ballast on curves, ribs or projections can be formed across the bottom surface as frequently as is necessary simply by grooving the roll; or the ends

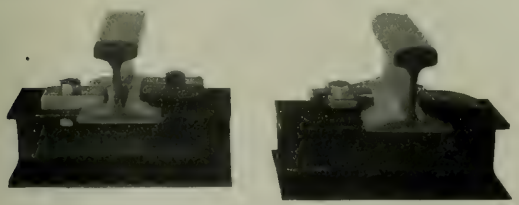


Fig. 7—Three Types of Rail Fastenings.

can be turned down by a modification of the forming blocks on the bed.

The shape of the tie permits a great number of different types of fastenings to be used and several which have been designed are shown in the illustrations. Fig. 7 shows three types. The first is the usual clip and bolt type, two clips being used on each tie bolted through the top flange on opposite sides of the web. The second is a modification of the first, having four clips formed in the shape of a cross, each clip being of different length to accommodate different weights of rail having narrow and wide bases. The third is the simplest and best of the three. Two holes are punched through the top flange, one on each side of the web, and a rectangular hole through the web just under the flange. The clip is in the shape of a T with the vertical leg split to pass down over the web. When the clip is dropped in a wedge key is driven through the hole in the web and the slots in the legs of the clip. This draws the head of the clip down firmly against the base of the rail and by bending over the wedge key slightly after it is driven home the fastening cannot work loose. If wear takes place the key can be driven in a little farther and again bent over. To remove the clip the key is straightened with a blow of a hammer and knocked out.

A stiff bridge joint has also been designed, the parts of which can be made entirely from rail scrap. Fig. 8 shows the joint as applied with steel ties. A short section of rail is rolled with the head tapered at the ends. The head and base and part of the flange are cut away to form two tenons on the web, which fit in holes punched in the webs of the joint ties. The joint is assembled and the fish plates bolted up, after which wedge keys

Fig. 8—York Bridge Rail Joint.

are driven through slots cut in the projecting tenons of the bridge rail. This draws the joint ties together and the taper on the head of the rail corresponding to the taper on the bottom flanges of the ties forces the bridge rail up tight against the base of the track rails. As wear takes place the wedge keys are driven farther in and the bridge rail is forced up against the track rail. The illustration also shows another method of preventing the rail from moving sideways on the tie. Grooves are rolled in the top surface outside of the rail seat and the tie clips are formed with a lip on the outer end which fits down in the grooves.

The process of rolling these ties and the sections, fastenings, joints, etc., have been designed and perfected by Mr. James E. York, Mem. I. and S. Inst., Mem. Am. Inst. Min. Eng., President of the York Rolling Process Co., Whitehall Building, New York, which owns the patents on the method. We are indebted to him for the illustrations and other data from which this article was prepared.

Progress at Panama.

Secretary Taft delivered an address before the Commercial Club of St. Louis, Nov. 18, in which he gave a clear statement of the present situation at Panama. An abstract of this address is printed below.

The publication of the interview with Mr. Wallace was made after consultation with the President, and was made not for the purpose of punishing Mr. Wallace, but because the public were entitled to know the facts and because it was hoped it would discourage others engaged in responsible positions in the construction of the canal from withdrawing at critical stages of the work without sufficient notice. This is all there is of the Wallace incident, except that I have been very glad to assure the advisory board, or the board of consulting engineers, that I believed Mr. Wallace to be an able, experienced engineer and an honest man who had large opportunities for acquiring information which would be valuable to them. I advised them to call him. Mr. Wallace has fully and freely responded to the call and has answered all questions, and has declined any compensation whatever.

I come now to discuss the actual progress which has been made. By the first of December we shall have spent $60,000,000 in the course of acquiring a canal. The two questions which the American people have a right to ask are, first, have we proceeded without unnecessary delay? Second, have we received our money's worth?

Many thoughtless persons cry out, "Why does not the dirt begin to fly? The way to build the canal is to dig." Such remarks only show ignorance and complete failure to understand the real character of what has to be done. The canal is to be built by manual

labor and machinery. The number of laborers required will perhaps be 25,000.

Panama is sparsely settled, with few laborers available. The great majority must be imported. For every laborer at least one person more will come who will be dependent on him. We must, therefore, count on an alien population of 50,000 along the line of the canal for 47 miles. To get the best work they and their families must be housed; must have healthful food; must have pure water to drink, and the filth caused by such a collection of beings must be taken care of so as not to promote disease. Yellow fever and malaria must be stamped out. All these things ought to be done before the "dirt begins to fly."

Panama is one of the oldest towns in America, and yet during the dry season there has been no means of furnishing water except from cisterns, puddles and receptacles often covered with green scum and as productive of disease as is possible to imagine. The first thing the first commission did was to arrange for a water supply for Panama. Engineer Wallace took a reservoir partly constructed by the French, built the dam 20 ft. higher and laid the mains into Panama, so that on July 4, 1905, the people were permitted to drink pure water. This reservoir furnishes water also to the town on the Pacific side; but another reservoir for Culebra, another one for Empire, another one for Bas Obispo, and others for Colon are being constructed. Sewers are now being constructed in Panama. To make Panama healthful the commission has decided to pave the streets, which for centuries have been dirty—muddy in rainy weather, dusty in dry weather, and full of disease in all weathers. The whole strip from Panama to Colon was grown up with underbrush, weeds and jungle. Now the jungle is being cut down, the hills are being shaved, pools are being drained, swamps relieved of water, and in every way the stagnant water surfaces and the propagating ground for the deadly mosquito are being reduced. The mosquito is the worst enemy in the propagation of disease in the West Indies and American tropics that man has.

As Mr. Stevens said to me, when I crossed the Isthmus with him this month, "I take off my hat to the work which the sanitation department has done in this Canal Zone." In the month of August among a force of 13,000 men the percentage of illness was less than 25 per thousand. Good food is now furnished by a commissary at reasonable rates. The carrying of refrigerated fruits and meats from Colon across the Isthmus has been begun. There is an ice plant at La Boca, another one at Colon, and others along the way are to be built, so that ice—that most healthful form of liquid in the tropics—will be at hand for all.

A hotel has been erected at Corozal, where the American employees of the commission may live and run in to their business in Panama in a few minutes by railroad. A hotel of 128 rooms is being constructed at Ancon. The French had excellent hospitals at Ancon and Colon, but it was necessary to refit them entirely. And now we have a hospital at Ancon, one at Panama, a convalescent hospital at Taboga, an island some 10 miles off the coast in Panama Bay, where very healthful water, healthful bathing and fine fruits can be had, so that in all, the hospital accommodation has been increased from about 350 to upward of 1,000 beds.

One of the great burdens is the procurement of transportation and proper disposition of the immense amount of supplies and equipment which have to be ordered and pressed forward to the Isthmus. The commission bought two large freight steamers costing $650,000 apiece. And even with these and three others owned by the Panama Railroad there is still much difficulty in getting the requisitions of the chief engineer supplied. The following is a list of the principal items of material purchased and delivered, or now under order, and will serve to give an idea of the vastness of the undertaking and why congestion in sea transportation and on the railroad, with all the commercial traffic besides, may be pardonable:

61 steam shovels.	152 rock drills.
1,300 flat cars.	30,000,000 ft. lumber.
12 rapid unloaders.	2 dipper dredges.
22 unloading plows.	646,000 lbs. blasting powder.
13 earth spreaders.	617,500 lbs. dynamite.
324 dump cars.	7,000,000 paving brick.
12 hoisting engines.	3,500,000 building brick.
120 locomotives	500,000 sq. ft. roofing tile.
5,000 tons of steel rails.	36,000 bbls. cement.
125,000 crossties.	3 steel water tanks and towers.
12,000 pieces of piling.	
14 air compressing machines.	12 standpipes.
3 cranes.	2 ocean steamships.

The Panama Railroad on its own account has also purchased during the last six months:

500 box cars, 40 tons.	1 locomotive crane.
12 caboose cars.	1 pile driver.
10 refrigerator cars.	3 track scales, 100 tons.
6 passenger coaches.	1 coal hoisting plant.
24 locomotives.	1 cantilever crane.
2 wrecking cranes.	

Mr. W. Berdrow, commenting in the *Journal* of the German Railroad Union, on the "Oregon Pony" exhibited at St. Louis, notices that for a long time American builders of express locomotives depended chiefly on increased piston-speed for fast-running, and used wheels of comparatively small diameter. "Then, however, especially through the investigations of Professor Goss, at Purdue University, American engineers came to the conviction that for high-speed locomotives the increase of driving-wheel diameter is more economical than increased piston-speed."

October Decisions in Railroad Law.

The following abstracts cover the important railroad law cases decided by Federal courts in October:

Patent for engineer's brake valve invalid.—The Circuit Court for the northern district of New York has decided that the Westinghouse and Moore patent for an improved engineer's brake valve, granted April 23, 1899, is void on the ground that the claim in the application for the patent was too broad. The court further held that this defect was not remedied by a subsequent disclaimer or abandonment of the claim except as to a single form of construction of the appliance, the court not being able to determine whether this form of construction was really included in the broad language of the original claim. The court took the ground that the Federal statute allowing a disclaimer where the claim is too broad is applicable only where the portion of the claim retained is clearly embraced in the original claim. Westinghouse Air-Brake Co. vs. New York Air-Brake Co., 139 Fed. Rep. 265.

Federal jurisdiction over non-residents.—The Circuit Court for the District of Nevada has passed upon a new phase of the Act of Congress providing that when jurisdiction is founded on diverse citizenship, suit shall be brought only in the district of the residence of one of the parties to the suit. In the case in question the Southern Pacific Company, incorporated under the laws of Kentucky, and hence a resident of that state, was sued in Nevada by a resident of Utah. The question before the court was whether the court had jurisdiction where both parties were non-residents of the district where suit was brought. The court held that the statute conferred a mere privilege on the defendant which he could waive, and having waived it the jurisdiction of the court was complete. The question has not been passed upon by the Supreme Court of the United States and is far from settled as the decisions of the various Federal Courts that have passed upon the question are far from harmonious. Burch vs. Southern Pacific Co., 139 Fed. Rep. 350.

Work of the English Railway and Canal Commission.

The following account of the work of the Railway and Canal Commission of 1888 is taken in abstract from a paper printed by S. J. McLean in the *Quarterly Journal of Economics* for November, 1905. It is especially timely because it reviews the actual results obtained during the last 17 years by a body possessing many of the functions with which President Roosevelt wishes to endow the Interstate Commerce Commission.

The report of the Select Committee in 1881 had stated that a permanent railway tribunal was necessary, and legislation looking to the establishment of a new railway commission was introduced regularly between 1882 and 1886. In 1885 the nine principal railways submitted bills to Parliament embodying a general classification and a rearrangement of their maximum rates, but the protests of the traders led to the withdrawal of these measures. The legislation of 1888 introduced important changes as compared with the former Commission of 1873 in the court organization of the Commission, and in the limitation of the right of appeal. Under the old organization the Commission was considered to be in the same position as any inferior court, and might be prohibited from proceeding in matters over which it had no jurisdiction, but in 1888 the new Commission was given a definite court organization, and its decisions were made final on questions of fact.

The 1888 law provided for a Commission of five members, composed of two laymen and three *ex officio* commissioners. The *ex officio* members are Superior Court judges, one for England, one for Scotland and one for Ireland. The active Commission at any given time has a membership of three, the two lay commissioners, as they are termed, being presided over by the designated Supreme Court judge of the country in which the Commission is sitting. The judges who serve on the Commission are appointed for terms of five years, but the lay commissioners hold office on a good-conduct tenure. The old provision whereby one of these lay commissioners was required to be experienced in railway business was continued, and Mr. Price, the railway member of the former Commission, was reappointed. The qualification of the other lay commissioner was not specified, and to this position Sir Frederick Peel, whose training was legal and who had been a member of the Railway Commission in 1873, was appointed. (Sir Frederick is still an active member of the Commission, in spite of his advanced years.) The lay commissioners were admonished as to the judicial character of their functions, for in their letters of appointment they were informed, "Doubtless you will feel that the judicial nature of your

office is also incompatible with any active connection in political controversies."

While the jurisdiction given by the Act of 1888 embraces a variety of functions, the most important of which are discrimination, facilities for traffic, traffic on steamboats, through rates, rate books, terminals, legality of rates, provisions relating to private branch sidings, and references under the Board of Trade Arbitrations Act of 1874, the most important matters from the standpoint of the traders are, respectively, terminals, reasonable facilities, through rates, discrimination and control over actual rates. By way of confining this discussion to the limits of a single paper, only those portions of Mr. McLean's article are included which deal with the functions of the Commission bearing on the problems that now confront railroads and shippers in the United States. Therefore, the enumerated function first in importance from the British standpoint, that of terminals, may be entirely omitted, as the British conditions are peculiar to that country.

The through rate clause of the Act of 1888 provides that through rates, stating the amount, route and apportionment of the rate, may be proposed by a railway, a canal company or a trader, and in case of dispute regarding a rate or its apportionment the matter is brought before the Commission and the commissioners must consider the special circumstances of the case, and must not compel any company to accept lower mileage rates than it may, for the time, legally be charging for like traffic carried on by a like mode of transit on any other line of connection between the same points, being the points of departure and arrival of the through route.

With regard to "reasonable facilities" in general, the English law has held, broadly, that they must be such as can reasonably be required of the railway company, due allowance having been made for the way in which the service is already performed. Similarly, in a reduced through rate it must always be considered whether there is commensurate advantage to the railway. *Prima facie*, it has been held against public interest to interfere with vested legal rights unless some compensation or equivalent is given. There must, therefore, be evidence both of public interest and of reasonableness in favor of the rate and route sufficient to outweigh the former considerations. It has been held that the fact that two competitive routes will tend to make either company treat the traders more reasonably is a consideration bearing on the question of public interest, but at the same time the Commission will not grant a through rate which creates unhealthy competition. The reasonableness of a rate over a proposed route is not to be measured by an existing rate over an alternate route, even if the rate over the latter route may in itself be reasonable.

The Commission has more than once had to consider questions similar in their bearing to the points brought up in our testimony before the Senate Committee on Interstate Commerce on private and terminal railroads as to what constituted a railroad entitled to participate in a through rate. Thus it was decided in 1897 that the powers the Manchester Ship Canal possessed to build railways on its quays, although these railways were simply for its own uses, constituted it a railway company, but in 1901 the action of the Commission in approving a through rate arrangement for a dock company was overruled on the ground that the railways possessed by the dock company did not constitute a railway within the meaning of the Act. In 1903 a further application of the same company (The London & East India Docks Company) subsequent to its acquisition of a short railway with which it had made connections, was refused on the ground that the difficulties of exchange of traffic did not justify granting such an application.

The Commission has looked at each through rate case by itself, British "through rates" being in general analogous to our interstate rates, as distinguished from local rates. It has refrained from proposing a through rate, and has limited its action to accepting or rejecting a proposed through rate as brought before it. The power which traders have to propose through rates to the Commission has been of little value to them. They have not generally been possessed of the technical knowledge necessary to formulate a rate that the Commission would sustain, and they have been successful in only one out of five applications. Since the constitution of the present Commission, in 1888, it has acted only on 19 through rate applications, some of which have been made by canal companies, some by dock companies, some by traders, and one by a municipal corporation.

Discrimination, or undue preference, as it is termed in English law, has long engaged the attention of the Commission. Complaints were made in 1882 before the former Commission that many anomalies existed in domestic rates, and domestic shippers have always claimed that they were almost habitually placed at disadvantage with the shippers of foreign products. Of course, the obvious reason for this is that rail rates in England are tremendously modified, so far as foreign produce is concerned, by seaport competition, and if the lines which run from Liverpool to London, for example, do not offer an extremely low rate on over-sea traffic, it will be carried to London direct by water. This fact was recognized by the Act of 1888, although the traders seemed never to have fully recognized it, and the undue preference section of the Act provides that where, for the same or similar service, lower rates are charged to one shipper than are charged to another, or any difference in treatment is made, the burden of proof that such actions do not constitute an undue preference shall be on the railway, while the commissioners must decide whether the difference in tariff or in treatment is necessary for the purpose of securing in the interests of the public the traffic for which it is made; but it is distinctly provided that no railway company shall make, nor shall the commissioners sanction any difference in the tariff for, or in the treatment of, home and foreign merchandise in respect of the same or of similar services. Before 1888 inequalities of charges for like services were only *prima facie* evidence, and the burden of proof was on the complainant; now it rests on the railway. A decreased rate to develop a particular traffic in a particular district constituted undue preference, but the mere fact that preference existed was not sufficient; it must be shown to be undue and unreasonable, and differences in rate might be allowed where there were differences in the cost of conveyance.

The present Commission has brought out some additional points in the matter of discrimination. A contract to give exclusive use of a given station to a particular colliery is undue preference; but competition has been held to be a circumstance to be taken into consideration, and the extent of it is considered a question of fact, not of law. As might be expected under these circumstances decisions on the preference cases have often been confused and contradictory. The long and short haul question comes before the Commission but seldom. The Commission has recognized effective competition as a justification of a lower rate for the longer distance.

From an early date English railway law has held that wholesale rates for large shipments did not constitute undue preference. So early as 1858 it was decided that carrying at a lower rate in consideration of large quantities and full train loads at regular periods was justifiable, provided the real object was to obtain a greater profit by reduced cost of carriage, although in taking this point of view it was recognized that certain shippers would necessarily be excluded from the advantage of the low rate granted on such conditions.

In dealing with the rate policy of the Commission a distinction has been made between the period prior to 1894 and the more recent years. Though it had been held in 1872 that legal maximum rates afforded but little real protection to the public, the system was continued by the Act of 1888. At the outset of its work the only way with which the Commission was brought in touch with rates was with the provisions concerned with undue preference and with through rates. The Commission will not state beforehand that a rate is preferential. There has been some difficulty in construing the statement in the original "undue preference" clause of the Act directing the commissioners to consider "whether the inequality cannot be mitigated without unduly reducing the rate charged to the complainant." Sir Frederick Peel, of the Commission, holds that that body may fix a through rate no matter what the railways concerned may have agreed upon. While this matter has not been passed upon judicially, the weight of opinion is against this interpretation. It would also appear that the Commission has no power to test the reasonableness of an established through rate, for although the Commission has power to fix a through rate if the parties do not agree, it would appear—although this is a moot point—that is, has no power to apportion such a rate. The Commission said explicitly in 1895 that it had no power under the Act of 1888 to inquire into the reasonableness of a particular rate. The reductions which have been ordered in connection with the workmen's trains applications are given in an entirely different jurisdiction.

The question of the reasonableness of particular rates was suddenly brought before the Commission in 1894. The adjustments necessary in putting into force the rates under the revised maxima were great. The fact that fully one-half of the traffic is carried on exceptional rates, which are below the class rates, still further complicated matters. At the same time there was an apparent desire on the part of some of the railways to give the traders an object lesson in regard to the disadvantages of the legislative intervention which had brought some maxima below the actual rates formerly charged. And so the maximum class rates were published as the actual rates effective January 1, 1893. The outcry which followed quickened the work of adjustment, and led to an undertaking on the part of the railways that the rate increase should not be more than 5 per cent. But this did not prevent the enactment of a piece of panic legislaion, passed hurriedly and without due consideration. By this act it was provided that, where rates were directly or indirectly increased after December 31, 1892, they were *prima facie* unreasonable. The fact that the rate complained of was within the maximum was not to be a justification of the increase. The Commission was given power to deal with complaints arising under this act, subject to the provision that an application was first to be made to the Board of Trade. Over 1,700 complaints were brought before the Board of Trade between the date of the passage of the Act and the end of February, 1895. In taking up the new functions imposed by the revolutionary Act of 1894, the Commission had

a full appreciation of the difficulties of the new jurisdiction, and it held that it was not competent of its own knowledge to say whether a rate was reasonable or not. The cost of service was considered as a criterion of reasonableness, and this squared with the views of the traders, but has, as may well be understood, led to some peculiar decisions. No general principle has been established in the unreasonable rate cases, but the Commission has shown its intention to look at each case by itself. Thus, if a 5 per cent. increase should be found justifiable in a particular case, it would not necessarily have any bearing on a later decision. The desire of the Commission not to engage in any rate making experiments, has kept it from making any statements as to general rates, and it has concerned itself with the reasonableness of particular rates. The Commission has painstakingly endeavored to get at the cost involved, and then has given decisions which were compromises.

Looking at the make-up of the Commission, with its two lay members and its one judicial member, it is apparent that the presence of a railway representative among the lay members has meant that those appearing before it have been more careful to give essential details. There is no real cause for complaint from the traders' standpoint with regard to the service which the lay members have performed. The railway representative, for example, in enforcing the legislation of 1894, has followed very closely the ideas favored by the traders. In spite of the assumption of 1887 that giving a *locus standi* to governing bodies and to traders' associations would cause much litigation, the number of complaints before the Commission is not great. From 1889 to 1903, there have been on the average 50 applications a year, many of these of minor importance.

In view of the expense attaching to suits before the Commission it has been urged that the power possessed by the Board of Trade under the Act of 1873 to institute proceedings before the Commissoin should be utilized. But the government has held that to make a government department public prosecutor in cases before the Commission would savor rather of persecution than of prosecution.*

The English Commission has used two sets of rate principles—competition as an important factor in differential rates, export rates, and in general in the home side of undue preference; cost of service in regard to preferential rates, and unreasonable rates. This has been in great degree attributable to the legislation. The traders have desired free trade in exports, not in imports. Admitting that there has been a certain judicial bias in favor of the cost of service principle, it is at the same time apparent that legislation, like that of 1894, which makes a past rate the *prima facie* criterion of reasonableness rules out the possibility of considering present competition. The defects of the legislation of 1894 are its own. The Commission has made the legislation less unworkable than could have been expected.

Irrigated Lands Along the Platte River.

A recent government report gives some striking figures to show what has been accomplished by irrigation in the valley of the Platte river. The first ditch diverting the water of this stream for irrigation was built in 1859. The Platte river and its tributaries now irrigate 1,924,463 acres of land. Some of the best farming land sells for $300 and none that is irrigated sells for less than $10 an acre. Fifty years ago this land was regarded as a desert and was practically worthless. If the right to use water in irrigation were taken away from it, it would be practically valueless to-day.

More than 500,000 people live in the irrigated territory on this stream. Not all of them depend on agriculture. The city of Denver with 200,000 people, Cheyenne with 15,000 people, Laramie with 7,000 people, North Platte with 10,000 people, and a score of other towns having from one to ten thousand inhabitants, with their machine shops, flour mills, paper mills, beet-sugar factories, and transportation interests, all tend to augment the importance of water, because not a city or town, a factory or a railroad, can be assured of the privilege of using the water of this stream without securing a right thereto through a definite legal procedure. The value of water rights for irrigation has risen from $4 an acre to $35 an acre, and stored water sells for even higher prices. Water to irrigate an acre of land has been sold for $15 a year.

The average flow of water in the South Platte and its tributaries is 2,765 cu. ft. per second. Against this supply, rights to 30,597 cu. ft. per second have been established in Colorado and Nebraska. The area irrigated from the North Platte and its tributaries is about 900,000 acres. In Nebraska riparian rights are recognized, as well as rights of appropriation. Being inherent in the land, the first-named do not require any legal procedure for their establishment. The measurements of the water used and the water returned to this stream bring out the fact that a large percentage of the water diverted by a particular canal is not wholly lost, but returns to the stream and is used over and over again. Some of the measurements showed that in low water the return seepage tends to increase the flow of streams rather than diminish it.

*It is interesting to note that this suggestion is very closely in line with the suggestion frequently brought out in our own discussions on government regulation, that the Interstate Commerce Commission should become prosecutor before a special court, having the additional advantage that its opinion would be final on questions of fact.—Editor.

Railroad Shop Tools.

MILLING MACHINES.
(*Continued.*)

As a plain milling machine for heavy service the Garvin No. 14 plain miller made by the Garvin Machine Co., New York, shown in Fig. 1, possesses several notable features. The spindle cone is of three steps for a 4-in. belt and is back-geared 8 to 1. The arm is of steel; it is of large diameter and is provided with heavy braces. These braces can be attached to the arbor yoke or to the end of the arm itself, independently of the position of the yoke. The spindle is of forged crucible steel, and the front bearing is tapered and runs in a solid bronze self-oiling box and is fitted with hardened and ground thrust washers.

The construction of the knee is patented. It is absolutely closed on the top and sides, so there is no chance for the sides to spring, and no need for cover plates to protect the feed works. The bearing on the column is also extended upwards, thus increasing the stability and holding power of the knee on the column. The closed construction of the knee secures the perfect stiffness necessary to heavy cuts and forced feeds, and prevents all straining

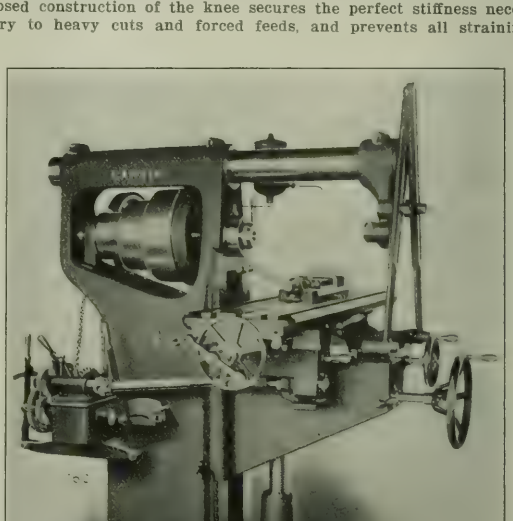


Fig. 1—The Garvin No. 14 Plain Milling Machine.

of the knee and fit of the saddle from overhung work. The saddle is fitted to the knee with a taper gib. The table is large and deep, and has a cast oil space all around, the top edge of the groove being finished, which adds to the effective working surface. The front and back edges of the table are also finished for convenience in squaring work. The table feed screw is extra large, and is provided with a quick pitch, which gives a movement of 1 in. per turn. The torsional stiffness of the large diameter secures steady feed under the heaviest loads, and the increased wearing surface assures durability.

The application of the power to the feed screw is direct, by means of a large bronze worm gear which is mounted on the screw itself, and which is driven by a hardened tool steel worm, running in an oil-bath. Reverse motion is provided for in the feed-box. The feed drive is through a change gear box in which fine feeds are positively driven from the spindle, and fast feeds are driven from the countershaft by a wide belt and large pulleys. This arrangement permits of changing instantly from spindle to countershaft feeds and instantaneous changes of rate are obtained by setting levers. The gears in the gear-box are hardened steel, and run in an oil bath. A safety shear-pin is provided in the gear box to prevent any damage that might occur from carelessness in setting the trips.

Tests made by the makers it is claimed have demonstrated that 30 per cent. of the power of the spindle belt is used in driving the

feed at fast rates; and when the feed is driven from the countershaft, the spindle power is increased by that much; and this saving, in addition to increasing the back-gearing and widening the belt, has resulted in more than doubling the power of the above tool. The table feed-screw has two nuts, one adjustable for take up. The saddle in and out screw is also provided with a take-up nut and the elevating screw of the knee is ball-thrusted, and telescopes, so that no hole is required in the floor. The hand-wheels on the knee are interchangeable, so that the large wheel can be used for the up and down or in and out adjustments, as most convenient. Micrometer adjustments are provided for feeds in all directions, and the spindle speeds are in geometrical progression. A number 10 Brown & Sharp taper hole is provided in the spindle, and a positive key-drive and screw draw-in rod is provided for the arbor. A speed range from 12 r.p.m. to 450 r.p.m. is provided, and feed ranges from .004 in. per turn of the spindle to over 12 in. per minute can be obtained. The machine can pull a cut $^{5}/_{32}$ in. deep by 5½ in. wide, by 9 in. long per minute, with a single belt on the cone. The table has an automatic feed of 28 in. The adjustment in line with the spindle is 8 in. and the vertical adjustment under the spindle is 19 in. The weight of the machine complete is about 2,520 lbs.

Fig. 2 shows a No. 9 Bement vertical milling machine made by the Niles-Bement-Pond Company, New York. This machine is largely used in locomotive shops for finishing the ends of side and main rods, for milling mud rings of locomotive fireboxes, and for

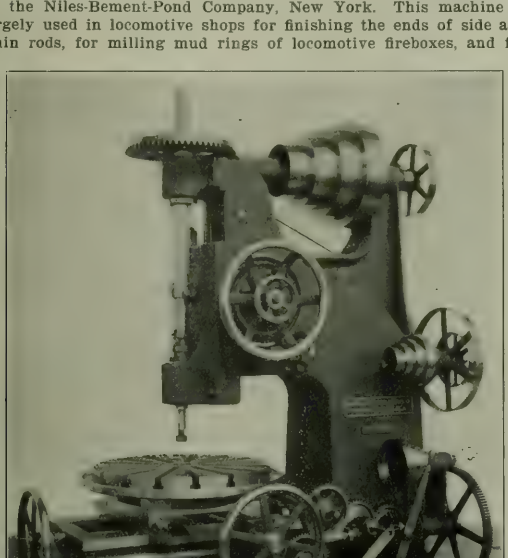


Fig. 2—The Niles-Bement-Pond No. 9 Vertical Milling Machine.

a variety of other work. In one or two shops, the jaws of the knuckle pin connections on the side rods are milled out on this machine. It has been found that for this work the vertical milling machine is much superior to the slotter. Milling machines of this type can also be used on work such as cylinder heads where it is necessary to machine the face of the heads and to finish the lugs which are cast directly on them.

The spindle of this machine is of steel 4 in. in diameter. It is counterweighted and at its lower end is held in a slide, which has a vertical traverse of 17 in. by hand. Automatic variable feeds can be provided when desired. The cutter mandrel is held in position by two circular nuts on the spindle, the lower one of which locks it in, and the upper one forces it out of the spindle. The distance from the center of the spindle to the inside of the frame is 26 in., and the vertical distance from the table to the underside of the frame is 16 in.

The compound tables have a movement of 28 in. longitudinally, and 28 in. transversely, and support a circular table with a working surface 32 in. in diameter. The tables are provided with four reversible feeds. The feed shaft for the circular table may be swung out of position to permit it to be rotated by hand for adjusting the work to position. Variable vertical feeds and copying attachments are provided when desired. A self-acting lubricating pump, with complete draining arrangements, is provided with each machine. The countershaft pulleys are 24 in. in diameter for a 5 in. belt, and they should run at 150 r.p.m.

Train Accidents in the United States in October.[1]

xc, 1st, Louisville & Nashville, Goodletts, Tenn., passenger train No. 93 ran over a misplaced switch and collided with some freight cars standing on a side track, and the engine was overturned; engineman and fireman injured.

*†xc, 1st, St. Paul, Minn., a freight train of the Chicago Great Western approaching a junction at uncontrollable speed, ran into the side of a passenger train of the Minneapolis, St. Paul & Sault Ste. Marie, and five passenger cars were thrown off the track. Two of these cars were overturned and fell to the foot of a 27-ft. retaining wall at the side of the track. One passenger was killed and five were injured. The wreck took fire, but the flames were quickly extinguished by the city fire department.

unx, 1st, 2 a.m., Louisville & Nashville, Birmingham, Ala., a switching engine running rapidly was derailed, and three trainmen riding on the front of the engine were killed.

dn, 3d, Cleveland, Cincinnati, Chicago & St. Louis, Terre Haute, Ind., a freight train was derailed at the derailing switch approaching the crossing of the Southern Indiana, and the engine and 10 cars were badly damaged. The engineman and fireman were killed and a man riding in one of the freight cars in charge of freight was injured.

dr, 4th, Baltimore & Ohio, Morgantown, W. Va., passenger train No. 1 was derailed by spreading of rails and three passenger cars fell down a bank. One trainman and eight passengers were injured.

bc, 4th, Chicago, Peoria & St. Louis, Hop Hollow, Ill., butting collision between a freight train and a work train, wrecking both engines; one engineman killed and six other employees injured.

xc, 5th, 3 a.m., Boyles, Ala., an empty engine of the Louisville & Nashville collided with a freight of the Southern Railway at a crossing; one employee killed, five injured.

unx, 5th, Chesapeake & Ohio, Colby, Ky., an empty engine was derailed and four employees were injured.

o, 6th, Williamsport & North Branch, Ringdale, Pa., the locomotive of a passenger train was wrecked by the explosion of its boiler; engineman killed, fireman fatally scalded.

rc, 8th, 4 a.m., Philadelphia & Reading, Royers Ford, Pa., a freight train taking water was run into at the rear by a following freight, badly damaging the engine and several cars. One fireman and one brakeman were killed.

rc, 8th, 4 a.m., Pennsylvania road, Millersburg, Pa., a passenger train ran into the caboose and one car of a preceding freight train which had become accidentally detached, and the caboose and car were wrecked. The fireman of the passenger train and two trainmen in the caboose were killed. There was a dense fog at the time.

dn, 8th, Jeffersonville, Ind., a freight train descending from the bridge over the Ohio river became uncontrollable and was derailed at a derailing switch by a signalman to prevent it from running into a passenger train which was approaching the junction from the north. The engineman and fireman jumped off, the former sustaining a broken leg.

bc, 9th, 3 a.m., Louisville & Nashville, Hopkinsville, Ky., butting collision of freight trains both running at full speed. Both engines and four cars were wrecked; one engineman and one fireman killed.

dn, 10th, Atchison, Topeka & Santa Fe, Newton, Kan., eastbound passenger train No. 8, while running at full speed, was derailed at a misplaced switch and the first three cars were ditched; three trainmen injured.

rc, 12th, Pennsylvania road, Coatesville, Pa., an eastbound freight train ran into the rear of a preceding freight, damaging six cars. A part of the wreck fell across the westbound track and was run into by a westbound freight train. One engineman was injured.

bc, 14th, Mobile & Ohio, Shubuta, Miss., butting collision between a southbound passenger train and a northbound freight, wrecking both engines and badly damaging several cars. Six trainmen and eight passengers were injured.

†xc, 14th, Baltimore & Ohio Southwestern, Springfield, Ill., a westbound passenger train collided with two cars of coal which had escaped control on a side track and had run afoul of the main

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

track, and two passenger cars were ditched. One passenger was killed and three were injured.

*unf, 15th, Iowa Central, Seaton, Ill., an eastbound freight train drawn by two engines was derailed by running over a cow, and both engines and 11 cars were wrecked. The wreck took fire and was mostly burnt up. Five trainmen were killed.

bc, 16th, Yazoo & Mississippi Valley, Crenshaw, Miss., butting collision between a freight train drawn by two engines, going north, and a work train going south. One trainman was injured.

unf, 16th, 2 a.m., Southern Pacific, Fresno, Cal., a passenger train was derailed at a misplaced switch and the engine was overturned, killing the engineman and fireman. Two cars were wrecked and a tramp was fatally injured. It is said that the switch had been maliciously misplaced.

unx, 16th, Missouri Pacific, Sugar City, Colo., a westbound passenger train was derailed and three passenger cars were overturned; 17 passengers injured.

bc, 16th, Pennsylvania road, East Sandy, Pa., butting collision of freight trains, wrecking both engines and several cars. One engineman was killed and one brakeman and one fireman injured. There was a dense fog at the time and it is said that the engineman of the northbound train mistakenly assumed that he had seen and passed the southbound at a station a short distance south of the point of collision.

17th, Colorado & Southern, Horse Creek, Wyo., a passenger train was derailed and two passenger cars fell down a bank. One employee and three passengers were seriously injured and 20 or more other passengers slightly.

unx, 17th, Louisiana & Arkansas, Minden, La., a freight train consisting of a number of empty log cars, drawn by a locomotive running backward, was derailed on a trestle bridge, and the engine and four cars were wrecked. One man riding on the engine was killed and two others were injured.

unx, 18th, Louisville & Nashville, Pittsburg, Ky., a passenger train was derailed on a curve and the engine was overturned. The first three cars were ditched. The engineman and fireman were injured, the former fatally.

rc, 19th, Atlantic Coast Line, Wedgeville, S. C., freight train No. 82 ran into the rear of a preceding work train, wrecking the caboose. Two trainmen were killed and two injured. There was a dense fog at the time.

unx, 19th, Missouri Pacific, Nehawka, Neb., a freight train was derailed while crossing a bridge and the engine and two cars fell 25 ft. to the stream below. The engineman and fireman were killed.

bc, 20th, Seaboard Air Line, Portsmouth, Va., butting collision between a special passenger train and a switching engine; 20 passengers injured, most of them slightly.

xc, 20th, Southern Railway, Lima, Va., a freight train broke in two and the rear portion afterward ran into the forward one, damaging several cars. Three tramps riding in one of the cars were injured.

†dr, 20th, Denver & Rio Grande, Caliente, N. Mex., a passenger train was derailed by spreading of rails; one passenger killed and four injured, one of them fatally.

rc, 21st, 4 a.m., Ann Arbor road, Shepherd, Mich., a freight train standing at the station was run into at the rear by a following freight, wrecking the engine, caboose and many cars. The engineman and one brakeman were killed.

rc, 21st, Chicago, Burlington & Quincy, Otis, Colo., an empty engine ran into the rear of a preceding freight train, wrecking the caboose and injuring three drovers.

†rc. On the evening of the next day, the 22d, the same train was run into at the rear at Eckley, Colo., wrecking the caboose and several cars of sheep, and killing a drover riding in the caboose.

dr, 21st, Missouri Pacific, Fort Scott, Kan., a passenger train was derailed by a broken rail and five cars were overturned. About 30 passengers were injured, most of them slightly.

o, 21st, El Paso & South-Western, Escondida, N. Mex., the locomotive of a freight train was wrecked by the explosion of its boiler, and four trainmen were injured, all probably fatally.

bc, 22d, Illinois Central, Middleburg, Tenn., butting collision of freight trains, badly damaging both engines and several cars. Two men stealing a ride were killed. It is said that the southbound train ran past an appointed meeting place.

bc, 23d, 1 a.m., Oregon Short Line, McCammon, Idaho, butting collision of freight trains, making a bad wreck. The fireman, one brakeman and two tramps were injured, the tramps fatally.

*23d, Gulf, Colorado & Santa Fe, Bangs, Tex., a string of freight cars which had escaped control and run from a siding to the main track collided with a freight train, wrecking the engine and several cars. The boiler of the engine exploded and a part of the wreck was burnt up. One man was killed.

dr, 23d, Southern Railway, Gadsden, Ala., a passenger train was derailed at a defective switch and two passenger cars were thrown against a freight car standing on a side track. The conductor and two passengers were injured.

o, 24th, Chicago & Eastern Illinois, Jackson, Ind., the locomotive of a freight train was wrecked by the explosion of its boiler, and the engineman and two other trainmen were injured. Several freight cars were wrecked.

†bc, 26th, Chicago, Rock Island & Pacific, Fairfield, Iowa, butting collision between westbound passenger train No. 11 and eastbound passenger train No. 12, both running at good speed. Both engines were wrecked and 11 cars were badly damaged. One engineman, one mail clerk, one passenger and a tramp were killed, and five trainmen and 10 passengers were injured.

xc, 26th, Southern Railway, Jenifer, Ala., a freight train collided with another freight train which was on a side track but not clear of the main line, and both engines and several cars were wrecked. One engineman and one fireman were killed and a brakeman was fatally injured.

unx, 26th, Western of Alabama, Ethel, Ala., passenger train No. 35 was derailed at a switch and six cars were overturned. One passenger was injured.

unx, 27th, Louisville Southern, Lexington, Ky., the tender of the engine of a passenger train was derailed just as the train was approaching a bridge and, with the first three cars, broke through the bridge and fell 40 ft. to the creek below. Three trainmen and nine passengers were injured.

unx, 27th, Southern Railway, Norris, S. C., passenger train No. 11 was derailed and the engine and first three cars were overturned. The fireman was killed and three other trainmen were injured.

o, 27th, Southern Pacific, Yuma, Ariz., the locomotive of a freight train was wrecked by the explosion of its boiler, and the engineman and fireman were killed.

bc, 28th, Norfolk & Western, Nace, Va., butting collision betwen an extra freight train southbound and a local freight northbound, wrecking both engines and 20 cars. One engineman and one fireman were killed and several other trainmen were injured. It is said that the southbound train ran past the appointed meeting station.

unx, 28th, Mobile, Jackson & Kansas City, Stratton, Miss., train No. 18, consisting of a number of freight cars and one passenger car, was derailed and four freight cars fell down a bank; one on one side of the road and three on the other. Three men of a track repair gang were injured, two of them fatally.

eq, 29th, Baltimore & Ohio, Mariner's Harbor, N. Y., a gravel train was derailed by the breaking of the flange of a wheel, and one car and the caboose fell down a bank. Eight employees were injured.

o, 29th, Pennsylvania road, Dean's, N. J., the locomotive of a freight train was wrecked by the explosion of its boiler; fireman killed, engineman and one brakeman injured. The wreck blocked four main tracks several hours.

bc, 30th, Oregon Short Line, Border, Idaho, butting collision of freight trains, wrecking both engines and damaging several cars. Two trainmen and two tramps were injured, the tramps fatally.

†30th, Atchison, Topeka & Santa Fe, Sheffield, Mo., passenger train No. 1 was derailed and ditched in a cut while running about 50 miles an hour and several of the cars were piled up in a bad wreck. The car most completely wrecked was the smoking car, and the occupants of this suffered severely. Ten passengers and three employees were killed and 46 persons were injured. The engine was not derailed and the tender was so near the rails that the engineman and fireman got it back on the track in about 20 minutes and then carried messengers to the nearest station for help.

unx, 30th, Midland Valley, Pawhuska, Okla. T., a freight train was derailed and wrecked and three trainmen were injured, two of them fatally.

dn, 31st, 4 a.m., Louisville & Nashville, Mobile, Ala., passenger train No. 3 was derailed in consequence, it is said, of a mistake in signaling, and the engineman and four other persons were injured.

Foreign Railroad Notes.

A German student finds one of the causes of the inability of the Russian railroads to handle their traffic is the antiquity of their locomotives. The number of these seems in tolerable proportion to the traffic, but out of 14,326 locomotives no less than 6,919 are from 24 to 46 years old. However well these may have been maintained, engines of that age are comparatively light. Recently an important part of the stock has been drafted into service in Siberia, and these, we may be sure, were among the best ones.

The Russian authorities have established greatly reduced rates on forage and fodder grains to the provinces where the crops failed last summer, and have ordered that such shipments shall have preference in time over other freight. It has been the experience in other seasons of short crops that the peasants have lost their stock for want of feed, and then the next year were crippled for lack of draft animals. Low freights did them little good because, waiting their turn on lines overcrowded after harvest, the forage did not reach them in time to save the stock. No reduction is made on bread grains, except for seeding.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.

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A committee of the Roadmasters' Association recently defined a tie plate as "a rolled steel plate having thin flanges on the under side, which, when embedded in a tie under the rail seat, has sufficient adhesion to cause it to act with and become practically an integral part of the tie." In enumerating the classes of tie plates, three kinds were mentioned: non-adhesive, longitudinal flange and cross-grain claw. The first, however, is really ignored in the definition for the declared reason that it "cannot perform the first requirement essential to a tie plate, which is to become a part of and act with the tie under passing loads." The foregoing is of interest in connection with the practice just adopted by the Union Pacific. After long experience with the flange-bottom plates, their use has been abandoned for the reasons that (1) it is almost impossible to get the men to embed them in the ties properly, and (2) with treated ties especially, the holes they cut in the wood allow the water to penetrate readily at these points, causing decay there long before the remainder of the tie shows signs of deterioration. Because of these difficulties, a flat-bottom plate has been used altogether in the new double-track between Kansas City and Topeka. Also, the size of the plate has been materially increased to give greater bearing area. The plates used in the past, which correspond to general practice, have been too small and have crushed into the timber; in fact, in many cases they crushed in so far that the rail also cut the ties. The new type used, which is as long as the tie is wide, weighs about 6½ lbs. and costs the road about 13 cents. In adopting the flat-bottom plate the Union Pacific is merely going back to first principles, as the earliest forms of tie plates were of this type. The chief objection urged against this type is that as soon as the rail becomes slightly loosened, as it does under the wave movement due to the rolling loads, the plate likewise is loosened and abrades the tie surface in much the same way that the rail would. However, some roads have continued to prefer the flat-bottom type, notably the Southern Pacific, which was a pioneer in the use of tie plates and has adhered consistently to the flat-bottom shoulder plate from the beginning, modifying the design as experience and increased weight of rolling stock dictated. The South Side Elevated Road, Chicago, found the same objection to the flange-bottom plate, as the Union Pacific, in regard to its instrumentality in causing local decay, and besides adopting a flat bottom plate, uses a screw spike to avoid the driven-spike evils. A chief engineer of a railroad, after a careful study of the tie plate question two or three years ago, said that any tie plate will penetrate the tie sooner or later; and, furthermore, that a plate cannot be prevented from moving on the tie when a train is passing and that its teeth or lugs or flanges thus widen the space they occupy, admitting foreign material and promoting decay. Both of these points are borne out in the experiences above cited.

Rail motor cars, which were attracting the closest attention in England last year, have turned the corner of their popularity in that country just as the first experimental uses are being made of them here. In October, 1904, the Swindon works of the Great Western Railway (England) were turning out upright-boiler steam motor cars as fast as it could be conveniently done. At the present time this construction has almost entirely ceased on the Great Western, and the economies of this type of car are being seriously questioned. The primary objection to all steam motor cars in England, constituting a very large proportion of the total number of rail motor cars in use, is that they require three men to work them and show no apparent economy over the light locomotive coupled to a single car with an arrangement by which driving can be done from either end, while the first cost of these steam cars—which is approximately $10,000—brings in no return that could not be had by the use of old and light stock remodeled for the service at small cost. Petrol cars in England are being investigated with great interest this year. The type in which the petrol engine drives a dynamo, thereby avoiding the difficulties of the starting strain, have been only partially successful, and have been rather expensive, the North Eastern cars of this type costing approximately $15,000 each. Straight petrol cars, to use the English term, are also being tried; as on the London, Brighton & South Coast between Eastbourne and St. Leonards, on the Channel coast. A month ago two cars were in use on this service; one a steam car similar in general design to the Great Western type; the other a straight gasolene or petrol car. The seating capacity of the two cars was about the same, but the seats were crowded into a considerably shorter car body in the petrol car. The latter had some difficulty in starting, and, as with an ordinary road automobile, the gears and the clutches occasionally made trouble in getting from the lower to the higher speeds. But after the car was well under way it ran on a level track with great smoothness at a speed of forty or fifty miles an hour, while the steam motor car, which had no difficulty in starting or stopping properly, was apparently not capable of exceeding about thirty miles an hour on the same

stretch of track. It is no exaggeration to say that the best English opinion at the present time holds that, taking into consideration interest on first cost and allowing for the wages of the third man, a small locomotive, retired from regular service, can be equipped with a single car to work a branch line cheaper than the line can be worked with a rail motor car. As Mr. Forney has pointed out in these columns in past years, it is a distinct advantage to have a car and engine capable of being separated when it is desirable to repair or renovate either one of them while keeping the other one in service. So far as we know, only two roads in this country have so far actually built rail motor cars for present day service, the Union Pacific and the Delaware & Hudson; and neither of these roads has as yet put its cars into what might be called regular, as distinct from experimental, use. The higher wages prevalent in this country make the use of a gasolene car, and the consequent reduction in crew from three men to two men, more important here than it is in England.

RAILROAD LEGISLATION LITERATURE.

"Surely every medicine is an innovation, and he that will not apply new remedies must expect new evils." *Lord Bacon, A. D.* 1625.

The rate regulation question is not one that lends itself to the production of election literature. It is too intricate a problem to interest deeply the ordinary citizen, and the leaders interested have so far failed to devise any abiding catch-words to be taken up by unquestioning voters. From circles where the problem is seriously examined from economic standpoints two most interesting contributions have recently appeared, one from an experienced railroad officer, Mr. Henry S. Haines, and another from a profound student, Professor Meyer.* It was perhaps not to be expected that any new light would be thrown upon the much debated subject by these two authorities. The question has long since been worn threadbare, even in its less obvious aspects, and neither of the two new books brings forward any constructive schemes for a solution of the problem. That the day is not far distant when academic theses must give way to concrete suggestions becomes more evident each week. The railroads have, so far, apparently failed to grasp that situation. It may appear to them better policy to wait until the government scheme has been formulated, and then, obeying the law, let the disastrous results prove to the communities which they serve that their interests are by so much identical with those of their railroad. This will be costly to both; but the problem has now passed the "Regulation or No-Regulation Stage." It is now a case of what shall be the minimum degree of additional regulation which the railroads need in order to serve the public best. As Mr. Haines lucidly puts it, "The several so-called railroad problems are reducible to one basic problem, viz., the efficient regulation of the management and operation of the national railroad system in matters affecting the public welfare." In another passage he states the matter still more clearly. "It is," he says, "no longer a question of the regulation of railroad rates, but of the regulation of the manner in which property rights are to be applied to a public service; and under our form of constitutional government this, it seems, can only be accomplished by the regulation of corporate powers in general."

Throughout his book, Mr. Haines maintains a strictly impartial attitude toward the two great forces at work in the controversy, the railroads and the people. He deals with matters in their true light, takes men as they are, and the railroads as he finds them. Judicially he examines the *pros* and *cons* of American methods of railroad finance, operation, rate-adjustment, etc., and while his opinions are more frequently suggested than specified, he shows a remarkable capacity to "see things clearly and to see them whole." To him a railroad is not merely a preserve for its stockholders, nor is it prey for the general public; it is a necessary adjunct to the social and commercial life of the commonwealth, and while it has its privileges, it has likewise its responsibilities, and its obligations to the State. Rate-regulation is not a question of dividends; it goes deeper than that. Will the public weal be advanced if the rate-making powers of the railroads are further restricted by the State? If so, then it is for the people to say what shall be the nature and extent of the restriction. It is useless to claim that the people have no right to answer that question. They have, even though they do not exercise it, and by giving an earnest of their desires to promote a satisfactory solution of the problem, one which does not do violence to their corporate rights, the railroads will not only be advancing their interests, they will be serving the State. "The path of social evolution is not in a circle," says Mr. Haines, "for the previous conditions can never be restored. It advances along a spiral course from one plane of environment to another. Selfishness tends to restrain it upon the lower plane."

Turning from Mr. Haines' book, which we cannot help describing as a masterly review of the economics of restrictive railroad legislation, to Professor Meyer's study of "Government Regulation of Railway Rates," we deeply regret that the learned professor should have approached his subject with such unmistakable evidences of partisanship and bias. We sincerely wish that Mr. Meyer, whose name carries authority and whose position commands respect, had seen fit to take into account the case of the advocates of drastic legislation before pronouncing judgment. We are certain he would not have modified his conclusions materially, for all the justice of the case which he examines is on his side, but he would have made his book less offensive to readers in the other camp, and he might thus have won some of them over to his views. Mr. Meyer's attitude in this respect is the more unfortunate in that his book is, in large measure, only indirectly concerned with the question at issue. It is primarily an exposition of the evils attending the State ownership of railroads. As such, it is without doubt the best book of its kind which has come to our notice. Mr. Meyer is an authority on the subject, and he makes a strong case against the principle of State ownership. He has closely studied every phase of the situation, both in Europe and in Australia, and there are few who will quarrel with his conclusions. When he turns to the subject of rate-regulation in the United States, however, we think he is unduly indifferent to the tenor of public opinion. As we have already said, the day is past when the academic aspects of the question may be profitably discussed. Matters have reached a stage where it behooves those concerned to make some definite attempt to grapple with a situation which is forcing itself upon them. Restrictive legislation by the people, however objectionable, may divert, but it cannot stem the tide of progress. And, as the author of "Restrictive Railway Legislation" points out, "Nothing definitive can be accomplished by hasty and impatient legislation. It will all come to naught in the clear, cold light of the Supreme Court." We notice that Professor Meyer makes use of every opportunity of attacking the Interstate Commerce Commission. That august body nas undeniably shown an incapacity to grasp a situation in all its bearings, and is, in its present form, incompetent to assume rate-making and rate-breaking duties. But does any one seriously propose to invest the Commission, as at present constituted, with these powers? "Political demoralization and industrial chaos" would ensue, declares Professor Meyer. Here is the railroads' opportunity; can they not suggest the form of a tribunal to which they would be glad to submit rate difficulties for solution? It is time that some definite effort, with some such end in view, was made. The people will soon be declaring their opinion with no uncertain voice.

*"Restrictive Railway Legislation" by Henry S. Haines. $1.25. "Government Regulation of Railway Rates," by Hugo Richard Meyer. $1.50. New York: The Macmillan Company. 1905.

THE FORAKER BILL.

An examination of the Foraker bill, which is printed in full in this week's paper, suggests that it is at once the best and the worst of the measures which have been introduced with a view to preventing discrimination between shippers. Its merit lies in the fact that it is aimed squarely at the real issue—the prevention of discrimination—and does not become involved in the hopeless muddle of the Esch-Townsend legislation to which the House of Representatives committed itself so readily last spring. The chief evil of the Foraker bill, as we see it, is in the fact that it relies for its sole weapon of effectiveness on the use of the injunction. A secondary defect, which is nevertheless of great importance, is that the author throws a most unmistakable sop to the ship subsidy vote by his absurd inclusion of special discriminations (in an anti-discrimination measure) to be given to American ships, after laying down a general scheme for import and export traffic that is intolerable in its conditions to all who ship in foreign bottoms.

There is one, and only one, basic principle, in rate making and rate charging, on which all leading men agree, and this is that the railroads must treat all customers alike, and without discrimination. The President and the great railroad officers believe that it is the duty of government to enforce this principle, and the tests to be applied to each one of the bills presented to Congress are: Does it in any way violate this principle? Is it a workable method of securing the result aimed at? Senator Foraker's bill is essentially vicious in that it aims to prevent discrimination in some things and legalizes discrimination in others. Non-discrimination means not only that one railroad must treat all of its customers alike, but,

more broadly, that railroads, as a whole, must not be allowed to discriminate against localities—the rates and classifications must be reasonable and defensible.

The portion of the bill which specially authorizes the Interstate Commerce Commission to investigate the transactions of common carriers under its own initiative is thoroughly good. After providing for this feature the bill at once concerns itself with discriminations, and provides that the Interstate Commerce Commission on its own motion may prosecute all such cases before any United States Circuit Court, sitting in equity, which has jurisdiction. The court is then required to inquire into facts and circumstances without the formal pleading and proceedings applicable to ordinary suits in equity; the expense of the prosecution to be borne not by the shipper, but either by the United States or by the railroad company, or companies, as the court shall order. So far, good; but there is a difficulty to be overcome, in that a court, being a judicial and not a legislative body cannot make a rate for the future. Senator Foraker placidly evades all controversy as to the legislative aspect of a new rate, the ability or inability of Congress to delegate its legislative powers with respect to rate making to a commission, and the other stumbling blocks in the path of rate making which have been suggested by many studious critics. He proposes, in effect, to make rates by injunction:

> And upon being satisfied of the truth of the allegations of said petition, said court shall enjoin according to the ground of complaint the publishing and charging of all or any such rate or rates so complained of in excess of what the court shall find to be reasonable and just. . . . or shall enforce an observance of the published tariffs if they are found to be just and reasonable.

That is to say, Senator Foraker would have the court say to the railroads, "I have no authority to establish 15 cents as the grain rate from Chicago to New York, but if you charge more than 15 cents I will enjoin you from putting your rate into effect." In using injunction law the Senator has hit a feature of our judicial system which has very uncertain limits, and we do not presume to say whether the Supreme Court, with its fondness for arriving at the facts in the case as distinguished from the manner in which these facts are presented, will uphold this obvious subterfuge for judicial rate making. The apparent thing is this: that injunction, long known as a resource of great value in times of crisis, is proposed to be made an agent for the transaction of everyday business—as a co-ordinate branch of the government by injunction of which we hear so much whenever a judge interferes with strike violence, we are offered rate making by injunction; provided the Supreme Court allows the lower courts to accomplish by indirection what they are constitutionally unable to do directly.

But even the obvious objections to a bill which rests its whole strength on injunction sink into smallness in comparison with the weak and pitiful demagogy of the paragraph providing for import and export trade carried in ships of American registry. Section 5 provides "that it shall be unlawful to transport foreign commerce that has been imported or that is designed for export at a less rate than is charged between the same points for the transportation of domestic interstate commerce of like character *unless carried in ships of American registry.*" The italics are our own. It is well known that there are many instances where foreign commerce, if it is to move at all, cannot move at the same rate which is charged domestic commerce for the same inland haul. This proposition is a red flag to an agitator who believes that all railroad rates are capable of adjustment on a cost-of-service-per-mile basis, yet it is indubitably true. To give but a single concrete illustration, borrowed from a foreign source, take the traffic in meat ("dead meat," as the English delight to call it) which comes over-sea and passes through Liverpool *en route* to London. If the London & North Western did not greatly reduce its rates on this specific traffic it would not move by way of Liverpool at all, but would go direct by sea to London. The English Railway & Canal Commission fully recognizes this, as we pointed out last week in an abstract of the work done by the Commission, and it permits a substantially lower rate to be made under these circumstances, with only the reservation that the proof that such difference in treatment does not constitute an undue preference, must rest on the railroad. But the Foraker bill flatly prohibits that the rate on over-sea traffic be lower for the rail haul than the domestic rate, unless the goods are carried in ships of American registry.

It is doubtless known that under our present laws restricting American registry to vessels built, or practically rebuilt, in American yards (except by special act of Congress under circumstances which need not be detailed), we cannot move sea freight as cheaply as foreign nations do, because of two governing conditions—the higher cost of American construction and higher wages. Taking the general run of the cargo-carrying steamers on the Atlantic it may be said, as a rough approximation, that the construction cost of American bottoms is one-third higher, and that the wage cost varies from one-half as much again to twice as much as the wages paid on the foreign ships. In view of Senator Foraker's bland discrimnation against the American shipper in favor of the American shipbuilder we are inclined to think that his bill, as an anti-discrimination measure, is handicapped by the scriptural injunction with regard to those persons entitled to throw the first stone.

The general use of compressed air in railroad boiler shops, which has been the principal factor in advancing boiler shop practice to a foremost place in railroad mechanical departments, is being extended at some shops to include the cleaning of crown bars and crown sheets with a sand blast. It is declared to be a big improvement over the old way with hammer and chisel. In a western shop where the sand blast is being used, it formerly took a 17½-cent man ten hours to clean a dozen bars—$1.75 for the lot. With the sand blast a bar is cleaned in from 20 to 30 minutes, or in about half the time of the old way, and the blast makes a cleaner job. This same shop uses the blast for crown-sheet cleaning with satisfactory results.

Rock Island Company.

The Rock Island Company controls, through the Chicago, Rock Island & Pacific *Railroad*—a dummy holding corporation—the two groups of railroads known as the Rock Island system and the Frisco system.

The Rock Island system, represented corporately by the Chicago, Rock Island & Pacific Railway, the Chicago, Rock Island & Gulf, the corresponding Texas corporation, and the Chicago, Rock Island & Mexico, covering that part of the line lying in New Mexico, has its nucleus in a line running from Chicago due west to the Mississippi river at Rock Island, Illinois, and Davenport, Iowa. This 182-mile double-track line connects all the rest of the more than 7,000 miles of road with Chicago. At Davenport the Omaha-Colorado line and the Kansas City-El Paso line divide; the one to reach Denver, Colorado Springs and Pueblo, the other bringing Rock Island ownership as far southwest as Santa Rosa, N. Mex., from which point there are close traffic arrangements with the El Paso & Northeastern over the remaining 272 miles into El Paso. These are the two main stems.

The Rock Island's St. Paul-Minneapolis line is comparatively new, track laying on it having been finished early in 1902 by the Burlington, Cedar Rapids & Northern, now absorbed into the system. Of even more recent construction is the St. Louis, Kansas City & Colorado, opened to traffic in August, 1904, which was built to connect the Rock Island system at Kansas City with the Frisco system at St. Louis. It was an expensive line to build, as very favorable grades and curvature were demanded and the best locations between the two cities were already appropriated by one or other of the four existing lines. The Rock Island system also includes a network of branches in eastern Iowa, eastern Kansas and Oklahoma Territory, and the Choctaw, Oklahoma & Gulf, now the Choctaw district, which runs west from the Mississippi river at Memphis to the Panhandle of Texas. During the past year the Arkansas Southern, an independent line 100 miles long running from Eldorado, near the southern boundary of Arkansas, to Winnfield, Louisiana, was acquired. There is a gap of 107 miles between Eldorado and the nearest point on the Rock Island's Hot Springs branch. A connection is now building to bring the Arkansas Southern into the system, and an extension of the Arkansas Southern to the southward is already built to within 30 miles of Alexandria, La. Alexandria is 194 miles from New Orleans.

The backbone of the Rock Island system is the old Chicago, Rock Island & Pacific Railway, which included the Chicago-Davenport line and numerous branches in Iowa, and was for many years one of the most prosperous of the Chicago granger lines. This was acquired about 1901 by a group of men who had made large fortunes in the promotion of certain industrial combinations formed about that time. Under their guidance the railroad was extended by purchases, construction, and the rental of trackage rights, from a mileage of about 3,910 miles in March, 1902, to 6,978 miles fifteen months later, this extension being accompanied by a more than corresponding expansion in capital account. The Rock Island system now includes something over 7,300 miles of line.

The Frisco system is primarily the St. Louis & San Francisco, which has its principal terminals at St. Louis and Kansas City, and operates 5,074 miles of line south of those cities. The Atchison, Topeka & Santa Fe, at the time it went into the 1893 receivership controlled the St. Louis & San Francisco, then operating about 1,000 miles of line. The road was acquired by the Rock Island interests in 1902. Like the Chicago, Rock Island & Pacific, a great expansion has come since that time. Most of the new lines are

territory as yet undeveloped. The Birmingham line on the other nd reaches into the prosperous iron and steel region of Alabama. various points in Arkansas, Indian Territory, Oklahoma Terri- y and Kansas the St. Louis & San Francisco connects with lines the Rock Island system.

As soon as the St. Louis & San Francisco was taken over by e Rock Island a Chicago connection for it became a necessity. cordingly the Chicago & Eastern Illinois with its controlled prop- ies, the Evansville & Terre Haute and Evansville & Indianapolis, s acquired. The Chicago & Eastern Illinois was a prosperous nois soft coal road with a Chicago terminal. By extensions and joint trackage arrangement with the Big Four two connections th the St. Louis & San Francisco have been made, one at St. uis, the other over the recently completed Thebes-Illmo bridge.

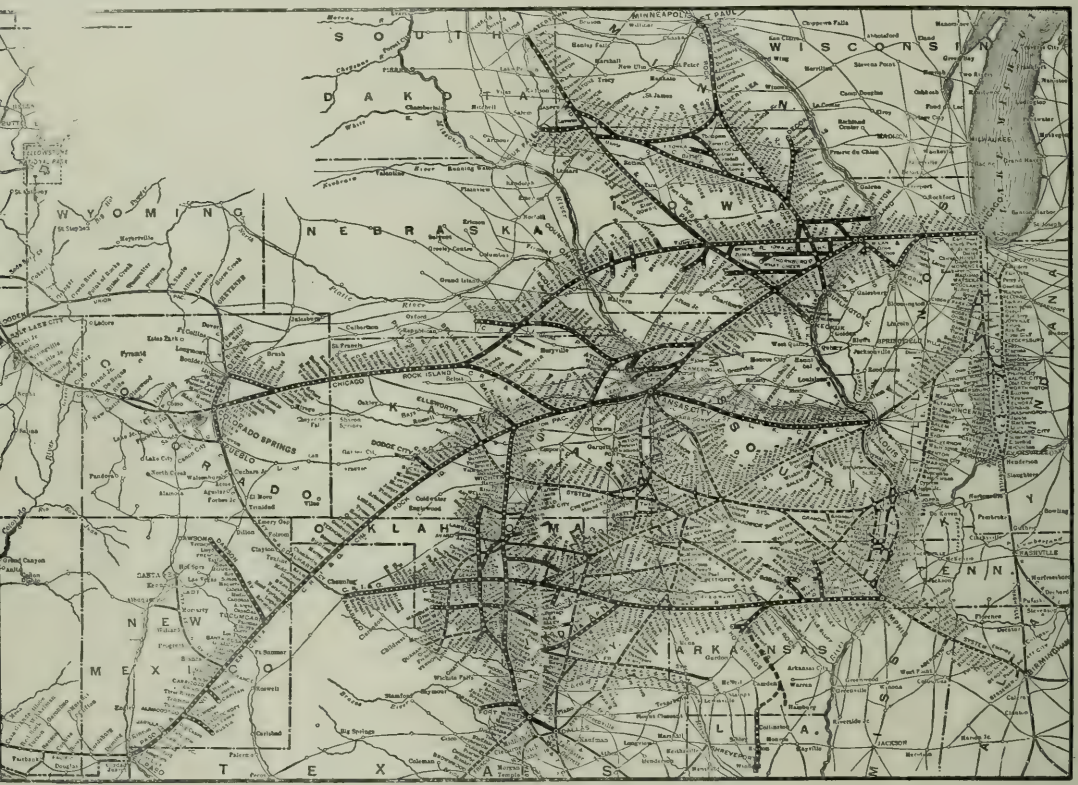
Including the Chicago & Eastern Illinois (948 miles), the Evans- le & Terre Haute (164 miles) and the Evansville & Indianapolis 46 miles) the Frisco system has a total of 6,332 miles of line.

The Rock Island system and the Frisco system are both con- lled, through ownership of a majority of the stock of each of ir controlling corporations by the Chicago, Rock Island & Pacific

The Rock Island system with an average operated mileage of 7,232 miles earned last year $44,051,509, a decrease of $917,982 from 1904. Operating expenses decreased nearly as much ($716,684) with the result that the $12,993,300 net earnings fell only $200,000 below those of the preceding year. All but $9,000 of this decrease was made up by other earnings, leaving net income at $14,519,472. There was, however, a 15 per cent. increase ($1,286,129) in taxes, interest and rentals, leaving only $4,733,109 available for dividends instead of $6,028,198 left for dividends in 1904. As on the dividends of the Chicago, Rock Island & Pacific Railway Company depends the Rock Island Company's income, the decrease of $1,295,089 in the dividend fund came near being a serious matter for the holding company. The Railway Company paid dividends amounting to 6¼ per cent. against 8 per cent. in the previous year. The decreased dividend rate, however, was still large enough to cover the Rock Island Company's preferred stock dividend.

Gross earnings per mile of road operated were $6,091, as against $6,241 in 1904. Net earnings decreased from $1,831 to $1,796 per mile.

The $44,051,509 gross earnings came $29,660,000 from freight,



Rock Island and Frisco Systems.

ilroad Company of Iowa, a corporation existing to fulfill cer- n legal requirements in connection with the holding of these ocks. This dummy holding company is itself controlled by the ock Island Company of New Jersey, whose stock it is that is gularly traded in on the New York stock exchange.

As will easily enough be seen from an attempt to keep in mind e inter-relation of these several parts, the complexity of Rock and organization is almost without precedent in railroad his- ry. The $54,000,000 preferred stock of the Rock Island Company New Jersey has power to elect a majority of the directors, and rough control of less than $28,000,000 of this, worth at present arket values only about $17,000,000, the two combined railroad stems, with a total mileage of over 13,600 miles and a total capi- lization of over $550,000,000, are held in safe control. No over- own industrial is a better example of holding company finance.

With so complicated an organization it is necessary to examine parate properties in detail in order to get any clear idea of their sults as operating railroads. Separate reports are issued for e Chicago, Rock Island & Pacific Railway, the St. Louis & San rancisco, the Chicago & Eastern Illinois, and the Rock Island ompany. The first of these covers the Rock Island system.

$12,000,000 from passenger, and a little over a million dollars each from mail and express earnings. Freight earnings decreased $1,504,620, or nearly 5 per cent.; passenger earnings increased $353,748. The principal decreases in freight earnings were from grain, flour, livestock, bituminous coal, lumber and merchandise. The light 1904 wheat crop in Kansas and Oklahoma especially hurt the tonnage of the road. There were at the same time increases in tonnage of cotton, fruit, vegetables, dressed meats, manufactured articles, stone and sand. An especial reason for the decreased earnings was the severity of the winter in the southwest. Gross earnings for the two months of January and February in fact show about two-thirds of the entire decrease for the year.

Maintenance of way decreased over $1,000,000, or 15 per cent. Most of this decrease was in the one item, repairs of roadway, which fell off $870,000, or 21 per cent. Maintenance of way cost $900 per mile against $1,052 in the preceding year. This and the same figure on the other roads is worked out on the basis of the average mileage operated, plus second track and minus trackage rights. The decrease in this expenditure to a point below what may be considered the normal for its territory and the fact that for two years there has been no new second track built, go to show

that there will have to be sooner or later much larger expenditures directly on the line.

Maintenance of equipment, on the other hand, increased $643,000, or 13 per cent. Repairs and renewals of locomotives increased 38 per cent.; of passenger cars, 31 per cent.; of freight cars, 17 per cent., and stationery and printing, 46 per cent. On the other hand, superintendence decreased 25 per cent., repairs of shop materials and tools 22 per cent., and other expenses 86 per cent., this from $499,000 to $71,000. Repairs and renewals work out at $2,730 per locomotive in service, $730 per passenger car, and $47 per freight car, against $2,036 per locomotive, $560 per passenger car and $43 per freight car in 1904. The 1905 charges, especially the locomotive figure, are high for a road most of whose mileage is in new territory and probably were the result both of under charges to this account in previous years and the unusual difficulty of keeping equipment in repair during the winter.

Conducting transportation cost $18,000,000, a decrease of $262,000 from 1904. With an increase of 1 per cent. in engine mileage the cost of fuel for locomotives decreased $233,000, or 5 per cent., the average price paid for coal being about 21 cents per ton less than the year before. Taken in connection with the large maintenance of equipment charge the increase of $295,000 in payments for hire of equipment shows that equipment was responsible for more than its share of operating expenses. There was also an increase of $171,750, or 150 per cent., in car mileage balance, and $86,800 was paid for switching charges, an entirely new charge. All these are definite expenses which should as soon as possible be decidedly reduced. Over $200,000 of the saving in operating expenses was made in the two items of advertising and outside agencies, both traffic department expenses. Conducting transportation was 41 per cent. of gross earnings and 58 per cent. of total expenses. These ratios are too high. There is a chance here for a large increase in net earnings through a reduction in the proportion of earnings spent in getting and moving the business.

Freight earnings were 67 per cent. and passenger, 27 per cent. of gross. There were 438,537 tons of revenue freight moved one mile per mile of road, a decrease of 12,634 ton miles. The number of passenger miles per mile of road was 76,453, an increase of 5,100 passenger miles. The average train load increased from 225 to 228 tons, or, including company freight, from 254 to 255 tons.

One large expense which handicaps the Rock Island is payments for rentals, which cost last year $1,080,277, or $149 per mile of road. This does not include rents for tracks, yards, terminals, buildings, and other property which appear under conducting transportation, and cost $244,308, an increase of 71 per cent. over 1904. Trackage cost $412,583. Here lies a particular weakness of the Rock Island, for of its 7,205 miles of road, 470 are not owned, but represent trackage rights. These cover some of the most important parts of the line and imply a corresponding weakness in terminal facilities. Were it not for the Union Pacific's 90 miles of track from Limon, Colo., to Denver, and the Denver & Rio Grande's 120 miles from Denver to Pueblo, Colorado Springs would be practically the only point of importance reached by the Rock Island system in Colorado. Similarly, 121 miles of the Chicago-El Paso line (the Hannibal & St. Joseph from Cameron Junction, 54 miles into Kansas City, and the Union Pacific from Kansas City to Topeka, 70 miles) are operated under trackage contracts. Of the Minneapolis-St. Paul line 56 miles are made up of trackage rights.

The St. Louis & San Francisco report includes results for the St. Louis & San Francisco and its underlying companies both separately and including the Chicago & Eastern Illinois. Figures for the two Evansville roads are not included in either classification. As the Chicago & Eastern Illinois is a very different sort of road from the rest of the Frisco system, it seems clearer to take up the two parts separately. Besides the difference in its territory and traffic, the Eastern Illinois is different from the Frisco in physical characteristics. For instance, 147 miles of its 948 miles of road is double tracked. The St. Louis & San Francisco is largely new road of light construction in new country in the southwest, and its 5,074 miles of line include only 40 miles of double track.

The Frisco system, exclusive of the Chicago & Eastern Illinois, with an average operated mileage of 5,030 miles, shows gross earnings of $29,958,240 in 1905 as against $26,896,731 in 1904, an increase of $3,061,508. An increase of 814 miles in the average operated mileage is responsible for a good part of this increase. The large amount of new line shows its effect in another way in the reduction of gross earnings per mile of road from $6,378 in 1904 to $5,955 in the year just passed. Gross earnings, in other words, increased only 11 per cent. against an increase of 19 per cent. in the operated mileage.

Operating expenses were $19,297,017, an increase of $1,540,765 over 1904. This left $10,661,223 for net earnings, an increase almost as large over the preceding year. Per mile, net earnings decreased from $2,168 in 1904 to $2,119 last year. This is the lowest figure since the reorganization of the company in 1896. An increase of $1,787,788 in fixed charges, largely due to the taking over of the Kansas City, Fort Scott & Memphis, more than used up the increase in net earnings and left only $1,024,128 available for dividends as against $1,342,172 in 1904. Four per cent. dividends were paid on each the first and second preferred stock, and out of the surplus of $184,386 (a decrease of $318,000 from 1904) no appropriations were made for betterments, although $78,500 was the year before appropriated for betterments and flood damages. No payments were made on the common stock and in consequence nothing was received directly by the Rock Island Company as return on its investment in a controlling interest in Frisco shares.

Freight earnings furnished $1,335,000, and passenger earnings $1,665,000 of the $3,000,000 increased earnings. Freight earnings increased 7 per cent. and passenger earnings, 28 per cent. The increase in freight earnings was on the whole fairly evenly distributed among the different commodities. There was an increase of 13 per cent. in the tonnage of products of agriculture, of 12 per cent. in manufactures, 30 per cent. in lumber, 13 per cent. in products of mines, and 16 per cent. in merchandise.

Maintenance of way increased $461,000, or 15 per cent. Most of this increase was in the three items, repairs of roadway, renewals of ties, and repairs and renewals of bridges and culverts. The largest decrease was one of 60 per cent. in renewals of rails. Maintenance of way figures out at $727 per mile against $758 per mile in 1904. Even with the large amount of new mileage this figure is low, though probably not as low proportionately to requirements as is the Rock Island's figure.

Maintenance of equipment increased $116,000, or 3 per cent. Repairs and renewals cost $2,333 per locomotive in service, $698 per passenger car and $50 per freight car, against $2,367 per locomotive, $1,021 per passenger car, and $59 per freight car in the preceding year. Like the Rock Island, the Frisco shows high maintenance of equipment charges, probably due to very much the same causes—the running down of old equipment which had been improperly maintained and the extra amount of repairs caused by cold weather.

Conducting transportation increased $853,518, or 8 per cent., and took 37 per cent. of the total earnings and 58 per cent. of the total expenses. The largest increase under this head was one of $249,714, or 63 per cent., in loss and damage. Other large increases were in superintendence, engine and roundhouse men, train service, switchmen, flagmen and watchmen and station service. The Frisco's problem is evidently much the same as that of the Rock Island—to cut down the proportion of conducting transportation expense. This outlay eats up in both cases a larger share of the earnings than either road can afford. One of the greatest improvements which can be made toward increasing stockholders' profits is in reducing this particular expense.

Freight earnings were 67 per cent. and passenger earnings 26 per cent. of gross earnings. There were 397,504 tons of revenue freight moved one mile per mile of road, a decrease of 58,521 ton miles from 1904. The passenger traffic density, on the other hand, increased from 60,349 to 66,849 passenger miles per mile of road. The revenue train load increased two tons over 1904, but is low, being just under 200 tons. Company freight brought the average loading up to 228 tons.

During the year there was an increase of over $21,000,000 in funded debt, which was accounted for, first, by the purchase of the Kansas City, Fort Scott & Memphis, second, by the funding of over $9,000,000 temporary loans outstanding, and, third, by the purchase of additional shares of Chicago & Eastern Illinois stock, against which $3,000,000 more preferred stock trust certificates were issued than in the previous year. In capital account the past year has been a critical one for the Frisco in the large amount of temporary indebtedness maturing and the necessity of raising large sums of money to be spent for new and as yet comparatively unproductive mileage. These conditions have been met successfully and the future seems much clearer.

It is from the St. Louis & San Francisco that some critics of the Rock Island Company believe that that company's largest future profits will come. If the southwest is to have a development anything like what has happened in the northwest these predictions surely have a good deal of truth, but on that very development the future of both systems must, more than on anything else, depend, both for solvency and for prosperity large enough to enable the lines to be put into first-class shape. Without the large expenditures for betterments which increased earnings will make possible the roads can never occupy the position in their territory which successful railroads of the northwest hold.

The Chicago & Eastern Illinois with an average operated mileage of 880 miles shows gross earnings of $8,423,378, a decrease of $240,665 from 1904. Operating expenses were $5,755,850, an increase of $314,417, leaving net earnings of $2,667,528 against $3,222,609 in 1904. Operating expenses were 68.3 per cent. of gross earnings. The net income after fixed charges and taxes was $780,466. Dividends amounting to $860,732 were declared, leaving a deficit for the year of $80,266. This is a great contrast with the show-

g in 1904 when after paying $126,500 more in dividends and appropriating $400,000 for new construction and permanent betterents, there was a credit balance of $358,000. Gross earnings per le of road were $9,572 against $11,521 per mile in 1904. Net rnings per mile of road were $3,031 in 1905 and $4,285 in 1904. eight earnings were $6,877,727, a decrease of $327,954 from 1904. ssenger earnings were $1,332,932, an increase of $108,900. The port includes no commodity statistics so that it is not possible trace changes in the sources of freight earnings.

Maintenance of way shows an increase of $50,000, which occrred largely in repairs of roadway and renewals of ties. There re considerable decreases in renewals of rails and repairs and newals of buildings and fixtures. Per mile, maintenance of way st $744 against $754 in 1904. These figures are unusually low a coal road.

Maintenance of equipment as a whole increased from $1,198,179 1904 to $1,231,288. The largest increases were in repairs and newals of locomotives and of passenger cars. Repairs and renewcost $2,431 per locomotive, $598 per passenger car and $32 per ight car against $2,234 per locomotive, $379 per passenger car d $42 per freight car in 1904. The freight car charge is low roads of this class.

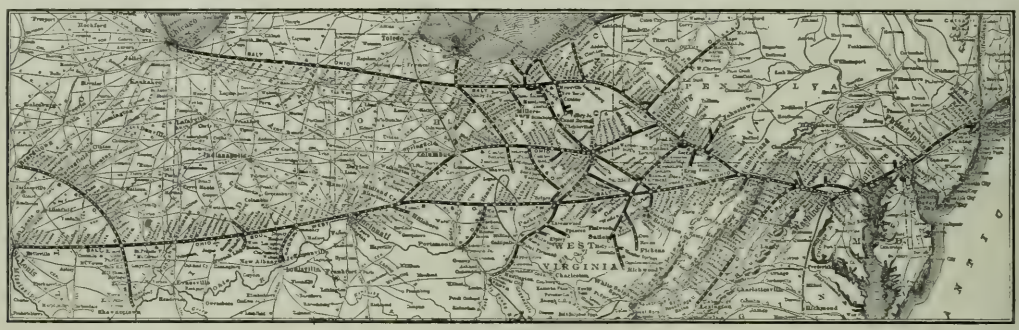
Conducting transportation cost $3,485,609 against $3,324,247 1904. There was an increase of 170 per cent. (from $94,000 to 5,000) in the account "Injuries to Persons," and of over 100 per t. in "Loss and Damage"; also a decrease from $171,690 to $892 switching charges balance, and a decrease of over 100 per cent. in e of equipment balance; otherwise there were no striking changes the separate items. Conducting transportation took 45 per cent. of oss earnings and 61 per cent. of operating expenses.

There were 1,691,328 tons of freight carried one mile per mile road against 2,046,188 in 1904. Passenger traffic density also creased from 91,806 passengers one mile per mile of road in similar possibilities. The only reason for thinking them less is because the Santa Fe started at a low level of prosperity with lessened capitalization, while the new Rock Island began its career in a time of great prosperity, which was discounted or more than discounted by very large increases in its capital accounts.

Baltimore & Ohio.

The long and interesting career of the Baltimore & Ohio Railroad was summarized in the *Railroad Gazette*, August 18, 1905, and we pointed out then that Mr. Murray's report this fall would be the seventy-ninth consecutive document of this character issued by the road; a record of continuous history which no other company in the country can equal. Mr. Murray, whose career as President of the company began in 1904, after many years of usefulness as an officer, took hold of the property after the reconstruction from the bad methods of earlier years had been completed, and he has been carrying it through a high tide of prosperity. Gross earnings from operation of the entire system for the year ending June 30, 1905, amounted to $67,689,997, an increase of $2,618,916 from the year previous. The increase in operating expenses was smaller than the increase in earnings, leaving net earnings of $22,979,394 as compared with $21,442,217 last year. After adding income derived from dividends and interest on securities owned and from miscellaneous sources, and after deducting interest, rentals, taxes and other charges, there remained a net income of $13,673,996, as against $12,357,360 last year. Beginning with Sept. 1, 1905, the dividends on the common stock were put on a 5 per cent. basis. The statements of income in this paragraph being for the entire system, of course include the Baltimore & Ohio Southwestern.

A year ago at this time, and also two years at this time, almost every report received from railroad companies, large and small, showed an alarming increase in operating expenses compared with



Baltimore & Ohio.

4 to 71,350 in the year just passed. The train load is unusually ivy—568 tons, or 599 tons, including company freight.

The Rock Island Company's report is, except for the income ount, profit and loss account, and the briefest of balance sheets, rely a repetition of various statistics of the Rock Island and sco systems. The income account shows that the total income the Rock Island Company—all but $28,877 from the C. R. I. & P. Co.'s dividends—was $5,510,000. Of this amount $3,683,892 was d as interest on C. R. I. & P. R. R. Co.'s bonds issued in exnge for Rock Island and Frisco stocks. This was an increase $132,000 over the corresponding fixed charge payment in 1904. e balance available for dividends was $2,011,254, of which four cent. on the Rock Island Company's preferred stock took $1,-,210 or all but $61,044. This sum was the Rock Island Comy's surplus for the year. Although the large increases in earns reported by the C. R. I. & P. Ry. since the close of the fiscal r, make it improbable that current rumors of the passing of the t Rock Island Company preferred dividend have much truth, h reports have at least some justification in this small surplus l in the far from first-class condition of most of the controlled roads as operating properties.

To-day Rock Island in railroad language, instead of standing the conservative and well-known granger railroad which operated many years successfully west from Chicago, has come to represent ery large and, it cannot be denied, a very over-grown collection all sorts of railroads. Thus far, the policy of extension has not duced wonderfully favorable results. Whether within the next years the Rock Island system and the Frisco system can be ught to a point where operation is increasingly profitable and nings and dividends are entirely secure, will depend on the wisn of the management and in particular on the continued develop-nt and prosperity of the southwest. The Santa Fe has been ught within ten years from an apparently hopeless tangle of krupt roads to its present strength. The group of railroads trolled by the Rock Island Company has great and perhaps the increase in gross earnings. The Baltimore & Ohio has fully corrected this tendency, as is shown by the report at hand, and it is especially encouraging to see a falling off in the cost of conducting transportation in the face of a larger traffic handled. The easiest place to economize in the expense account of a railroad that is shown in an annual report is in maintenance of way and structures; the hardest is in the cost of conducting transportation. Maintenance of way and structures this year increased from $6,839,882 to $7,852,636 on the Baltimore & Ohio, and maintenance of equipment increased from $10,530,211 to $10,937,106; while conducting transportation and general expenses each showed considerable decreases. Looking at these items more in detail, it is seen that the increase in maintenance of way and structures was due primarily to the charge for rails, and in maintenance of equipment to repairs to locomotives; while under the head of conducting transportation the principal economy over the preceding year was in locomotive fuel, and this item, plus the additional credit to the road for car service as compared with 1904, would alone account for the better showing of the department. As a matter of fact, out of the 41 items in the operation side of the conducting transportation charge, 23 showed decreases from the year previous, the most important decrease from 1904 being in the items, loss and damage, signalmen, and hire of equipment. A separate charge of eight items is also made against the traffic side of conducting transportation; these items include passenger superintendence, foreign agencies, advertising and stationery and printing for the passenger department, and the corresponding items for the freight department. In view of the fact that this classification has only been made in the company's reports since 1903, and that it contains three more items this year than ever before, it is interesting to place the eight as given in the order of their importance. Foreign agencies for freight cost the most ($443,449 out of a total of $1,535,185 under this head); freight superintendence cost a trifle less. Foreign passenger agencies come next in importance, with $260,867, and then, considerably below, come passenger advertising.

passenger superintendence, freight stationery and printing, passenger stationery and printing, and freight advertising. This last cost only $200, in the year under review.

The route mileage worked for the current year was 4,026, and the company shows a considerable increase in ton miles and in passenger miles. The distance traffic is moved is shown by the fact that the average haul was 189 miles. In 1901 this average reached 213 miles, and the present is the lowest since 1897. These figures exclude company freight, and the shorter average haul of recent years may perhaps be attributed to the large increase in the tonnage of bituminous coal carried. The bituminous coal traffic of the Baltimore & Ohio has been increasing very rapidly with additional purchases of coal territory. In 1900 the bituminous coal carried, including the Baltimore & Ohio Southwestern, amounted to 12,158,330 tons. This current year it amounted to 20,125,514 tons, and along with this increase in actual tonnage its proportions to the total traffic hauled increased during the same period from 39.81 to 42.56. The grain traffic of the road is not quite as strong proportionately as the coal traffic, with an aggregate tonnage much smaller; and decreased from 1,654,303 tons in 1900 to 1,107,789 tons in 1905, with but a single increase during the period, that for the year 1901. Next to bituminous coal the heaviest tonnage carried was coke, and this has been true for a number of years. Merchandise traffic has fallen off somewhat, both absolutely and relatively in recent years. Taken altogether, however, the traffic density in 1905 amounted to 2,218,955 ton miles per mile of road as against 2,096,559 ton miles per mile of road in 1904. The average ton mile rate decreased from .582 cent to .566 cent, a decrease presumably also accountable to the increase in coal traffic; but it is interesting to see that the average ton mile rate which the company has been able to obtain was higher this year than in any previous year since 1896, with the single exception of 1904. This rate fell as low as .390 cent in 1899, constituting the company's low record.

The increase in passenger earnings was $670,693, and the number of passengers carried 115,311. The large travel to the St. Louis Exposition contributed to this result, but apart from this the passenger traffic was encouraging. The average haul on account of the Exposition travel reached 45.46 miles, which is considerably higher than any previous record. In 1889 this average haul was only 30 miles. At the time of the World's Fair in Chicago it jumped from 36½ miles to 43.6 miles, and returned again to its former average immediately afterwards; but ever since 1902 the average passenger haul has been higher than 40 miles.

The capital account shows new issues during the year of $4,841,000 bonds, divided unequally between prior line 3½s, first mortgage 4s, Southwestern division 3½s, and P., L. E. & W. V. refunding mortgage bonds. The proceeds of these issues are applicable for improvements, betterments and extensions, as provided in the respective mortgages. In exchange for old securities and for 10-year gold convertible debentures, $13,712 of new stock was also issued, and $2,301,900 of P., L. E. & W. V. 4 per cent. refunding mortgage bonds. The total capital liabilities aggregate $429,864,998. or $106,772 per route mile. Last year they stood at $422,779,287, or $106,039 per route mile.

Principal statistics of operation follow:

	1905.	1904.
Average route mileage.*	4,026	3,987
Freight earnings	$50,607,087	$48,617,103
Passenger earnings	13,817,141	13,146,449
Gross earnings	67,689,997	65,071,081
Maint. way and structures	7,852,636	6,839,882
Maint. equipment	10,937,106	10,530,211
Conducting transportation	24,543,341	24,777,870
Total expenses	44,710,604	43,628,861
Net earnings from operation	22,979,394	21,442,217
Gross income	25,956,392	24,090,815
Net income	13,673,996	12,357,360

*This figure and the ones following exclude 456 miles of line controlled by or affiliated with the B. & O., but not worked directly. They include the B. & O. Southwestern.

TRADE CATALOGUES.

The Cole 4-Cylinder Balanced Compound Locomotive.—The Cole 4-cylinder balanced compound locomotive is described in a 36-page pamphlet, which is about to be issued by the American Locomotive Co., New York. The reasons for recommending this form of construction of locomotives to meet American conditions, are first outlined, and the locomotives of this type applied to the New York Central & Hudson River, the Erie and Pennsylvania Railroads, are illustrated from photographs, and the leading dimensions of each design given by means of tables. To illustrate the chief details of construction, the New York Central locomotive No. 3000, which was among the locomotives tested at the Louisiana Purchase Exposition, is selected for description. Line engravings show elevations and sections of the locomotive as a whole, the construction of the frames, cylinders, crank-axles and valves. A brief statement of the performance of this locomotive on the Pennsylvania Railroad testing plant at St. Louis is presented, followed by six different arrangements showing the application of 4-cylinder balanced compounding to different types of freight and passenger locomotives, each of the types being illustrated by an outlined diagram. The pamphlet also includes an arrangement of cylinders served by a single valve, the cylinders being in the same transverse plane. It concludes with comments from the technical press concerning this type of locomotive. In view of the important requirements which 4-cylinder locomotives are designed to meet, a study of this pamphlet is commended to those who have to do with the determination of designs of locomotives.

Rock Drills.—The Chicago Pneumatic Tool Co., Chicago, has extended the scope of its business by entering into the sale of rock drills for mining, tunneling and quarrying work generally, and to this end has effected an arrangement whereby it has acquired the selling rights to the McKiernan rock drills, which are made under its supervision at Dover, N. J. The company has just issued a catalogue in which the various sizes and designs of these drills are illustrated and described.

Motor Cars.—Illustrations and general dimensions of various types of Sheffield gasoline motor cars are given in a catalogue issued by Fairbanks, Morse & Co., New York. Several types of "section" motor cars are also shown and a brief talk on the relative advantages of "Motor Cars vs. Hand Cars" is given.

Electric Elevators.—Freight elevators, passenger elevators, and elevators of special design, operated by steam, electricity and hydraulic power are illustrated and described in a handsome catalogue just issued by the Otis Elevator Company, New York.

The Mallet Articulated Compound Locomotive.—A brief general description of this type of locomotive, including both line and half-tone illustrations is given in a neatly gotten up pamphlet published by the American Locomotive Company.

Hollow-Chisel Mortiser.—An improved machine for cutting mortises for framing and other purposes is illustrated and described in a neat folder issued by the S. A. Woods Machine Co., Boston, Mass.

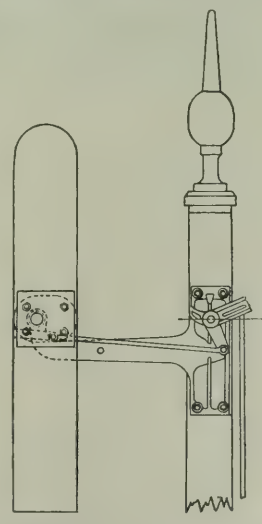
CONTRIBUTIONS

Different Kinds of Signals in England.

London, Nov. 21, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In connection with the recent discussions in your columns of the question of forms of signals and the arguments, pro and con, on the subject of standardization and on adapting the forms of signals more specifically to different uses, your American readers may be interested to know that the signaling art in Great Britain is not so completely settled as one might imagine from a superficial view. Many English readers have been interested in what has been told about America, and it may be of passing interest now to tell Americans something of the situation in England.



Balanced Signal Arm—Great Northern of England.

In the matter of outward form, except in one feature, the front lights of signals, there is no uniformity existing. Even in that particular there is a divergence, as some companies still use a blue light for danger in certain signals. It would therefore be more correct to say that the only standard is the adoption of the green light for clear.

It is true that there is a general adoption of the practice of placing signals on the left side of the running (left) road (track), but the custom is not so universal as is desirable, and it is often spoiled by locating signals outside side-tracks when space does not permit of their being placed immediately adjoining the line to which they apply. A bad practice also still prevails on some lines, where there are two lines in the same direction, of placing the signals for the two lines side by side. The objection to this ar-

ngement is that under English practice the signals might be istaken for the splitting signals for a junction and therefore pplicable to one line. Also the steam from a train in advance one road (track) may obscure the signal for the second train the other road. Some companies endeavor to remedy this by tting a distinguishing mark, such as a ring, on the arm for e slower line, but this is worthless at night and cannot be adopted nen both lines are of equal importance.

Under such conditions the signals should be carried on a bridge, t this expense may be avoided by the use of a specially con-ructed bracket signal whereby the mast for the inner line is rried over the parallel line. Another general practice on British es that ought to be standardized is that the signals at junctions ould be "stepped" (i.e., graduated in height) according to the portance of the lines they are leading to. To appreciate this int it must be remembered that in Great Britain the blades junction signals are not placed above each other, but each e to which access can be obtained has its signal on a separate ast. These should be graduated in height according to the im-rtance of the line they lead to. Each blade should be about 3 ft. low the one next higher.

As the reader has been reminded by the letter of Mr. Henry hnson, the signals for diverging routes are fixed according to different plan here, a separate mast being used for each arm. hile it is difficult for an Englishman, or any one else, to find ılt with the American practice of putting the blades one above other on the same post, the point should be noted that this actice is not likely ever to meet with favor in England so long distant signals at night are precisely the same as home signals; d and green lights being used on home signals and the same on e distants. With this practice a two-blade junction signal would ok at night precisely the same as a home and a distant signal the same post.

It must be said that England is behind America in the arrangement of signals for entering upon two or more low speed routes. u have already introduced extensively the practice of making e arm answer for any number of such routes, while here the ea that there should be a separate arm for each road or track ll finds much favor. As you have probably observed, the North stern and the London & South Western have put in use some Annett's indicating signals, which is nothing more nor less than revival of the indicator which was abandoned in the United States veral years ago. The same principle has been tried on certain ner English lines, but it is difficult to see the wisdom of it, unless are to go on experimenting forever.

You are, of course, familiar with the inconsistent use in Great itain of the same night indication on distant signals as on home gnals. The only rational defence of this practice is that it has t yet done any particular harm. Yellow glass has been tried t does not find favor, and now a reflected light giving a > ape by the side of the color indication is being extensively tried.

In the matter of the shape of blades of signals for switching ovements where disk or dwarf signals are not used, there is ich difference in Great Britain. Opinions also differ as to the terlocking of "calling-on" arms and the home or starting signals, low which these are placed. These arms merely act in place of rbal instructions from the towerman. Some British companies mpel this arm to be lowered before the stop blade can be pulled, t the only consistent arrangement is to treat them as conflict-g signals and have them regularly interlocked.

In connection with the recent proposition in your country to e the upward inclination of the blade for the all-clear indica-n, the fact should be noted that the problem which it is now empted to settle received attention on the Great Northern Railway about 20 years ago. The whole of the Great Northern lines now have signals like that shown in the foregoing illustration. This design was adopted (I think, in 1885) after a serious collision was caused by snow on the blades. Other English companies use this same signal and it is free to the world. I understand that it is looked upon as a successful solution of the snow and ice difficulty. The blade is centrally balanced and it can be used as a three-position signal.

On the question of the three-position signal *per se*, while no one denies the economies to be gained, how do you deal with the question of manually operated signals? And how would you arrange the blades at a junction where there are one or more diverging routes? Mr. Salmon, in his interesting letter, merely hints at this problem but gives us no solution of it.

While signal engineers are strongly attracted by the persuasive arguments of the three-position advocates there still remains the question, perhaps rather hard to decide, of the attitude of the drivers. I believe it is a fact that most locomotive enginemen pay but passing notice to signals at clear—that is, any signal which does not stop them absolutely. It is a signal in the "on" position that attracts the driver's attention. This being so, is it not likely that a driver may in running through a section fail to remember the condition of a signal he has passed in the "off" position?

X.

Heavy Consolidation Locomotives for the B. & O.

The Baltimore & Ohio is receiving the first of a lot of 210 consolidation (2-8-0) freight locomotives, 70 of which are being built at the Richmond works, and 140 at the Schenectady works of the American Locomotive Company. This order was placed last April in connection with an order for 25 passenger and five switching engines and 10,000 freight cars at an aggregate cost of about $14,000,000. This will give the road better and a larger amount of equipment than it has ever had.

Heavy Consolidation (2-8-0) Type Locomotive for the Baltimore & Ohio.

In order to produce a design of locomotive that might be expected to yield the best practical results in freight service on all divisions of the road, the following plan was tried: A sample locomotive was built in accordance with the original specifications, and delivered. The motive power department appointed three committees, one consisting of the superintendent of motive power, mechanical engineer, engineer of tests and the shop master mechanics; another, of the division master mechanics; and the third of the road foremen of engines, each of which brought with him a locomotive engineman and fireman from his division. Upon the arrival of the sample locomotive, certain parts were disconnected and the members of the committees given an opportunity to examine the details of design and construction. The locomotive was then connected up again and put under steam to give the committees opportunity to observe its operation, hauling capacity and steaming and riding qualities. The committees were instructed to submit reports after their investigations, giving any criticisms and recommendations and reasons for any changes that might be suggested. It is understood that these reports contained many valuable suggestions, which have been quite helpful in producing a design that it is thought will yield satisfactory general results.

The consolidation type decided on weighs about 208,000 lbs. in working order, has 60-in. driving wheels, 22 in. x 30 in. cylinders, 205 lbs. boiler pressure, radial stayed boiler and a tender capacity of 14 tons of coal and 7,000 gallons of water. The tractive power is about 40,000 lbs. Five of the present lot will be equipped with the Walschaert valve gear. Delivery is expected to be completed early in February, 1906.

Full Text of the Foraker Bill.

A bill to further regulate commerce with foreign nations and among the states, and to amend the laws on that subject now in force.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in addition to the powers heretofore conferred on the Interstate Commerce Commission it is hereby authorized to appoint from time to time such expert bookkeepers or accountants or other suitable persons as may be necessary, for the purpose of thoroughly examining, under its direction, the books, records, and transactions of common carriers engaged in interstate commerce with respect to all matters pertaining to the transportation of such commerce.

The persons so appointed shall be, and they hereby are, vested with full power to examine under oath any or all of the officers and agents of such carriers touching such interstate-commerce transportation, and they shall make a full detailed report of all such examinations to the said Interstate Commerce Commission in such form and at such times as it may prescribe; and all carriers so engaged in interstate commerce are hereby required to permit such examinations of their books, records, officers, and employees, and do all other things necessary and proper to facilitate such examinations.

Sec. 2. That section three of the Act approved February nineteenth, nineteen hundred and three, entitled "An Act to further regulate commerce with foreign nations and among the states," be, and the same is hereby, amended so as to read as follows:

"Sec. 3. That whenever the Interstate Commerce Commission shall have reasonable ground for belief that any common carrier is engaged in the carriage of passengers or freight traffic between given points at less than the published rates on file, or is, either singly or in co-operation with one or more other carriers, publishing and charging unjust or unreasonable rates therefor, or is committing any discriminations forbidden by law, whether as between shippers, places, commodities, or otherwise, and whether effected by means of rates, rebates, classifications, preferentials, private cars, refrigerator cars, switching or terminal charges, elevator charges, failure to supply shippers equally with cars, or in any other manner whatsoever, it shall be its duty, if such carrier or carriers will not, after due notice, desist from such violation of the law, to file with the Attorney-General a brief statement of its grounds for such belief and the evidence in support thereof, and thereupon, under his direction, and in the name of the United States, a petition shall be presented alleging such facts to the Circuit Court of the United States sitting in equity having jurisdiction; and when the act complained of is alleged to have been committed or as being committed in part in more than one judicial district or state, it may be dealt with, inquired of, tried, and determined in any one of such judicial districts or states, whereupon it shall be the duty of the court summarily to inquire into the facts and circumstances, upon such notice and in such manner as the court shall direct and without the formal pleadings and proceedings applicable to ordinary suits in equity, and to make such other persons or corporations parties thereto as the court may deem necessary; and upon being satisfied of the truth of the allegations of said petition said court shall enjoin according to the ground of complaint the publishing and charging of all of any such rate or rates so complained of, in excess of what the court shall find to be reasonable and just; such injunction to continue in force during such period as the same or substantially the same conditions may continue, as are established by the evidence in such case; or shall enforce an observance of the published tariffs if they are found to be just and reasonable; or direct and require a discontinuance of such discriminations, by such proper orders, writs, and process, as will, as nearly as may be, secure equality of right and treatment to all shippers, which said orders, writs, and process may be enforcable as well as against the parties interested in the traffic as against the carrier or carriers complained of; and all proceedings hereunder shall be subject to the right of appeal to the Supreme Court as now provided by the Act of February eleventh, nineteen hundred and three, to expedite the hearings of suits in equity; but such appeal shall not operate to stay or supersede the order of the court or the execution of any writ or process thereon, unless the Circuit or Supreme Court, on application therefor made for good cause, so order. It shall be the duty of the several district attorneys of the United States, whenever the Attorney-General shall direct, either of his own motion or upon the request of the Interstate Commerce Commission, to institute and prosecute such proceedings, and the proceedings provided for by this Act shall be prosecuted at the cost of the United States or the railroad company or companies as the court may adjudge equitable and just, and such proceedings shall not preclude the bringing of suit for the recovery of damages by any party injured, or any other action provided by said Act approved February fourth, eighteen hundred and eighty-seven, entitled "An Act to regulate commerce and the Acts amendatory thereof." And in proceedings under this Act and the Acts to regulate commerce the said courts shall have the power to compel the attendance of witnesses, both upon the part of the carrier and any shipper or shippers who may be interested, who shall be required to answer on all subjects relating directly or indirectly to the matter in controversy, and to compel the production of all books and papers, both of the carrier and the shipper or shippers, which relate directly or indirectly to such transaction; the claim that such testimony or evidence may tend to criminate the person giving such evidence shall not excuse such person from testifying or such corporation producing its books and papers, but no person shall be prosecuted or subjected to any penalty or forfeiture for or on account of any transaction, matter, or thing concerning which he may testify or produce evidence or information, documentary or otherwise in such proceeding: Provided, That the provisions of an Act entitled "An Act to expedite the hearing and determination of suits in equity pending or hereafter brought under the Act of July second, eighteen hundred and ninety, entitled 'An Act to protect trade and commerce against unlawful restraints and monopolies,' 'An Act to regulate commerce,' approved February fourth, eighteen hundred and eighty-seven, or any other Acts having a like purpose that may be hereafter enacted, approved February eleventh, nineteen hundred and three, shall apply to any case prosecuted under the direction of the Attorney-General in the name of the Interstate Commerce Commission."

Sec. 3. That no carrier engaged in interstate commerce shall, directly or indirectly, by any special rate, rebate, drawback, or other device, charge, demand, collect, or receive from any person a greater or less compensation for interstate transportation of passengers than it charges, demands, collects, or receives from any other person for a like service. And any carrier violating this provision shall be deemed guilty of unjust discrimination and shall for each offense pay to the United States a penalty of not less than one hundred nor more than two thousand dollars: Provided, That nothing herein shall prevent the free carriage of destitute or indigent persons, or the issuance of mileage or excursion passenger tickets, or prevent such carriers from giving free or reduced transportation to ministers of religion, or to the inmates of hospitals, eleemosynary and charitable institutions, or to prevent any such carrier from giving free transportation over its own lines to any of its officers, agents, employees, attorneys, stockholders, or directors, or to the families of its employees.

Sec. 4. That nothing in the Act to regulate commerce, approved February fourth, eighteen hundred and eighty-seven, or in the Act to protect trade and commerce against unlawful restraints and monopolies, approved July second, eighteen hundred and ninety, or in any Act amendatory of either of said Acts, shall hereafter apply to the establishment of rates or the changing or publication of the same with respect to foreign commerce if carried in ships of American registry; or shall prohibit any necessary or reasonable act, association, or agreement with respect to interstate transportation that is not in unreasonable restraint of trade or commerce with foreign nations or amonng the several states; or shall hereafter authorize forfeiture of property as punishment for any violation of such Acts.

Sec. 5. That it shall be unlawful to transport foreign commerce that has been imported, or that is designed for export, at a less rate than is charged between the same points for the transportation of domestic interstate commerce of like character unless carried in ships of American registry.

Sec. 6. That the Interstate Commerce Commission is hereby authorized and empowered to appoint such inspectors and adopt such other means as may be necessary to ascertain what foreign commerce is carried in ships of American registry and on that account entitled to the benefits of the provisions applicable thereto of sections four and five of this Act.

Sec. 7. That all laws and parts of laws inconsistent with the provisions of this Act are hereby repealed, and this Act shall take effect from and after its passage.

Mr. Wallace Before the Panama Board.

While the proceedings of the meeting of the Consulting Board of Engineers for the Panama Canal, held on Friday, November 3, when Mr. John F. Wallace, former Chief Engineer of the Isthmian Canal, appeared before the board, have not been published, it is understood that Mr. Wallace strongly recommended the construction of a sea-level canal on the general plan outlined in his official report of Feb. 1, 1905.

Mr. Wallace, in response to the invitation of the board, had previously submitted for its consideration a series of notes covering technical studies, the advantages and disadvantages of various suggested plans, including the sea-level multilock and intermediate lake projects, and a very complete analysis of the cost records as shown by the experimental and other work conducted on the Isthmus under his administration as Chief Engineer, from July 1, 1904, to June 30, 1905. He also suggested general plans and

methods of construction and presented estimates of unit costs and time required to complete the excavating and other classes of work. The facts and recommendations contained in these notes had already been read to the members of the board, and formed the basis of Mr. Wallace's examination Friday afternoon.

Mr. Wallace stated that he strongly advocated the sea-level project, as in the consideration of designs for transportation routes a straight and level line was the most desirable, and in his opinion, there were no obstacles to be overcome except such as could be measured by time and cost, and the estimates laid before the board by him developed the fact that such a project could be completed at a reasonable cost to the American people, the saving in the maintenance and operating expenses of the sea-level over any other plan being a large offset to the increased interest on the greater cost of construction.

As to time, Mr. Wallace considered as a very conservative estimate that in eight years from Jan. 1, 1906, the canal could be opened to navigation and completed in ten years—at most twelve. This conclusion was based on the length of time required to excavate the divide, or what is known as the Culebra cut, or central section of the canal, where there is concentrated within a stretch of from five to eight miles 100,000,000 cu. yds. of material of approximately one-half the total amount of excavation necessary for a sea-level canal, which will have to be removed—it being safe to assume that all other excavating and auxiliary work can easily be completed in a much shorter period than that required for the central excavation.

The method of excavation suggested by Mr. Wallace for the Culebra cut consists of the installation of modern American steam shovels at the rate of 24 each year (there being 10 already employed on the work) until at least 82 shovels are installed and constantly at work on this central five mile section. While the theoretical capacity of the steam shovel is in the neighborhood of 4,000 cu. yds. per day, in his calculation as to time, Mr. Wallace, from his experience on the Isthmus and his knowledge of conditions both in this country and there, estimates the average daily capacity of each steam shovel, with proper train service to haul away the spoils, at 800 cu. yds., which would admit of the excavation of practically 111,000,000 cu. yds. of material within the above mentioned period of eight years, with an average of only 21 working days to the month, and without taking into consideration the practicability of night or extra shifts.

To properly install these steam shovels, Mr. Wallace recommends the terrace plan of excavation, with horizontal spacing of 25 ft. and a perpendicular face of about 28 ft., by cutting down with a series of terraces and sinking the central portion of the excavation to the maximum depth as soon as possible. This method permits of obtaining the ultimate grade for a sea-level canal with a great deal less excavation than the entire canal section would call for—approximately 25 to 35 per cent. less, according to the desired bottom width of the temporary section—leaving the widening to be done after the canal is opened for traffic. Mr. Wallace, in this connection, called particular attention to the necessity for proper track facilities and dumping grounds, as the capacity of the steam shovel was practically dependent upon the rapidity with which it was supplied with empty cars and the loaded ones removed. His plans provided for four distinct main track railroad systems leading from the cut, two at each end of the central excavation and one on each side of the canal axis, to consist of at least two main running tracks with the Panama Railroad as a base; with a greater amount of the excavated material going to spoil banks on the flats between Miraflores and La Boca on the Pacific side, and a portion to the Gamboa dam site for construction purposes and other dumping grounds between the canal axis and the foot hills. He estimated that each steam shovel would require about three miles of track, making approximately 250 miles of track for the Culebra section alone.

Mr. Wallace also recommended building the Gamboa dam in connection with a sea-level or any plan adopted with a summit level of not to exceed 60 ft. He strongly advised against building any dam on alluvial formations or where it could not be founded on bedrock or an impervious curtain wall constructed thereto. He was likewise opposed to building any high dam, the destruction of which would prevent the operation of the canal until it was replaced.

As to costs, Mr. Wallace, both in his notes and in the hearing before the board, carefully analyzed the various items of mining, excavating, and loading, maintenance of tracks, transportation, dumps, general expense, and arbitraries to cover plant, which go to make up the unit cost of excavation. He gave to the board the result of his experimental work with the old French machinery, rails, engines and car equipment, which were unsuited to economical and efficient prosecution of the work, the only modern part of the plant being the few American steam shovels installed after November, 1904. The figures submitted showed a maximum output for the month of March (part of the dry season), 1905, of 133,000 cu. yds. at a minimum cost of 43 cents per yard. On the data obtained from this experimental work, conducted with inexperienced labor and with old appliances and equipment, and in the light of his experience on similar work in the United States with modern plants, Mr. Wallace reached the conclusion that the unit cost of the Culebra excavation, with the use of modern machinery and equipment, and proper methods and supervision, should not exceed 50 cents per cubic yard; or with 20 per cent. added for contingencies, making a total conservative estimate of 60 cents per cubic yard of material excavated.

Mr. Wallace took occasion to invite especial attention to the fact that his estimates both as to time and cost were predicated on the assumption that the work would be conducted in an efficient, vigorous and up-to-date manner, and that existing governmental methods, which are responsible for innumerable delays and difficulties would be so modified as to permit of the prosecution of the work with the same expediency, economy and competent personnel, required and found in all great undertakings not under governmental control.

Mr. Wallace also gave careful consideration to and placed at the disposal of the board his information and views concerning the treatment of other portions of the work, including the harbors at Colon and Panama, the construction of dams and locks and the sea-level portions of the canal. He expressed the hope that if the board failed to recommend the adoption of the sea-level project, no plan should be considered by it that would interfere with the ultimate accomplishment of this desirable object.

It seems that the information heretofore obtained from the engineers who had either been connected with the work but a short time or were familiar with only some detail of it, was not sufficient to enable the board to arrive at correct conclusions, but the data on record, reviewed and explained by Mr. Wallace, who had been closely connected with all parts of the work and had planned and carried out the various investigations on the Isthmus, will no doubt prove of invaluable assistance to the members of the Consulting Board in determining the facts and in formulating their recommendations for the canal project as a whole. It is the consensus of opinion that the presentation of the case by Mr. Wallace made a very deep impression on the individual members of the board, and as it is understood that he declined to appear before the board until assured that it was agreeable to Secretary Taft, it is interesting to note that at the conclusion of the hearing not only was the motion made to thank Mr. Wallace for the papers he had submitted and for the able way in which he had informed the board of his views on the subject, but the foreign members went so far as to say that the members of the board who were strangers in this country were especially indebted to Mr. Wallace for the trouble he had taken for the free, frank manner in which he had laid his acquaintance of the situation before them. This sentiment was warmly subscribed to by all the members present, and the vote of thanks was pronounced the unanimous action of the board and made a part of its proceedings. Mr. Wallace then expressed his appreciation of the kindness with which he had been treated.

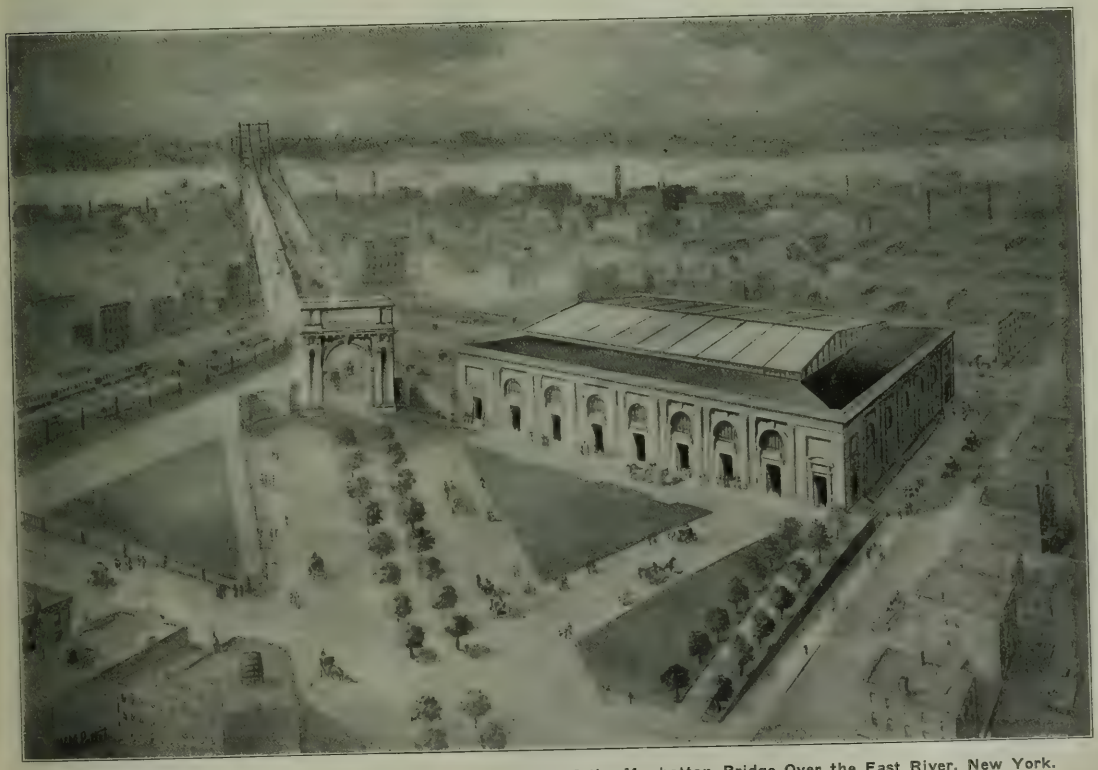
As an incident of the invitation to Mr. Wallace to appear before the board, it may be mentioned that he declined to accept any compensation for his professional services, being perfectly willing to give the administration the benefit of his experience and knowledge without remuneration. It is thought by those in a position to know that the Secretary of War and Administration are more kindly disposed toward Mr. Wallace, and while there is an impression that if he had been less abrupt in his presentation of his matter to the Secretary last June the misunderstanding which occurred at that time might have been avoided, the indications now are that the incident will be closed with a more friendly feeling existing between the parties concerned.

Terminals of the Manhattan Bridge.

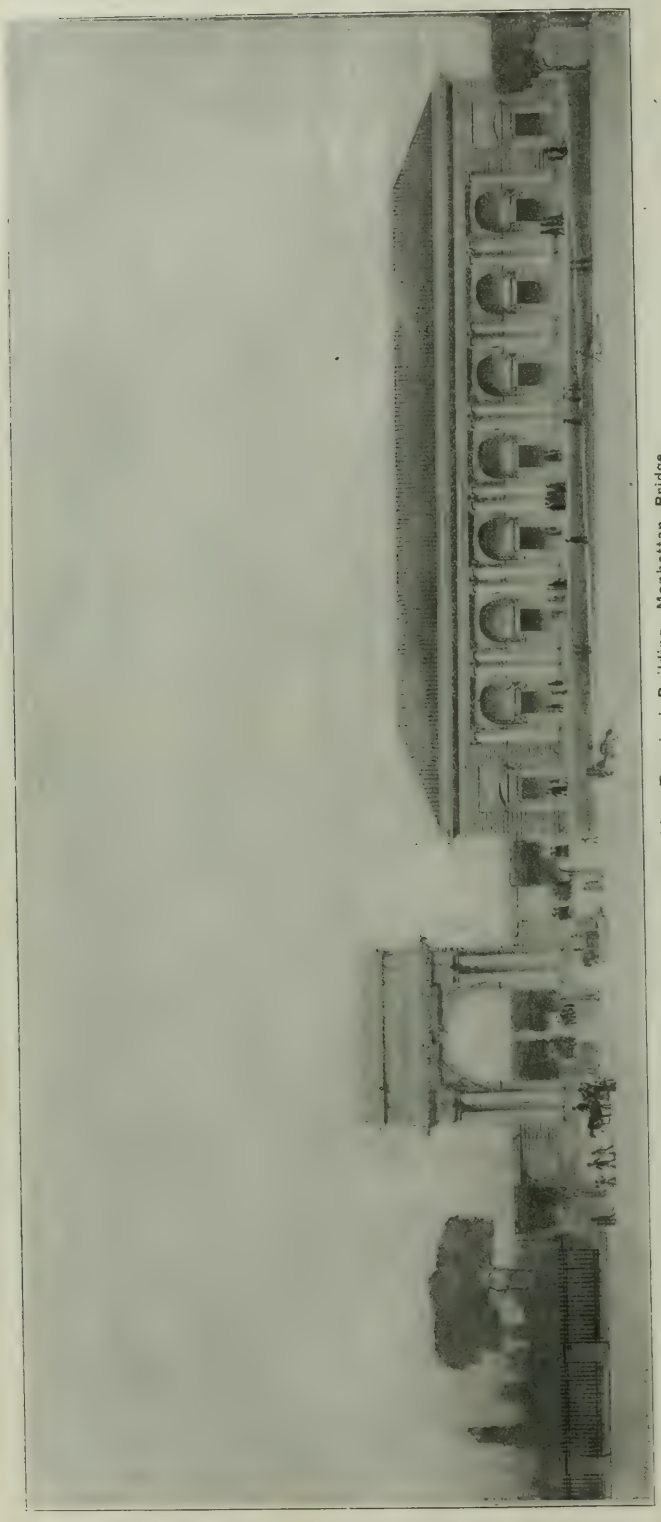
The earliest designs for a bridge across the East river at the site of the Manhattan bridge provided for a central and unobstructed roadway in the middle of the bridge and in continuation of an extension of Flatbush avenue, and this has been persistently adhered to in all subsequent plans for the bridge. The width of the bridge was made 120 ft., including a central roadway 35 ft. wide, two spaces, one on each side of this roadway, for railroad tracks, these tracks to be placed in two stories, one above the other, and two sidewalks for pedestrians, one on each side of the bridge.

It was originally intended to use the two tracks on the lower or roadway floor for trolley cars alone, and the two tracks on the upper floor for elevated trains alone. It has since developed that the elevated tracks may not be extended beyond the terminals in Manhattan, and a subway route has been laid out by the Rapid Transit Railroad Commission through the Flatbush avenue extension, over the Manhattan bridge and through Canal street in Manhattan. The subway tracks can only be carried on the bridge with a grade of 5 per cent. at the terminals, and these tracks on the

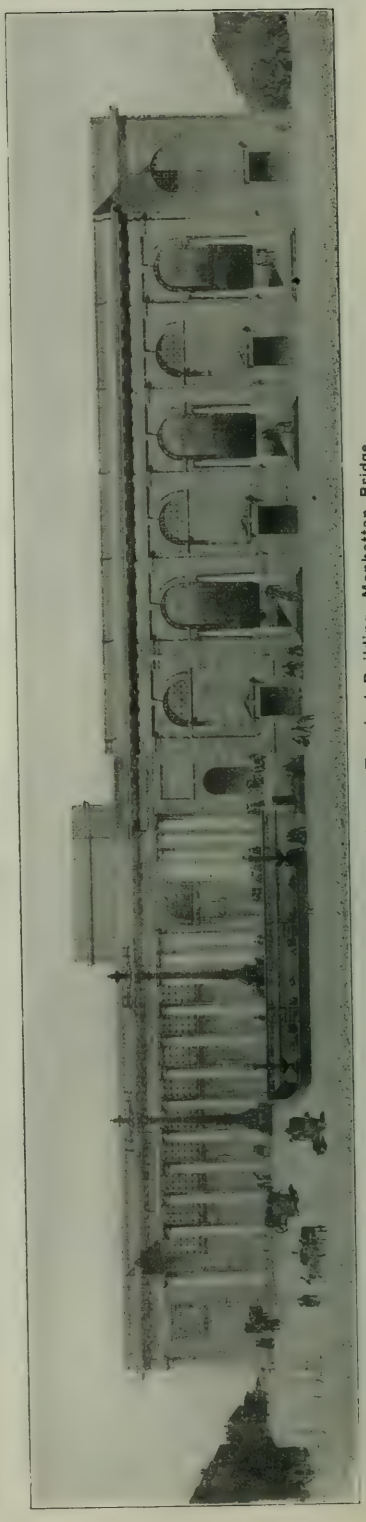
Perspective of Proposed Manhattan Terminal and Approaches of the Manhattan Bridge Over the East River, New York.



Perspective of Proposed Brooklyn Terminal and Approaches of the Manhattan Bridge Over the East River, New York.



Elevation of Proposed Brooklyn Terminal Building, Manhattan Bridge.



Elevation of Proposed Manhattan Terminal Building, Manhattan Bridge.

bridge must occupy a portion of the lower floor on the bridge since the grades to reach the upper floor would be prohibitory. The space on the bridge has therefore been divided as follows:

1. A central roadway 35 ft. wide.
2. Two footwalks, each 12 ft. wide, on the north and south sides of the bridge.
3. A double track subway line on the north tracks of the main floor for the Manhattan bridge route of the Rapid Transit Commission.
4. A double track trolley line on the south tracks of the main floor for Brooklyn trolley cars running to the Manhattan terminal.
5. A double track trolley line on the north tracks of the upper floor for Manhattan trolley cars running to the Brooklyn terminal.
6. A double track elevated railroad line on the south tracks of the upper floor for Brooklyn elevated railroad trains running to the Manhattan terminal.

The plans have been worked out as to lines and grades so as to furnish:

(a) A central unobstructed roadway across the bridge.

(b) Connections as above outlined for subways, surface and elevated railways.

(c) Provision for the pedestrians crossing on the outside footwalks, which footwalks will terminate generally on the lateral streets and keep the pedestrians entirely away from the car and vehicular traffic.

The general idea of both the terminals is the same; to furnish masonry walls enclosing the terminals, bounded in Manhattan by the Bowery, Bayard street, Forsyth street and Canal street, and in Brooklyn by Nassau street, Bridge street, Sands street and Jay street.

The terminal building on the Manhattan side, which is on Bayard street and the end on the Bowery, will furnish on the ground floor an assembly room for persons about to take trains over the bridge, on the second floor 10 terminal loops for Brooklyn trolley cars, and on the third floor at least four tracks and five platforms for the elevated trains from Brooklyn.

The terminal building on the Brooklyn side, with its end on Bridge street and its side on Sands street, will furnish five terminal loops for trolley cars from Manhattan.

The Brooklyn trolley lines may approach the bridge either through the Flatbush avenue extension or through Jay street, and pass along Jay street to the bridge. The elevated trains from Brooklyn will pass through Jay street or private property to the bridge terminal and pass on an upper level over the trolley tracks along Jay street to the bridge.

The entire terminals have been worked out with a view to appropriate architectural treatment, and will, it is believed, present in their open spaces and the architectural treatment of the buildings thereon ornamental as well as convenient terminals to the bridge.

Transportation of Explosives on the Pennsylvania.

The Superintendent of Freight Transportation of the Pennsylvania Railroad has issued new regulations for the transportation of explosives, the notice being numbered 174C and dated November 1. The new rules conform quite closely to those recently approved by the American Railway Association and they differ considerably in form from those issued by the road three months ago, and noticed in the *Railroad Gazette* of July 14, page 43. In substance, however, the new rules are very much like the old, as the code reported by the A. R. A. committee was based on the same general plan and theory and on the same statement of facts. The principal features in which the railroad company's new rules differ from its old ones are as follows:

Shipments made by the United States Government will be accepted on a suitable certificate of an army or navy officer.

No limit is prescribed as to the quantity of explosives affected by the rules, or as to the day of the week on which shipments will be accepted.

The rule specifying the kind of cars says that steel underframe box cars of at least 30 tons capacity are "recommended." This is the language of the A. R. A. rules; in a railroad circular it seems to indicate that the decision as to whether or not a car is large enough or strong enough is to be made, not by a general officer but by the station agent. Full copies are given of the forms for the manufacturer's certificate as to method of packing, the shipper's certificate that the explosives are in the original packages, the United States Government certificate, and the certificate of the inspection of the car. The last is to be signed both by the agent or car inspector and by the shipper. Conductors must indicate on their reports to the car record office the position in their train of cars carrying explosives. The agent must deliver a special form to the conductor with the card waybill of each such car and every conductor, yardmaster, or agent, handling such a car must receipt for it on the proper form.

The limit of one car to a train is abrogated; there may be three cars, with five other cars between each two containing explosives. The requirement that two-thirds of the cars in the train shall be air-braked is omitted, as also the rule limiting the length of the train to 30 cars.

New C. P. R. Steamers.

On Nov. 1, the "Empress of Britain" was launched from the Fairfield yards, Glasgow, and will be followed in January by a sister ship, the "Empress of Ireland." These two vessels are to be used by the Canadian Pacific for a fast passenger and mail service from Liverpool to Quebec and Montreal, in the summer months, and to Halifax and St. John in the winter. They have a gross tonnage of 14,500 tons, are 570 ft. over all and 65 ft. beam, and are designed for a speed of 20 knots. The accompanying cut, from the designer's sketch, shows the general appearance of the boats. In 1903, the C. P. R. bought a fleet of 14 steamers from the Elder-Dempster Company, and has been maintaining a regular service from England to Canada, but this fleet is inferior in speed and passenger accommodations to the best steamers of the Allan Line, in the same service. The newest Allan boats, the "Victorian" and "Virginian," are three-screw turbines of 12,500 tons and 18 knot speed. The two Empress boats will therefore be 2,000 tons heavier and two knots faster than the Allan steamers, although they will be driven by reciprocating engines. They are scheduled to make the run from Liverpool to Montreal in six days. The cost of the C. P. R. boats will be approximately $2,000,000 each, and they will have accommodations for 300 first class, 350 second class and 1,000 steerage passengers. They will complete the link of first class carriers to the far East under the C. P. R. flag, since the company has despatched the Empress of China, Empress of Japan and Empress of India from Vancouver to China and Japan for about 20 years, but has heretofore not been represented on the Atlantic by fast vessels. The beauties of the St. Lawrence route to Europe have been little known by Americans, because, until the Allan Line built the "Bavarian" and the "Tunisian," several years ago, there were no really good steamers in the service. The land-to-land distance, Straits of Belle Isle to County Donegal, is less than 1,700 miles, so that the new boats will be out of

New C. P. R. Steamer, Empress of Britain.

sight of land for only four days, in making the passage. It is reasonable to expect that they will attract a large and profitable passenger business, besides the grain and other freight that already moves by this route. Who the Empresses of Britain and Ireland are, in real life, the company does not state.

Early Experiments with Smoke-Consuming Fire-Boxes on American Locomotives.

BY C. H. CARUTHERS.

Until the latter part of 1859, wood was the only fuel used on American passenger locomotives, and on a large number of those used in freight traffic, except on a few lines where anthracite coal was easily obtained.

Bituminous coal was used in a goodly number of the freight engines, but no effort appears to have been made previous to the year named, to handle it either in an economical or a cleanly manner. All that was required of a fireman was the physical qualifications necessary to shovel in the coal and "keep her hot"! Hence these engines using bituminous coal usually rolled along with a dense cloud of smoke and cinders pouring from the huge balloon stacks and spreading out over the fields and forests. If occasional breakdowns occurred to the wood-burners and necessitated the use of one of these lampblack factories to take a passenger train to the end of its run, this same black cloud of smoke and cinders bestowed its atoms liberally through the doors and windows upon the passengers and the crew and produced much coughing and sneezing as the grumbling occupants wiped the grimy streaks from off their faces and made "remarks" about the coal-burner. If an idea of using such fuel regularly in a passenger engine had ever presented itself to a railroad official, these occasional experiences no doubt retired it very promptly, for just at that time the spirit which was in George Stephenson to "mak' it wark," did not seem to possess American railroad men to a very great extent. Wood, however, was becoming scarcer and costlier, and the many advantages of bituminous coal as a fuel were becoming apparent, even under the careless manner in which it was used; so that some of the more progressive men who did their work upon the idea given in Tennyson's verse:

"I hold it truth with him who sings
To one clear harp in divers tones,
That men may rise on stepping-stones
Of their dead selves to higher things:"

began to see not only a possibility of lessening the density of these objectionable clouds of smoke and cinders, but of making them an efficient factor in the economical production of steam. These convictions were probably further strengthened when this inky mass at times ignited at the top of the stack and streamed aloft in a plumé of lurid flame.

The earliest attempts to properly consume the smoke and gases of bituminous coal in locomotive fireboxes which came under the writer's notice, were made by the Pennsylvania Railroad Company in 1857 with two freight engines. One of these was a 4-6-0 with Phleger's patent boiler, built by R. Norris & Son in that year, and run by the company on a trial of 30 days and then returned to the builders. The other was a Baldwin freight engine, 4-6-0, which had just been rebuilt at the Altoona shops.

The Phleger boiler of the Norris engine, as will be observed by reference to the drawing, had the entire barrel filled with flues, and surmounted by a semi-circular casing containing the drypipe and forming an additional steam space. The drypipe entered the wagontop at the union of the latter and the casing named, and passed thence in the usual manner to the dome. At the front end, it left the casing and was divided into two parts, which were wrapped with an non-conducting substance and carried around the outside of the boiler to the steam chests. The firebox was long and shallow, and the crownsheet was dropped near the front end to form a deflector by means of which the smoke and gases were kept longer in contact with the flame; and a peculiar form of

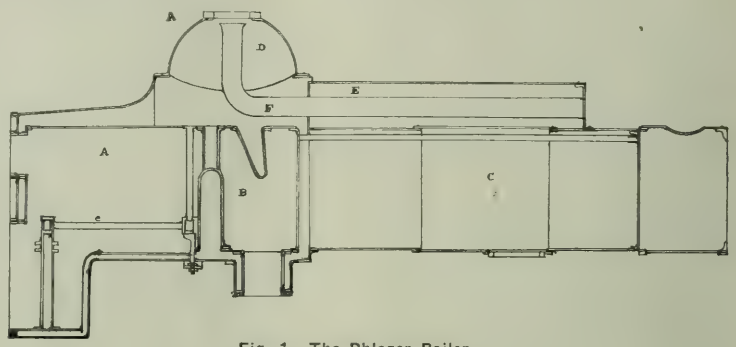


Fig. 1—The Phleger Boiler.
As built by Richard Norris & Son.

water grate and bridge-wall was used which, with the deflector, formed the front part of the firebox into a combustion chamber. The rear of the firebox was closed by two fire-doors which were supposed to be used alternately in firing. This boiler was 24 ft. long over all, and reveals the germs of features which have developed in a type of boiler quite popular at the present time, such as the use of a large number of tubes, ample steam space at the dome, sloping firebox casing, and shallow fire-space with its accompanying advantage of enabling the entire firebox to be placed above the frames. The smokestack was straight and without spark arresters. The drawing accompanying this article was not made from the engine used on the P. R. R. but from a somewhat smaller one which contained the same arrangement of parts, except that a straight dome 30 in. in diameter was used on the Pennsylvania engine. This engine was purchased by the company soon after the trial mentioned, and was numbered 210, by which it will be designated in the remainder of this article.

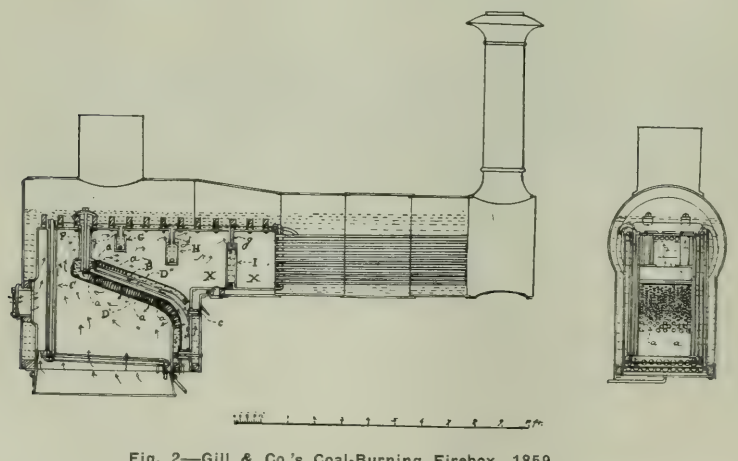


Fig. 2—Gill & Co.'s Coal-Burning Firebox, 1859.

The other engine was No. 120, and had a long firebox with a shallow fire-space, sloping crown and roof sheets, and had the rear of the furnace closed by four doors somewhat after the manner of the original Ross Winans "Camel" engine. An arch of fire-brick similar to that now used on locomotives was placed in the firebox, and no combustion chamber was used. The stack of this engine was also straight and without spark arresters.

In the annual report of the company for the year 1857, the Master Mechanic states that experiments with this engine show a saving in fuel of fully 30 per cent. below other engines of the class, and that the combustion is almost perfect and the annoyance from sparks and smoke almost obliterated. No especial mention is made of the results from the Phleger engine. In the report for the following year, however, he mentions that in addition to these two engines two more have been prepared for the better consumption of fuel and smoke—one, No. 190, having the Dimpfel boiler, and the other, No. 206, having Gill & Co.'s patent firebox, and that these engines would all be put in order to undergo a thorough trial at an early date.

This trial began soon after and was conducted by W. J. Palmer, Esq., of the mechanical department of the company. The Master of Machinery, in his report for 1859, referring to these experiments, states that the results have been very satisfactory, and adds: "We are now satisfied that our rich bituminous coal can be used for all passenger and freight trains with great economy, and the smoke and gases heretofore so objectionable can be consumed in so complete a manner as to render the working in every respect more satisfactory than we have ever obtained from the use of wood."

In addition to the engines already named, there had been added to the number set apart for these experiments, No. 166, a Lancaster Locomotive Works 4-4-0 passenger engine rebuilt at Altoona with Gill & Company's firebox; No. 156, a new Baldwin 4-4-0 passenger engine with Smith's patent boiler; No. 136, a Baldwin 4-4-0 freight engine; and No. 51, a 0-8-0 Ross Winans' "Camel." This latter engine possessed no distinctive features for smoke-consuming aside from a long, deep firebox, and its use in the tests was probably more for purposes of comparison, although the results obtained from it were fair. It retained the odd Winans' stack with the surmounting square cinder box from which was suspended a long, cylindrical receptacle of the same diameter as the vertical part of the stack. The report referred to adds, "I am so well satisfied that the true secret of consuming smoke has been discovered and rendered practicable by the different inventors, that I have no hesitation in recommending the alteration of all wood-burning engines as fast as circumstances will permit," and in the same report reference is made to the performance of passenger engine No. 166 as follows: "Passenger engine No. 166 has been furnished with Gill & Co.'s improvement, and upon a recent trip over the western (now called the Pittsburg) division with the express passenger train (note the word 'the'!), she was found to work clean, and caused less annoyance to passengers by sparks and smoke than is done by the regular wood-burning engines. Consumption of coal for the round trip was 6,736 lbs., or say 28$^{7}/_{10}$ lbs. to the mile run over the heaviest portion of our line."

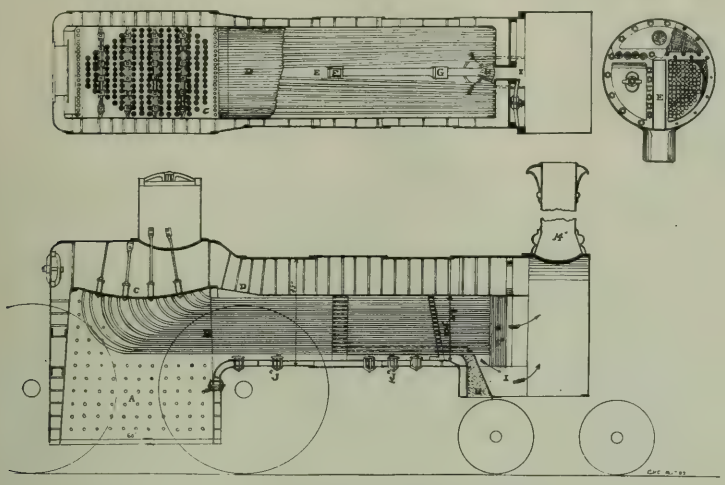


Fig. 3—Dimpfel's Coal-Burning Boiler.

186 *tubes, 1¼-in. outside diameter.*

The following table furnishes the sizes of the principal parts of the engines used in these experiments.

No. of engine.	Cylinders. Diam.	Stroke.	Drivers. No.	Diam.	Weight—On drivrs lbs.	Total, lbs.	Total cost per 100 miles.
51	19 in.	22-in.	8	43 in.	61,700	61,700	$22.38
120	19 in.	22-in.	6	48 in.	70,000	55,000	8.64
136	17 in.	22-in.	4	56 in.	64,550	40,850	9.58
156	15 in.	24-in.	4	66 in.	63,000	40,500	15.34
166	16 in.	20-in.	4	66 in.	55,200	33,200	9.09
190	18 in.	22-in.	4	54 in.	61,900	36,900	11.86
206	19 in.	22-in.	6	48 in.	64,000	49,000	6.47
210	16 in.	24-in.	6	48 in.	64,700	45,745	9.86

The great variation in the cost per 100 miles run is owing to the fact that in the case of Nos. 120, 166 and 206, no charge for repairs appears to have been made; and while this has been done in the case of the other engines, the amount appears to have in some instances included other than ordinary road repairs. The experiments of Mr. Palmer were very carefully conducted, all of the coal and water used having been accurately measured. It is greatly to be regretted that my copy of the published report of these tests has vanished with the flight of years, and deprives this article of some data which might be of more than passing interest. However, the author of the pamphlet writes that he is still interested in the subject and may yet obtain me a copy.

Reference has already been made to the Gill & Co. firebox. This device was patented on July 26, 1859, and the patent was numbered 24,867. The official drawing shows a firebox having a deflector, a combustion chamber, three hanging bridges, and a peculiar form of water-grate. The deflector was in the form of a letter U, having both stems slightly curved in the same direction, and was hollow, its walls forming a water space about 4 in. deep. The sheets forming these walls were united by staybolts and short tubes, spaced at about the same distance as the staybolts of the firebox. The curved end of the deflector was placed about 15 in. in front of the fire-door, and a similar distance below the crown-sheet. Its stems were carried from that point, downward, at an angle of about 30 deg., until the under leg reached the mud ring, and was there attached to the firebox. The upper leg was shorter, and only reached to the throat-sheet, where it also was connected similarly to the other stem, from which it had been kept at a uniform distance of 6 in., and this intervening space was divided by a baffle plate to produce a more thorough contact of the gases with the flame before their entrance into the combustion chamber. This combustion chamber was a semi-circular extension of the firebox for a distance of about 36 in. into the barrel of the boiler. The front end of the extension formed the back tube-sheet. Between the tube-sheet and the curved end of the deflector, the hanging bridges were suspended from the crown-sheet; the smallest

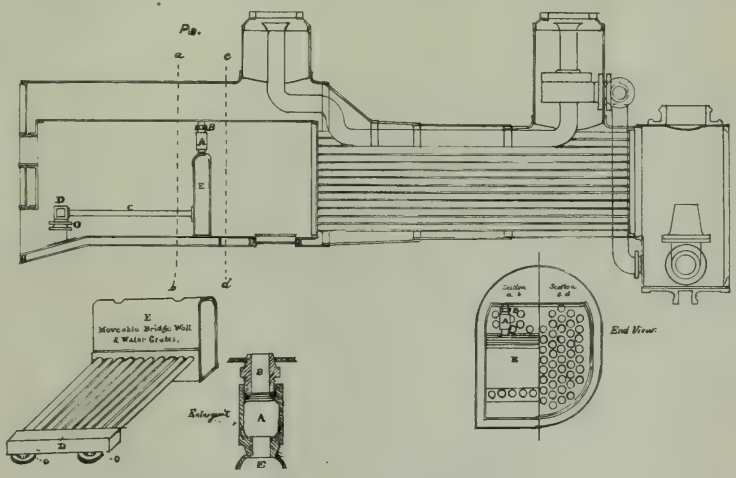


Fig. 4—Septimus Norris' Coal-Burning Boiler.

He adds, however, "The plan of Messrs. Gill & Co. includes a 'combustion chmaber,' and this would necessarily involve considerable change in the present boilers. I think we can succeed in getting rid of the smoke sufficiently to prevent its being objectionable to passengers, without a combustion chamber (until the engines now in service require general repairs) at a trifling expense per engine, combustion chambers to be put in when renewals of fireboxes become necessary. We are now trying a firebrick deflector, forming an air chamber on the principle of Gill & Co.'s improvement, at the suggestion of W. J. Palmer, Esq. The results so far have been highly encouraging."

at the rear, and the longest at the front end. Two columns, one on each side of the firebox at the rear end, inside, united the water-grate to the crown-sheet, and a smaller pipe was placed in each of these columns, having the lower end level with the top of the grate, but curved at the top and then carried forward at a short distance above the crown-sheet and terminating a few inches in front of the combustion chamber, at which point it was turned slightly downward. By means of this arrangement, a more perfect circulation of water was supposed to be maintained through the grate bars.

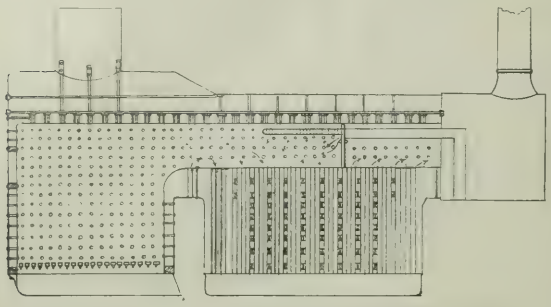
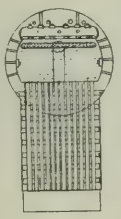


Fig. 5.—The Boardman Boiler.

In a very economical use of fuel, an almost perfect consumption of smoke, and an absence of small particles of dirt, this Gill type of firebox gave most excellent results, and the Pennsylvania Railroad Company looked forward to the final equipment of all of its locomotives with the improvement. So perfectly was the smoke consumed, that even when several shovelfulls of coal were thrown into the furnace successively on heavy grades, only a comparatively small amount of smoke issued from the stack, and all traces thereof vanished after the fourth or fifth exhaust. Satisfactory as the results were from the standpoints named, a new source of trouble developed after a large number of the engines were so equipped. Numerous complaints coupled with claims for damages from fires caused by the large cinders thrown out from these engines were sent in. To insure the necessary draught in fireboxes so filled with internal appliances, no cones, netting, or other spark arresters had been used, and the stacks were perfectly straight. To overcome this later trouble, John P. Laird, the new Master of Machinery at Altoona, designed a balloon type of stack containing a cone and some netting, and substituted it for the unobstructed straight stack. This obviated the trouble from fire to a great extent, but owing to the impeded draught it was found that the results were not quite as good as when the open stacks were used, but the traveling public was by this time becoming better accustomed to the use of soft coal in passenger engines, and but little complaint, if any, was made of the smoke. Considerable difficulty had also arisen from leakage in deflectors, hanging bridges, etc., and the result was the lengthening of fireboxes in new engines, and doing away with the combustion chamber and hanging bridges, while the wrought-iron deflector was replaced by the familiar firebrick arch which had been perfected after various experiments.



The Phleger and the Dimpfel boilers were also changed to the standard types, but the manhole, with its cover, was allowed to remain in the back head of the latter, and in the later years of service which the engine rendered on the road, proved a puzzle to the younger employees.

This Dimpfel boiler, as will be seen by the drawing, was of the water-tube type. The firebox was about of the ordinary form except that its front end formed a huge combustion chamber which reached to the usual position of the front tube-sheet, and what are the flues of an ordinary boiler were replaced by water tubes which entered the waterspace at the front end, and were at their back end, curved upward and into the crown-sheet. An air pipe was carried from underneath the smoke arch into the combustion chamber, and other air openings were provided at several points along the barrel, and a manhole in the back head. This boiler is said to have steamed well and to have been a fair smoke consumer, but gave constant trouble on account of leaking and difficulty in carrying water.

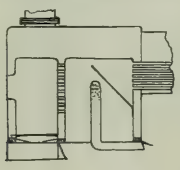


Fig. 6—Dewrance's Coal-Burning Fire-Box. 1846.

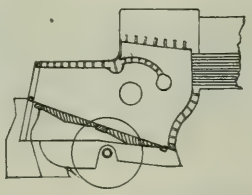


Fig. 9—Craig's Coal-Burning Boiler.
Manchester, Sheffield & Lincolnshire Ry.

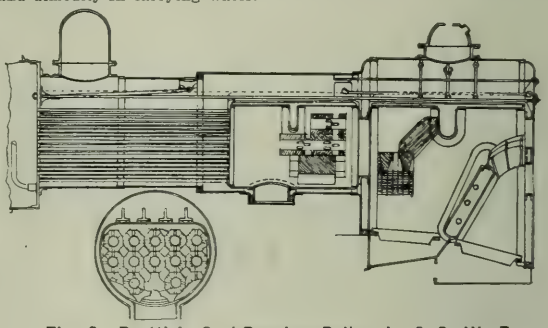


Fig. 8—Beattie's Coal-Burning Boiler, L. & S. W. Ry.

Two other types of smoke-consuming boilers came out about the same time as those already described, but I have never obtained any definite data as to roads upon which they were tried or the results of such trials. Both are shown in the accompanying drawings. One is the Boardman boiler in which the barrel was almost filled with a combustion chamber extending from the firebox to the smoke-box. Underneath, the barrel extended downward like another firebox, and this part was filled with vertical flues and had an air-tight ashpan covering its under side. A vertical partition in the combustion chamber caused the unburned portion of the gases to pass down through two-thirds of the flues, and then pass up through the other third on their way to the stack. Evidently this type of boiler required the use of eccentrics on a return crank attached to the main pin, as there could not have been sufficient room between the firebox and the fluebox to permit their use on the driving axle in the customary way.

The other type was that of Septimus Norris, and bears many earmarks of the Phleger boiler, of which it was probably designed to be an improvement. The removable grate and water bridge are certainly novel.

The other drawings show the boiler designed by J. Dewrance

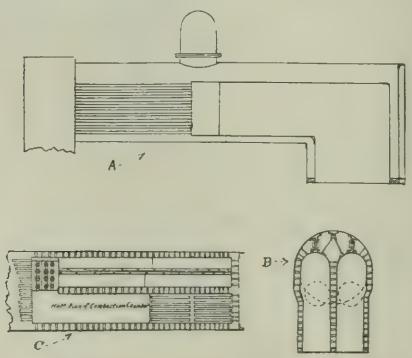


Fig. 7—McConnell's Coal-Burning Boiler, L. & N. W.

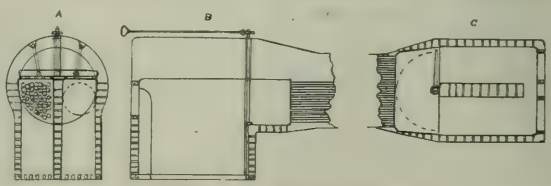


Fig. 10—Head's Coal-Burning Boiler.

in 1846; by J. McConnell, for the London & North Western Railway, in 1852; by Mr. Beattie, for the London & South Western Railway, in 1855; by Mr. Craig, for the Manchester, Sheffield & Lincolnshire Railway, in 1856; and by S. W. Head, for the Fitchburg Railway, in 1859.

The chief features of these last named boilers are, the transverse midfeather of Dewrance's boiler and the deflector in the front part of the firebox so divided; the long combustion chamber of McConnell's divided by a midfeather; the deflectors, combustion chamber, firebrick arch, and firebrick tubes, of Beattie's; the deflector, and the strong resemblance of the firebox to that used by Ross Winans in his short firebox camel, of Craig's; and the longitudinal midfeather with regulating door of Head's.

A Novel Water Hoist for Deep Mines.

In the anthracite regions there are mines in which, for every ton of coal raised, as high as 14 tons of water must be pumped to the surface. A great variety of pumps and lifting devices have been tried, and the most satisfactory type for handling large quantities of water at comparatively low heads has proved to be large bailers operated by steam engines. These, however, lack mechanical regularity, as they are necessarily operated by men. The electrical engineer of the Delaware, Lackawanna & Western, Mr. H. M. Warren, recently designed a water-hoisting equipment for one of the company's mines which has all of the valuable features of the steam hoist and at the same time operates automatically. The mechanical details of the hoist and its automatic devices were worked out by The Wellman-Seaver-Morgan Company, of Cleveland, Ohio, and the electrical controlling devices were furnished by the Electric Controller & Supply Company, Cleveland, Ohio.

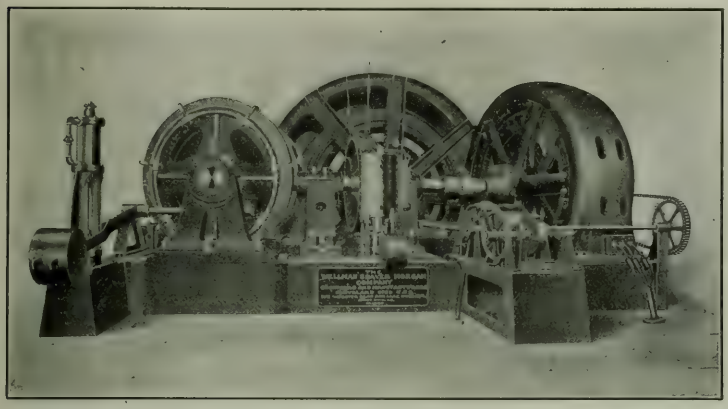


Fig. 1—End View of Hoist Drum, Motor and Clutches.

The original specifications of the D., L. & W. called for a hoist to be operated by an alternating current motor of 800 h.p. The problem of starting, stopping and reversing so large a motor had to be met at the outset. The duty to be performed by the hoist called for raising 4,000 gals. of water per minute to a height of 550 ft.; 4,000 × 8.27 lbs. = 33,180 lbs.; 550 ft. of 2-in. rope × 6.3 lbs. = 3,465 lbs.; 33,180 lbs. + 3,465 lbs. = 36,645 lbs. to be raised 550 ft. per min. $\frac{36,645 \times 550}{33,000}$ = 610 net horse-power. Weight of bucket = one-half weight of water, so that weight on rope = 53,235 lbs., or nearly 27 tons, requiring 2-in. steel rope.

It was decided that it would be impracticable to design the hoist other than to have a motor running continuously in one direction. This necessitated the use of friction clutches for accelerating and reversing the load. Several smaller plants were already in operation using a.c. motors on similar hoists, and as they were running successfully, and the repairs and renewals for clutches had not exceeded that required for other hoisting engines, it was decided to use this method.

Fig. 1 shows a side view of the hoist. The general arrangement consists of a motor driving a pair of bevel wheels through a single bevel pinion. The bevel wheels run loose on a shaft and are fitted with Webster, Camp & Lane friction clutches. The operating mechanism for the clutches is so designed that only one clutch can be thrown in at a time, but both clutches can be out at the same time. Throwing in one clutch runs the drum in one direction; throwing in the other clutch reverses the motion of the drum. To the shaft on which the bevel wheels run there is keyed a pinion meshing with the main gear on the drum shaft. The drums are of the cylindro-conical type 10 ft. at the small diameter and 16 ft. at the large diameter. At a hoisting speed of 550 ft. per minute the drum makes about 15 r.p.m. There is one main brake located between the drums. All of the clutches and brakes are operated by auxiliary air cylinders fitted with oil cushion cylinders, the compressed air being furnished by a motor-driven air compressor located near to the hoist.

The hoist is controlled by a mechanical device shown in the illustration. This consists of a drum rotated by a friction drive from the motor through a sprocket chain. The drum shaft transmits its motion to a secondary shaft fitted with a variable speed gear which in turn operates a secondary stop. The main hoisting drum shaft operates a traveling nut which is so located with respect to the controller drum that at either end of its travel it releases a stop and allows the controller drum to make a quarter turn. This movement, through suitable electrical connections, operates the solenoids on the clutch valve, releasing the clutch and the solenoid on the brake valve and setting the brake. The further movement of the controlling drum is arrested by the secondary stop. This stop is released by the variable speed shaft and its connections, which has been given a predetermined time movement corresponding to the interval for emptying the buckets. The further movement of the controlling drum releases the brake and throws in the reversing clutch, thus starting the hoist in the opposite direction, and also starting the traveling nut on the controlling mechanism in the opposite direction. At the end of the hoist the cycle of controlling movement is repeated, making the hoisting operation continuous and automatic.

Every attention has been given to the safe operation of the hoist. The main brake is of the gravity type and to be released the current must be on the solenoid operating the valve so that air can be admitted to the underside of the brake piston. If for any reason either the supply of current or of air pressure is interrupted, the valve drops, and the counterweights on the brake lever set the brake. The clutches are designed so that they are thrown out by weights. As is the case with the brake, either clutch can only be thrown in when the current is on the solenoid, and the air pressure admitted under the piston, and if either current or pressure fails, the clutch remains off. The motor shaft is fitted

Fig. 2—Head Frame of Hoist Showing Bucket Discharging.

with an emergency brake operated by a weight controlled by a solenoid, and any interruption in the flow of current to the motor sets the brake and stops the motor. A safety cut-out is provided for in the head frame so that in case a bucket is carried beyond the proper height the current is cut off.

Fig. 2 shows the head frame. It is 93 ft. from the base to the center of the sheave at the top. It is built of structural steel, roughly in the shape of an "A." From the head frame are suspended two buckets 6 ft. in diameter and 19 ft. 6 in. deep. The capacity of each bucket is 17 tons of water. In the bottom of the bucket are located two lift gates with an area practically equal to the cross section of the bucket. These gates are lifted automatically when the bucket reaches the top, and the water is discharged through the bottom into a spout fitted below the bucket, and which deflects it to either side of the shaft. Each bucket makes a complete round-trip in 1 minute and 50 seconds, the total lift being 555 ft.

The Surgical Department of the Chicago & North-Western.

The surgical department of the Chicago & North-Western was established in the early '70's and has therefore been in existence about 30 years. The headquarters in Chicago are located at 56 Kinzie street, on the north side of the tracks of the Wells street passenger terminal. As a matter of fact, the headquarters have been in this building since the formation of the department, but the space occupied has, of course, been enlarged from time to time as the railroad has grown. Further enlargement recently became necessary and new quarters were fitted up on the second floor of the building, the old ones having been on the first floor.

Before describing these new quarters, brief mention should be made of the organization of the department. Outside of Chicago headquarters, the arrangement accords with the general custom on American roads; that is, each division has its regularly appointed surgeons, selected from practitioners in the towns along the line. These are divided into two classes: district and local, each important point having its local surgeon or surgeons, while the district appointees are subject to call to any point within the district assigned to them. This does not mean, however, that the local surgeons are subject to the district surgeons. While a few of the foregoing are retained on a regular salary, the majority operate on a fee basis, being paid only for such work as they actually perform. All report to the Chief Surgeon at Chicago, who in turn reports to the General Claim Agent.

Operating Room in New Hospital Quarters of Chicago & North-Western, Wells Street Station, Chicago.

The department has arrangements with hospitals along the line to care for its patients. However, at Chicago headquarters, as has already been implied, facilities are provided for performing surgical operations and for the treatment and care of all but hospital cases. The quarters now occupied consist of two waiting rooms, an operating room, laboratory, a room for the examination of applicants for service and promotion, drug room, private office and two rooms for the doctor on service at night. This is more than double the space previously occupied.

A view of the operating room is shown herewith. It is 18 ft. x 24 ft., and is as well equipped as any hospital in the city for performing operations. The walls are white enameled tile 7 ft. high, the remainder of the walls and the ceiling being finished with white enamel paint. The floor is white tile. There is no woodwork in the room except in the doors and windows, which are painted with white enamel paint. The tables, cases and stands are white enameled iron and glass, and the chairs are white enameled iron. A large three-door cabinet is built into one wall, this and the other cases being dust-proof. The dressing table, seen on the right of the wall cabinet in the photograph, normally belongs against the wall not included in the view, and high above it is a marble shelf on enameled iron brackets, on which are four large bottles with different solutions for irrigating wounds. The double porcelain sink at the right has pedal cocks so that the surgeon need not use his hands to obtain hot or cold water after having prepared for an operation. The electric lights, which were not installed at the time the photograph was taken, include a six-lamp sunburst over the operating table, and adjustable extension brackets for the dressing table.

The laboratory will be equipped for urinalysis, microscopic examinations and similar work performed in such laboratories. The department distills its own water, having a still with a capacity of a gallon an hour and a 24-gal. reservoir. The laboratory also contains an electrically heated sterilizer and hot water tank, which are emergency apparatus in case of any difficulty with the gas apparatus ordinarily used. The laboratory room contains a large vault in which are kept stretchers, crutches and blankets and also the laboratory apparatus.

There is a large fireproof drug and record room, 24 ft. long by 10 ft. wide, fitted up like a vault, in which are kept all important records of the department and a full stock of drugs and supplies.

The room for examination of applicants for service and promotion is 22 ft. long by 12 ft. wide, with three large windows for ample lighting. The interior is finished in white, and the necessary equipment provided for making the examinations for vision, color sense, hearing, etc., prescribed for such applicants. Of the two waiting rooms mentioned, one is for these applicants and the other for patients for surgical attention. An elevator from the track level connects with the latter and a wheeled stretcher is kept in readiness at the bottom.

While the department at Chicago is intended primarily for cases from the Wisconsin and Galena divisions, it not infrequently happens that patients are brought there from points all over the system. In addition to employees, the department, of course, cares for persons injured on the road, in wrecks, etc. Besides the facilities at 56 Kinzie street, there is a department maintained at the large shops on the west side of the city known as the "shop dispensary," which is intended only for the treatment of injuries received in the shops, an assistant in the department being constantly in charge.

The surgical department is in charge of Dr. John E. Owens, Chief Surgeon. He has three assistants in Chicago, who give their entire time to the work, Dr. J. D. Andrews being Chief Assistant. It is interestinng to know that the department, during its more than 30 years, has had but two chief surgeons, Dr. Owens having been in charge since 1885. His predecessor was Dr. Ralph N. Isham.

The department for examination of applicants for service and promotion has 45 points on the line outside of Chicago where such examinations are made. It has been in existence ten years.

Washington Correspondence.*

Washington, Nov. 28.—It cannot be said that the Senate Committee on Interstate Commerce has made much progress during its sessions of the past week. There has been little more than an informal exchange of views on the part of the senators composing the committee. Some of the members of both parties seem to be disposed to wait until the President has submitted his formal recommendations in his annual message and then undertake to formulate a bill that will embrace these recommendations. While there is not much doubt as to the general character of the recommendations that the President will make, there is hope among some of the members of the committee that the text of the message may contain some suggestions that will be of assistance to those members of the President's party who trust that it may be possible to frame a compromise bill that will be satisfactory to conservative senators and representatives and not objectionable to the President.

The only member of the committee who has not thought it necessary to wait for suggestions from the White House before beginning active work is Senator Foraker. Probably no other member of the committee has given so much attention to the problem of railway legislation as has the senator from Ohio. He has very clear ideas as to what he believes ought to be done, and he came to Washington with a bill in his pocket framed to carry out those ideas. He has drawn up a bill that, in his opinion, would give to shippers prompt and effective remedies for unrea-

*During the present period of uncertainty about rate legislation, we will print weekly a brief statement of the situation.

sonable and extortionate rates and for rebates and discriminations of all kinds, whether obtained from the roads openly or covertly through the medium of private freight cars, private terminal roads, underbilling, or by any other device. At the same time that he is affording these remedies for shippers he has endeavored to protect the interests of the railroads.

The Foraker bill is being attacked principally on the ground that the proposition to require the courts to practically fix a reasonable maximum rate by enjoining the roads from charging more than might be found to be a reasonable maximum compensation for any given service, would be unconstitutional. Advocates of the bill, while contending that it would be held to be constitutional, attack the constitutionality of the proposition of the President to confer upon the Interstate Commerce Commission the power to fix either a maximum or an absolute rate. It is also contended that the Foraker bill avoids the constitutional questions as to whether the making of rates by an administrative body would not be held to be the taking of property without due process of law, and whether it would not in many instances, unless the rates were made on the basis of a uniform charge per ton per mile, be held to be giving a preference to the ports of one state over the ports of another state.

As matters stand now, the Foraker bill is the only concrete proposition that has been brought forward, and current discussion is centered upon it. When it was first made public it was hoped by its advocates that it might be acceptable to the President as a basis of compromise, it being argued that it would give Mr. Roosevelt the substance of what he is contending for—an authority outside of the railroads to determine the reasonableness of a challenged rate and an effective method of promptly enforcing the substitution of a reasonable maximum rate for one found to be unreasonable. It soon became apparent, however, that it would not be acceptable to the President, and it now seems probable that it will be made the rallying point of most of the opposition to the carrying out of the President's exact recommendations. J. C. W.

The Cost of Locomotive Operation.

XVII.

BY GEORGE R. HENDERSON.

CLEANING FIRES.

(*Continued from page 467.*)

This cost will depend not only upon strictly local conditions and the price of labor, but the quality of the fuel used. With coals that burn to a free ash, the cleaning of the fires will be confined to shaking the grate bars and hoeing out the ash pan—if the latter has drop bottoms or hoppers the process is extremely simple and brief. On the other hand, engines sometimes come in so badly clinkered that it may require a couple of hours to properly clean the firebox of slag and incombustible masses. This may not apply to all the engines coming in from their runs, for it is often claimed that by having two cleaning tracks, if an engine arrives in the condition above mentioned, the other engines giving less trouble can run around the difficult member, thus facilitating the work of turning. The process of cleaning is managed differently at various points. In some cases the hostler shakes or drops the fire into the ashpan, while the ash-pit man pulls it out of the pan; in others, a "fire-knocker" is employed to break up the clinker and push it into the pan. Occasionally, but not often, the pit man does this work, but the precise method depends upon the nature of the coal and the number of engines to be handled. Then, at times, the smoke-box must be cleaned of cinders, which may provide another operation. After this work has been done and the engine moved on into the house, the ashes must be taken from the pit.

This brings us to the construction of the pit itself. The old style were merely "pits," and all the refuse had to be thrown out over the rail, and into a car on a depressed track alongside. A more advantageous arrangement is the "elevated pit," where the ashes are simply raked out under the rail while the engine is still on the "pit," or is moving off, and pushed or thrown into the loading car without having to be actually lifted to any distance.

Then there are mechanical arrangements which lift buckets out of the pit and drop their contents into open cars, or elevate the ashes by an endless chain or buckets and place them in a bin, where they drop by gravity into cars, or take them at once to the waiting cars. This all varies the cost of cleaning fires, as the expense does not cease until the refuse is actually deposited at some point, though as there is generally demand for material for filling, and the hauling will benefit this work, the expense, as far as the engine is concerned, may be considered ended when the cars are loaded from the ash-pit.

It is likely that under averge conditions one-half hour will be consumed by engines at the ash-pit, during most of which time two men will be engaged upon cleaning the fire and front end. If these men are paid 15 cents an hour, we will have the cost of such cleaning represented by this sum, viz., 15 cents. In many cases the cost will be greater, in others less, so that the average will probably not be far from the figure stated. There may be so few engines that one man will not find his time wholly occupied with pit work, but it is then customary to provide him with other duties. If many engines arrive more men and facilities are needed, and mechanical devices in this line are more generally for the purpose of increasing the output than for diminishing the cost of cleaning fires.

Wiping.

This item is an exceedingly variable one, and it must be considered in connection with the local existing conditions. The practices in the method as well as in the amount are, perhaps, not alike in any two roads. Some of our most important railroads do little, if any, wiping of freight locomotives and not much of passenger engines. Even limited trains are sent out with locomotives that resemble mud balls, and the shape is all that distinguishes them as a piece of machinery. This is somewhat exaggerated, but filthy locomotives are too often the order of the day.

There are several reasons for this, and they are not hard to trace. When engines were small and were regularly assigned to crews, it was the duty of the fireman to keep the locomotive clean, and even to polish the brass work, of which there was a great amount. As the size and quantity of the power increased, there was a marked tendency to reduce brass work and polished surfaces of all kinds. This was the first reduction of the fireman's labors. As the engines still kept growing, and more surface had to be cleaned, the fireman's wiping was confined to the portion above the running board, and then to the inside and outside of the cab. Recently a number of roads have discontinued the practice of requiring the firemen to do any wiping on pooled engines, and also those of large size in assigned service, the men claiming (with some justice) that they did not have time to clean engines and obtain the necessary rest during lay-overs. When the wiping was done by the firemen there were no extra expenses attached, except the quantity of waste and cleaning mixtures used, which would, altogether, probably not amount to over 10 or 15 cents per engine cleaned. But now, when men have to be employed specifically for this purpose, the figure has increased, and in an effort to keep down costs comparatively little wiping is done.

The actual cost depends, of course, upon the price of labor, speed of workmen, and quality of work. The costs are variously stated at from 10 cents to $2 an engine, so that little data can be obtained from such reports that could be used with any satisfaction. The writer calls to mind one road with which he was connected, where the wiping was done piece work. A contract was made with a gang leader to clean all the engines entering the house for 50 cents each, and he hired the necessary men and looked after them. These were mostly passenger locomotives, the largest having 20-in. cylinders, of the 4-4-0 type. The firemen were supposed (at that time) to clean above the running board, and the wipers took the wheels, pilots, front ends, tenders, trucks, etc., and the work was very well done—better, perhaps, than actually needed. Later this road relieved the firemen from all wiping.

We do not believe that satisfactory work of this kind can be done for less than 50 cents an engine, and very large ones will cost more. It would certainly require from three to five hours to do the work properly. Under the arrangement above mentioned, each man averaged three or four engines per day, so that fairly good wages were made at the work.

The writer has always favored clean engines, not for the benefit of appearance alone (although that has a certain commercial value), but for the greater opportunity of discovering defects that might later cause breakdowns on the road. With half an inch of mud on wheels, boxes, eccentrics, etc., it is almost impossible to discover incipient cracks, and if the wipers are careful they can prevent many an engine failure on the road. Indeed, some roads pay the wipers a bonus for discovering and reporting cracks, etc., and other roads promise promotion to the much coveted fireman's berth for careful examination and reporting of defects. Wiping not only furnishes a certain amount of inspection, but it greatly facilitates the work of the regular inspector, who is ordinarily paid better wages than the wipers.

Inspecting.

This item is about as irregular as the one last considered, and depends largely, if not entirely, upon the method of handling the engines. Where assigned crews and engines operate, few inspectors will be found, as the engineer is supposed to do his own inspection—in fact, he can hardly oil and look after the machinery day in and day out without knowing the condition of the engine in detail. It is true that enginemen seldom know the link motion parts thoroughly, and there is some excuse for this. When engines arrive from a trip, they generally lie upon the "standing track" for an indefinite time, and the enginemen dislike to "worm" themselves between the wheels and the track, perhaps thick with mud, soil their over-clothes, and generally inconvenience themselves, instead of going to their homes. Some roads have built inspection pits, so that a man can easily get under the engine and examine all parts of the machinery, and these are very much to be com-

mended, though somewhat costly. It is a generally accepted proposition nowadays that if we wish a piece of work satisfactorily done, we must make it convenient for those who do the work.

When the inspection is performed by the enginemen there is no charge made for this work, and it practically costs the company nothing. When engines are pooled, however, one of the first industries to be organized is the inspection force, and few, if any, roads attempt to pool locomotives without having regular inspectors appointed. This is not so much with the idea of relieving the enginemen, as they are expected to report anything wrong on arrival, but it checks them up, makes them more attentive to this work, and gives some assurance that the engine is in proper condition for the succeeding crew. When engines are assigned, the engineman will naturally watch for defects so as to protect himself against failures on future trips, but when he may never see the engine again his main object is to get in from the current trip, and let the next man look out for trouble.

The cost of inspection, when done by special inspectors, varies considerably. It is often the custom to take some engineman who has been disqualified from road service on account of some physical misfortune, and give him the post of inspector. As he will expect to make some where near running wages, the cost of the work is apt to be high. Sometimes a machinist is put on this work, and obtains machinist's pay, which may be nearly as great as that of enginemen. Very often bright young men are selected, with promises of promotion if their work is well done, and in these cases the pay is much lower.

The length of time taken will depend upon the man—some will claim that they can inspect an engine in 15 minutes, but if it be done thoroughly, as it should to be effective, it will take about double that mentioned. Some roads do this piece work, paying 10 cents for each engine inspected, but we believe a nearer figure will be 15 cents for the average case, where a special man or force is employed for this purpose.

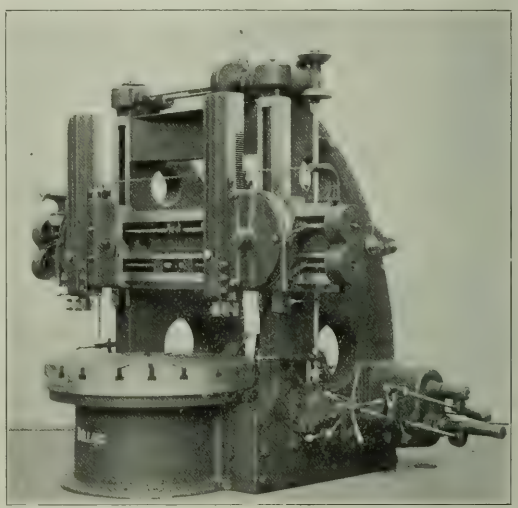
(To be continued.)

The Bullard 54-Inch Rapid Production Boring and Turning Mill.

The 54-in. boring mill illustrated herewith shows the latest development in boring and turning mills made by the Bullard Machine Tool Co., Bridgeport, Conn. Its actual capacity is 56 in. in diameter and 42 in. in height; the table, which is 52 in. in diameter, being driven by a large steel spur pinion meshing an internal gear at its greatest diameter. The drive is from a constant speed shaft, and 15 changes in table speed are obtained by a speed box, shown attached to the rear of the right hand housing in photograph, and a set of three reducing gears in the headstock, which is mounted on the bed between the housings. Any speed is instantly obtainable by the manipulation of the pilot wheel and lever shown above it. So completely is the centralization of all operating levers carried out that every movement or adjustment for the entire machine, excepting the left-hand head, may be consummated by the operator without taking a step. All speed changes are controlled by the pilot wheel and lever shown, as is also the quick-acting brake, all movements of these parts being interlocking. The pilot wheel operates the friction clutches in the speed box by turning, and it applies the brake by lifting. The brake can be applied only when the frictions are disengaged and it is rendered impossible to turn the pilot wheel while the brake is on. Similarly, the lever (behind the pilot wheel) controling the changes in reduction gearing cannot be operated except when the brake is set, and it, in turn, locks the brake lever until a gear is fully engaged. While completely performing its function of safeguarding the driving mechanism from careless handling, this interlocking device in no way interferes with the rapid manipulation of the machine, a change from the highest to the lowest speed being made in a very few seconds. The speed changes being so readily obtained, the question of individual motor drive is materially simplified. The requirements are fully met by a constant speed motor mounted on a bracket between the housings. This bracket is designed so that if a gear or chain drive is considered preferable the motor may be suspended and gears or sprockets substituted for the pulleys.

The feeds are independent for each head and have 10 changes, ranging from $^1/_{32}$ in. to $^3/_4$ in. for each revolution of the table, and are readily changed by the levers shown on feed bracket. Rapid power traverse of the head and tool bar is obtained from the vertical feed rod, the cone frictions at its upper end being engaged by the horizontal lever shown at its lower end. In its central position the feeds are engaged, but by raising or lowering the lever the clutch is released and the cone frictions are brought into contact with a high-speed top shaft and the rod revolved at a high speed. The connection between the feed box and feed rod is a claw clutch arranged so as to engage in but one position, the rapid traverse may be used in thread cutting with no danger of a split thread resulting. The feeds are reversed in the feed box, so the position of the traverse lever bears a constant relation to the direction of movement in the head and bar, confusion in the mind of the operator being entirely obviated.

A notable feature in connection with the feeds is in the entire elimination of pull gears and crank handles at the ends of rods and screws; pull gears being replaced by gears constantly in mesh, and change from vertical to cross feed, or vice versa, being made by adjustable friction clutches operated by the lever shown projecting at the bottom of rail. This device multiplies many times the value of the rapid traverse and serves the purpose of a safety slip point in an otherwise positive train of feed gears, obviating all chance of breakage and delay through careless handling. Fine adjustments of the cutting tools are made by the double acting ratchet levers shown attached to the saddle. These ratchets automatically release their grip when actuating pressure is relieved. This device renders it possible for the operator to set the tool to the proper depth of cut or the diameter required at close range, and saves the time consumed in going to the end of the rail to make adjustments as in the case of the ordinary machine having crank handles. The construction of the rail is a feature which adds much to the rigidity and accuracy of the mill, as the entire weight of the head is supported by the bearing at the bottom of the rail, the upper bearing serving only to resist the tendency of the head to tilt forward under the pressure of the cut. The feed screw is directly in the center of the long, narrow, guide bearing, consequently there is no tendency to cant and bind on the rail. This principle of a guide bearing having a great proportion of length to width is also used in maintaining the alinement of the center stop on the rail, the rail being held central by a gibbed



The Bullard 54-in. Rapid Production Boring and Turning Mill.

block having its bearing in the recess in the face of the right-hand housing.

Another notable feature is the method of driving the top shaft which operates the rail lifting screws. The change in direction of movement is secured by tumbler gears, the driving pinion of which is cut in the end of a quill which is a running fit on the top shaft, the driving key being located in the middle of shaft in order to equalize the torsion between the ends. Special attention is given to lubrication. Both the head stock and the speed box are entirely enclosed and the splash system of oiling is used, the gears running in a constant bath of oil. All high-speed shafts have ring or chain oiling boxes and gages are placed so as to indicate the amount of oil in each. The angular thrust bearing of the main spindle is entirely immersed, oil pockets in the bed insuring ample lubrication of its entire surface, while a felt ring feeds oil to the vertical journals. The thread cutting attachment is not a part of the regular equipment of the mill, but may be applied at any time with no further change than the substitution of extension studs for the bushings in the feed bracket on the rail. The net weight of this machine is about 17,500 lbs.

Disastrous Rear Collision at Baker Bridge, Mass.

In a rear collision of westbound passenger trains at Baker Bridge, Mass., on the Fitchburg division of the Boston & Maine, 18 miles west of Boston, on Sunday evening last, about 8 o'clock, 16 persons were killed and 32 or more seriously injured, most of the 16 killed being passengers in the two rear cars of the leading train. The wreck took fire from the coals in the firebox of one of the two locomotives of the second train, and many of the victims were burnt. The flames spread so rapidly that it was impos-

sible to know whether the victims were killed by the collision or by the heat, or suffocation caused by the fire. The leading train was an accommodation for Marlboro, leaving Boston at 7:15 p. m., and a few minutes behind time. It had just started from Baker Bridge station. The train which ran into it was the Rutland express for Montreal, consisting of two engines and nine cars. The reports indicate that at Lincoln, one mile east of Baker Bridge, the express was only about one minute behind the preceding train, and it appears to have run into the way train at full speed. The President of the road issued a statement on Monday, saying:

"While no complete and thorough investigation has yet been possible, every part of the appliances for stopping the express train seems to have been in perfect order, and the train should have easily made a stop at any time within a distance of 1,500 feet. All of the testimony as yet secured shows that the express passed by at least two and probably three block signal lights and three red fusees without paying the slightest attention to them. * * *" The engineman of the leading engine was not seriously injured, but no statement from him is forthcoming.

Engineering Contracts.*

The dividing line between specifications and contracts is most difficult to draw, for in any particular case two engineers will rarely agree as to what clauses pertain properly to the specifications and what to the contract, of which the specifications form a part. Some engineers prefer to throw nearly everything into the specifications and thus keep the size of the contract proper as small as possible, while others make the latter very extensive by including in it many clauses that are ordinarily found in the specifications. Again, others make a practice of repeating in the contract certain clauses that have already been covered in the specifications. In my opinion, the last mentioned method is open to criticism in that it is liable to result in conflicting clauses; nevertheless, it is quite possible that my practice has not been entirely free from this objectional feature—it is so hard to be always consistent; and again, one's methods are a matter of development and are not created perfect at one essay.

Before proceeding to the direct treatment of my subject I shall endeavor to make clear the method that I have adopted for locating the dividing line between specifications and contracts. I say "endeavor" advisedly, for I am not sure that I can always give a satisfactory rule or reason for any particular division; because absolute consistency is an attribute that, strive as one will to attain it, lies ever just beyond reach.

My preference is to throw as much of the matter as possible into the specifications and reduce the size of the contract proper to a minimum, avoiding repetition of statement in the two parts of the work, but of necessity treating certain subjects in both parts, though from different points of view. There is no doubt about the proper place for most of the topics or headings, but in certain cases there are plausible reasons for locating them in either division. All clauses that relate to methods of construction, qualities of materials, character and excellence of the work, rules limiting the functions and powers of the contractor and defining the authority of the engineer, directions to bidders, and transportation of men and materials unquestionably belong to the specifications; but such clauses as those relative to adherence to specifications, alteration of plans, damages, extras, payments, responsibility, for accidents, the spirit of the specifications, strictness of inspection, liquidated damages, scope of the contract, and time of completion might perhaps be properly inserted in either division. My custom, however, is to include all of these clauses and others of like character and scope in the specifications.

Nine out of ten of the contracts that an engineer has to prepare are in connection with construction, and an intelligent specialist soon learns how to prepare satisfactory specifications and contracts for all ordinary kinds of work; but this style of contract is by no means the only type with which an engineer is concerned, for he is sometimes called upon to draft agreements between promoters of enterprises and capitalists, between himself and promoters of enterprises, between two engineers, between two contractors, or between a bond company and a contractor. Some of these unusual types are exceedingly difficult to draft properly, as, owing to their varying conditions, they cannot be systematized. It is mainly with them, therefore, that this lecture on contract writing is concerned; because for construction in general it is practicable to evolve a form which, when correctly filled out, will apply to any ordinary case.

Before one can draft a contract, he must have clearly in mind a full and well defined idea of all the conditions and *desiderata*, and he should epitomize these systematically before beginning to write. It is advisable to keep constantly in view the possibility that each party to the contract may be unscrupulous and willing to take every possible advantage of every weakness which the contract may contain and which will tend to his own profit—honor and integrity to the contrary notwithstanding. Failure to do this will often result in some ambiguity that will cause rank injustice to one of the parties to the agreement. It is difficult for an engineer to recognize this weakness of human nature and to bear it steadily in mind when writing contracts; because the training and the work of engineers tend to develop in them to an eminent degree the principles of absolute honesty; consequently, it comes hard for them to be forced to make a practice of doubting the integrity of their business associates. To mistrust the motives of one's fellow men is disagreeable but essential, if the writer of specifications and contracts is to protect himself or his clients from loss and fraud.

Concerning this matter I speak from sad experience, for my business career has taught me the necessity for exercising the utmost caution in drawing contracts, so as not to put temptation in the way of either party by inserting a single clause of which he could take advantage by compelling the other party to do something that was not contemplated when the agreement was made. Occasionally it happens that after a contract is executed, one of the parties finds a flaw that will give him an improper advantage; and it is only a strictly just and upright man who will refuse to avail himself of such a weakness in the document.

The essential elements of any contract, according to Mr. John Cassan Wait, the noted authority on "Engineering and Architectural Jurisprudence," are as follows:

"1st. Two parties with capacity to contract.

"2d. A lawful consideration: a something in exchange for its legal equivalent, a *quid pro quo*.

"3d. A lawful subject-matter, whether it be a promise, an act, or a material object.

"4th. Mutuality: a mutual assent, a mutual understanding, a meeting of the minds of the parties."

Without these four elements no contract is binding in law.

The essentials of a well-drawn contract that comes within the province of the engineer, however, are as follows:

1st. A proper and customary form.

2d. A full and correct description of all parties to the agreement.

3d. A thorough and complete preamble.

4th. A statement of when and under what conditions the contract is to become operative.

5th. The limit, if any, for duration of contract.

6th. An exhaustive statement of what each party to the contract binds himself, his executors, administrators, successors, or assigns, to do or to refrain from doing.

7th. A clearly defined enunciation of the consideration which each party is to receive—this is the essential *raison d'être* of the instrument.

8th. The forecasting of all possible eventualities that would materially affect the agreement, and a full statement of everything that is to be done in case of each eventuality.

9th. Penalties for failure to comply with the various terms of the agreement.

10th. Provision for possible cancellation of contract.

11th. Provision for settlement of all business relations covered by the contract or resulting therefrom in case of cancellation, taking into account all possible important eventualities.

12th. Mention of the place where the agreement is drawn or of the place where it is to be put in force, so as to show the state under the laws of which the validity of the contract is to be determined, should suit be necessary to enforce it.

13th. Methods of payments, if any are to be made.

14th. Provision for extra compensation and the limitations connected therewith.

15th. Provision for possible changes in contract.

16th. Provision for transfer of the contract or for sub-letting.

17th. Provision for settlement of disputes.

18th. Provision for satisfactory and sufficient bond, if any be needed.

19th. Provision for defense of lawsuits, if such provision be necessary.

20th. Definition of names used in contract such as "Engineer," "Company," "Contractor," or "Trustee."

21st. Dating of contract.

22d. Proper signatures with the necessary seals, if the latter be required.

23d. Witnesses to the signatures, or execution before a notary public.

I shall now take up and discuss in the order of their enumeration each of these essentials to a properly drawn contract.

1st. The styles of opening clause for contracts are both numerous and varied, and it is difficult to say which is the best. Each writer naturally will have one favorite style and will adhere to it whenever possible. Mine for many years has been as follows:

MEMORANDUM OF AGREEMENT, made and signed this eleventh day

*Extracts from a lecture before the students of Rensselaer Polytechnic Institute, by Dr. J. A. L. Waddell, reprinted from *The Polytechnic*.

of February, 1905, by and between the Kansas City Bridge & Terminal Railway Company, a corporation of the State of Missouri, the party of the first part, and sometimes termed in this agreement and in the specifications the "Company," and The Western Contracting Company, a corporation of the State of Kansas, the party of the second part, and sometimes termed in this agreement and in the specifications, the "Contractor."

Wait recommends the two following forms of introduction:

This agreement, made and entered into this eleventh day of February, in the year 1905, by and between, etc., etc.

Articles of Agreement, made and entered into between The Kansas City Bridge & Terminal Railway Company, a corporation, etc., etc., and The Western Contracting Company, a corporation, etc., etc., on this eleventh day of February, 1905.

After the introductory clause comes the preamble, and immediately after it I insert in capital letters "NOW THIS AGREEMENT WITNESSETH," and follow with consecutively numbered clauses that embody all the terms and conditions of the contract, then close with provision for the signatures and seals of the contracting parties and witnesses to these signatures.

2d. In describing the various parties to an agreement, care should be taken to make the description full and convincing in order that there shall be no possible mistake concerning the identity of each party. This is effected in the case of an individual by stating his occupation and place of residence, in the case of a firm by naming it fully, mentioning its place of business, and describing the kind of partnership, and in case of a company by giving its legal title and the name of the state or country where it was incorporated. In case of a partnership it is sometimes well to specify whether it is general or special in respect to the work covered in the contract.

While most contracts are drawn between but two parties, it sometimes occurs that an agreement will involve three or even more. Such a contract is much more complicated and difficult to draft than one between two parties only.

Each party should be designated in the instrument by his special number, as the party of the first part or the party of the second part; and in addition it is well to give each another designation, such as "Contractor," "Company," "Owner," "Engineer," "Promoter," "Board," "City," "Incorporator," or "Trustee" in order to avoid the use of too many words throughout the document, as would be the case were he always referred to as the party of the first or second part. In order to make assurance doubly sure it is well in some cases to define the terms "Contractor," "Company," "Engineer," "Promoter," etc., at the end as well as at the beginning of the document. In any case these explanatory clauses should be placed at the beginning or the end of the specifications, because the latter are often used without the contract being attached.

There is no strict rule as to the order in which the several parties shall be placed, but it is customary to make the one who pays the money the party of the first part. In case of employer and employee the employer should come first. In other cases it is a good rule to put the most important party first and the others as nearly as may be in the order of the importance of their relation to the enterprise or object matter of the agreement.

There is a consideration of primary importance in contract writing that is sometimes overlooked, viz., whether the parties to the agreement are legally entitled to enter into contract. For instance, in the case of a company, the president or general manager, or perhaps either can sometimes legally contract in the company's name, but sometimes he cannot, in which case, if haste be essential, it would be proper to have him enter into and sign the contract and afterwards have it formally approved at a meeting of the board of directors. A properly certified copy of the board's approval should subsequently be attached to the contract. Access to its charter and by-laws is generally necessary to determine who has authority to enter into and sign contracts for a company.

In contracting no corporation can exceed the limit of its powers as given by its charter. If it attempts to do so, its act will be *ultra vires* and without effect; consequently it behooves one in writing a contract with a corporation first to study well its charter, articles of incorporation, and by-laws.

Contracting with unincorporated organizations as parties, such as associations, clubs, societies, or congregations, is a precarious business; nevertheless it often has to be done. In order to ensure the payment of money obligations by such parties a sufficient sum should be deposited in advance in the hands of a reputable trustee with instructions to pay it to the proper party or parties as soon as the obligations covered in the contract have been met. Otherwise, the other contracting party is liable to lose his entire consideration, because it is very difficult to hold legally an organization that has no legal existence, even if all the members thereof be individually liable. Here again I speak from sad experience, for at the outset of my consulting practice I lost what I considered then a large fee by dealing with a committee of public spirited citizens, who were not honest enough to pay their just debts after the proposed enterprise had failed. Even the law did not enable me to collect the bill, as my lawyers did not present the case to the court in the proper manner.

Again, any person under 21 years of age, termed in law an infant, who enters into a contract, has the privilege of repudiating it after arriving at the age of maturity, in case that it does not redound to his advantage; consequently it behooves the writer of a contract to make sure in all doubtful cases that the contracting parties are of age. In engineering contracts, however, this question is seldom likely to arise because very young men are not often concerned in a prominent way with important enterprises.

Similarly, imbeciles, inebriates and lunatics are incompetent, and contracts made by them are legally voidable at their option. While it is highly improbable that either an imbecile or a lunatic would ever be made a party to an engineering contract, it is not impossible that a man chronically addicted to the over use of liquor might be so concerned. Such a man might plead that he was under the influence of drink when he signed the document and thus possibly effect his release from its obligations, consequently the writer of an engineering contract should assure himself of the temperate character or at least of the sober condition of the parties thereto.

A married woman in some states cannot contract, sue, or be sued in her own name. While it is uncommon for women to be engaged in enterprises involving engineering, it is by no means impossible, as I have learned from a hard lesson; for in the case of a contract for the engineering of a large and novel enterprise that I entered into with a certain man, it transpired that he was acting as agent for a married woman. Before our work was finished the man died, and the woman gave us notice in writing that she would assume his share of the contract, and instructed us to finish our work. This we did, and she paid us one-half of our total fee; but before the date specified in the contract for the payment of the second half, the bottom dropped out of the scheme, and the lady then refused to make any further payment. She did not plead her married state as a justification for her refusal; but we knew what we might expect in a legal contest over the question, consequently we entered the balance on the wrong side of our ledger in the "Profit and Loss" account.

In case of war a contract entered into between parties who are subjects or citizens of the conflicting countries is illegal, and if war be declared subsequent to the signing of the contract, its obligations cannot be enforced by law until after the war has ceased. As engineers are often interested in projects in foreign countries, this is a matter that needs to be borne in mind when preparing the contracts for such enterprises.

When a contract is entered into by an agent, care should be taken to make this relationship both clear and legal in the document by stating the name of the owner or corporation and following it with the words

"acting by and through Mr. X., Agent, Attorney, Engineer, President, or Treasurer (as the case may be), by virtue of the authority vested in him through power of attorney of the (here name the individual or company) dated the .... day of ....., 19.., a copy of which is hereto annexed,"

or in some similar and equally explicit manner. In this way the name of the real principal is made certain, the authority of the agent is preserved, and the possible liability of the agent as the principal is averted. It must be remembered that no claims or obligations against a principal are created by a contract entered into by an agent who acts without proper authority, unless the contract be afterwards confirmed directly or indirectly by the principal.

Much engineering work is being done and is to be done in the future by contract with the United States Government. In making such contracts it is important to note that although the Government may enter suit on its contracts for their enforcement, it cannot, without its own consent, be sued for non-compliance therewith. Instances are not unknown of repudiation of contracts by governments. Furthermore, public officers cannot be held personally liable for contracts signed by them in their official capacity.

The names of the parties in the body of a contract should correspond exactly with the signatures and seals at the end, for a variation might prove fatal to the validity of the document.

3d. The preamble is a most important portion of any contract. It should explain fully all the whys and wherefores of the agreement and its *raison d'être*. A thorough explanation of these would often render clear the intent of a clause in the body of the instrument that is otherwise ambiguous.

Once more I am speaking from sad experience, for in an important but hurriedly prepared contract one of the clauses was not drawn with sufficient clearness, and, in consequence, one of the parties to the agreement tried to take an unfair advantage of it. Had the preamble explained carefully and in detail the ultimate object of the contract and the various steps necessary for its accomplishment, the said party would not have been able to make the claim he did.

4th. Every contract should contain a statement of when or under what conditions it is to become operative. The date may be some particular day of month and year or immediately after or some definite time subsequent to, some act or occurrence, such, for

instance, as the giving of written notice, or the deposit of a certain amount of money in a certain place, or the completion of a certain piece of work, or the arrival of a railroad at a certain point. Whatever the "condition precedent" may be, it should be made clear in the document beyond the peradventure of a doubt.

5th. Too often in contracts nothing is said concerning the duration of the agreement or of how it is to be drawn to a close. In some cases it would be impracticable thus to limit the life of the contract; but in others it is not only practicable but also advisable, and sometimes it is imperative, especially where a bond for proper completion of work is involved.

6th. The statement of what each party to the contract binds himself, his executors, administrators, successors, or assigns, as the case may be, to do or to refrain from doing should be thorough and complete in every detail. The importance of this is self-evident, nevertheless it is a point that is not always given proper attention in contract writing.

In all contracts between corporations or between a corporation and an individual, the promises to perform should be made binding upon the successors or assigns of each corporation, although it is probable that the law would enforce this even if the stipulation be omitted.

In contracts where an individual is a party to the agreement it is best to bind not only himself but also his executors or assigns, unless, perchance, the obligation be of such a nature as to be non-transferable, as, for instance, the performance of personal duties or services of an expert nature or involving special skill. Thus an engineer's services are not transferable, unless some special provision be made and agreed to by both parties that, in case of his death or inability for good and sufficient reason to finish his work, his contract is to be assumed by some other engineer either named or to be determined afterwards in some specific way. But the death of one member of a firm of engineers will not cancel an agreement; for as long as one of the original members of the firm remains in charge the contract will hold. In other words, it would require the death or incapacity of all the original members of the firm to abrogate the contract, unless special provision to the contrary exist in the written agreement.

Construction contracts are generally assignable, unless they contain provision to the contrary.

7th. The consideration which each party to an agreement is to give and is to receive should be clearly and fully stated in the document, otherwise unsealed contracts are liable to be held valueless and void in law. Moreover, the consideration must be real, substantial, and adequate. Some lawyers make a practice in many cases of specifying a consideration of one dollar, and they even try to pass that dollar around among the several parties to the agreement by having each party make nominally that payment to each of the other parties so as to show that each receives a valuable (?) consideration. In my opinion, such a practice is mere humbug and unworthy of adoption by any man pretending to scientific attainments in his profession, no matter whether that profession be law or engineering. Its adoption, it seems to me, is *prima facie* evidence of weakness in the document and a confession by its writer that he has failed to make evident the true consideration that each party is to receive and the real reason for each party's entering into the agreement.

There may be some excuse for passing the dollar in case of a parent deeding property to his child, where the true consideration is love and affection; but a dollar does not constitute a real consideration—it would be insufficient usually to pay the cost of typewriting the document, hence its employment is a fiction and a farce.

8th. No portion of the work of contract writing requires greater experience and ability than the forecasting of all possible eventualities that would materially affect the agreement and the proper provision for what is to be done in the case of each eventuality. All contracts are more or less faulty in this particular, for it would require omniscience to forecast all future happenings; nevertheless, in preparing an important contract one should endeavor to foresee and provide for all possibilities and probabilities. The lawyer or engineer who makes a practice of giving this important matter full consideration in every contract that he writes will soon find himself in demand by capitalists to aid them in making their investments and in consummating their enterprises.

9th. The matter of penalties is one that has to be handled with gloves, for the law is very jealous of its rights and prerogatives, and deems that it alone is authorized to specify and enforce a penalty, which it interprets as a punishment for failure to perform or comply with the terms of an agreement. On this account it is better not to use the term "penalty" in any contract but to employ instead that of "liquidated damages." In my practice I have a clause in construction specifications that reads as follows:

"For each day of delay beyond the date set in the contract for completing the entire work herein outlined, all in accordance with the plans, specifications, and directions of the Engineer, the Company shall withhold permanently from the Contractor's total compensation the sum of ..... dollars; and the amount thus withheld shall not be considered as a penalty, but as liquidated damages, fixed and agreed to in advance by the contracting parties as a proper compensation to the Company for the loss caused it by such delay."

Liquidated damages are but seldom enforced, owing mainly to the characteristic good nature of engineers; for they object to taking advantage of a contractor who has worked faithfully but has been unfortunate. Again, the fact that the sympathy of jurors is generally with the working man and against corporations is a reason why disputes involving the retention of money to compensate for delays are generally settled out of court.

10th and 11th. In most contracts for construction and in some other types of contract there is no need to provide for a possible abrogation of the agreement, because the completion of the work involved is a natural cancellation; but in some other types, such, for instance, as partnership contracts that continue indefinitely, full detailed provision should be made for annulment at any time. Great care should be exercised to describe fully how all current business matters are to be closed and what compensation is to be paid to the other party or parties by the party who desires the said cancellation. To do this in a satisfactory manner will require business knowledge and ability of the highest order.

12th. It is quite important in many contracts to state where the instrument was executed and where it is to be put in force, notwithstanding the fact that the residence of each party in case of individuals or the state of organization in case of corporations has been described in the introductory clause of the document. The laws governing a contract may be determined by the place where the contract was made or by that in which it is performed. Wait treats this question very thoroughly on pages 49 to 51 of his *Engineering and Architectural Jurisprudence*.

13th. Methods of making payments under construction contracts are generally covered in the specifications, where, in my opinion, they properly belong, although I have on several occasions been adversely criticized for not putting a payment clause in the contract proper. In all other types of contract in which payments of money are involved, full provision should be arranged for the exact manner in which all payments, both partial and final, are to be made. This remark applies with special force to contracts involving engineering fees; for in these, if payments on account are not arranged for, there is a chance that the engineers will receive no compensation at all until after the completion of their work, and this might be delayed for an indefinite period. Our usual practice is to ask one-half of our fee upon the completion of the plans and specifications and the other half in monthly payments proportionate to the amount of contract work done on the construction, so that when the latter is finished we shall have been paid in full. We have learned to provide also that we are compensated properly for all extra expense to us due to failure to complete the work in the time specified. It has cost us many thousands of dollars to learn this lesson, consequently the hint ought to be valuable.

14th. In construction contracts the subject of extra payments also belongs in the specifications, although in many cases it is covered in the contract proper. Our standard clause for this item reads thus:

"No extras will be allowed, unless they be ordered in writing by the Engineer. For extras so allowed the contractor will be paid the actual cost to him plus ten (10) per cent. for profit. Satisfactory vouchers will be required from the Contractor for all extra labor and materials."

15th. It is a wise precaution to provide for making changes in every important contract. Our standard clause for this item is as follows:

"No change or alteration shall be made in the terms or conditions of this agreement without the consent of both parties hereto in writing; and no claim shall be made or considered for any extra work, unless the same shall be authorized and directed in writing by the Engineer."

16th. In construction contracts there should always be a clause to govern assigning the contract and sub-letting the work. Our standard clause for this reads thus:

"The party of the second part hereby agrees that it will not assign or sublet the work covered in this contract, or any portion of it, without the written consent of the party of the first part; but will keep the same within its control."

17th. In respect to provision for settlement of disputes engineers are somewhat at variance. Some think that the Engineer should be the sole arbiter, but I do not believe that such an arrangement is just, savoring, as it does, altogether too much of autocratic rule. I am a firm believer in arbitration for the settlement of all disputes on important matters, and it has for many years been my custom to provide in all construction contracts for such a method of settlement. Our standard clause for this matter is as follows:

"The decision of the Engineer shall control as to the interpretation of drawings and specifications during the execution of the work under them; but if either party shall consider itself aggrieved by any decision, it may require the dispute to be finally and conclusively settled by the decision of three arbitrators, the first to be appointed by the party of the first part, the second

: the party of the second part, and the third by the two arbitrators thus hosen. In case that the two first chosen fail to agree upon a third, the tter shall be appointed by ..... By the de- sion of these three arbitrators or by that of a majority of them, both par- es to this agreement shall be finally bound."

The person chosen to appoint the third arbitrator should be ome prominent official such as the judge of a certain court, the ayor of a certain city, or the governor of a certain state.

It is seldom that an arbitration clause in a contract is utilized, ecause engineers as a rule are reasonable. Only once in my 30 ears of practice has it been appealed to. The subject of dis- ute in that case was some lumber very properly rejected by my spector as unfit for use. Unfortunately, the result of the arbitra- on was adverse to my decision, owing to a too friendly under- anding between the officers of the company and the contractor.

Notwithstanding the fact that the contract reads that "By the ecision of these three arbitrators, or by that of a majority of hem, both parties to this agreement shall be finally bound," the w has decided that the losing party has still a right to appeal the courts; consequently this clause of our form of contract is ot binding. Although I have known this for years, I have made change in the clause for the reason that at least nine con- actors out of ten prefer arbitration to the delays, uncertainties, nd expense that are inseparable from legal litigation, and I have ever heard of a case in which the loser by arbitration appealed the courts. It would simplify matters if immediately after an rbitration is agreed upon, each party concerned were to give to he other a bond guaranteeing that he will abide by the decision f the arbitrators.

18th. The bond question is a prominent feature of any con- ruction contract and occasionally is important in other types of ontract. My firm has finally come to the conclusion that a good urety company bond is the only kind that we shall either ask or or accept in future, for no other kind is so satisfactory to the ompany or is obtained with so little difficulty by the contractor. ll personal bonds are obtained by favor and they are generally ery unsatisfactory, for the solvency of the sureties is difficult prove, and to enforce payment is still more difficult. Many years go I had my first and last experience with a personal bond. It as when building my residence that I accepted from the con- actor a joint bond signed by three or four persons, among them good friend of mine. This bond was accepted by my lawyers, evertheless, later on when the contractor threw up the work I ound that the only responsible man on the paper was my friend. s I could not press him, I waived the matter, and in consequence as materially out of pocket.

There is considerable humbug in connection with sureties to greements, for a slight change in contract, plans, or specifications s often sufficient to render the bond null and void. If anyone doubt is statement, let him read what Wait says on pages 13 to 17 f his *Engineering and Architectural Jurisprudence*. In my opin- on, the only way to protect the company is to insist upon having bond that will permit of all necessary changes in plans and pecifications without releasing the surety, and even such a bond ight be avoided by the law's declaring it illegal because it departs rom current practice.

There are some very strange things about the law. On two or hree occasions I have been provoked to make the statement that laws are made to protect rogues against honest men," and truly does seem sometimes as if such were the case. Law and equity re two entirely different things. The less that engineers have to o with the former and the more they employ the latter, the better will be for all concerned.

In adjusting disputes I am a firm believer in the principle f compromise, or, to put it in more homely words, in that of "give nd take." It is nearly always practicable to bring two disputing arties to terms by suggesting a reasonable compromise.

19th. If, according to a contract, the contractor is to indem- ify the company against all liability or damages on account of ccidents, it is only fair that the former should be given the priv- ege of assuming the sole defense of all lawsuits arising from such laims.

20th. The manner of defining by special clauses names used n the contract, such as "Engineer," "Company," etc., will be seen y an examination of any standard form of contract.

21st. A contract can be dated either in the opening or in the nal clause or in both. In the latter case it is better not to repeat he date but to insert the sentence "Dated the day, month, and year rst herein written."

22d. It is important that the signatures coincide exactly with he names of the parties as given in the opening clause of the greement, and that proper seals are attached when they are needed. f a party to a contract be a corporation, its corporate seal should e used, but in the case of an individual almost any kind of seal ill suffice—either a wafer or the word "seal" with a scroll drawn round it with pen and ink being commonly used. In the latter case it is better to write in small letters the initials of the signer over the word "seal."

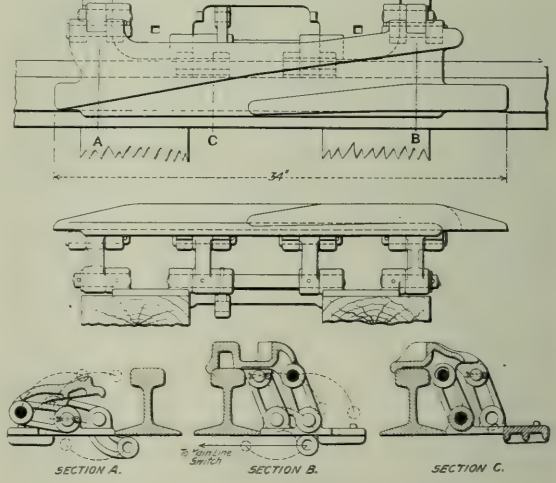
Let me here call your attention to an important and fundamental difference between contracts with and without seals. The former do not need to have a consideration mentioned in them in order to make them valid, while the latter do require such mention. In former times there was far greater difference in the importance of sealed and parole (or unsealed) contracts than there is to-day; for then a sealed contract could not be modified without taking many formal legal steps, while to-day it can be changed quite readily by a short supplementary contract, provided there be a proper consideration mentioned therein for the making of the change.

23d. Where the party to a contract is a corporation, the proper witness to the company's signature is the secretary of the company, who should use its corporate seal for attesting the document, but in case the party is an individual any witness will suffice.

The best possible witness to signatures is a properly authorized notary public; because if any doubt be expressed concerning the authenticity of the said signatures, all that is necessary is to prove the notary's authority, which is a matter of public record, while for all other witnesses it is obligatory to search for them and either produce them in person or prove that it is impracticable to do so on account of death or departure from the country; and in this case it is generally required that there be brought forward reliable parties who will swear that the witnesses' signatures are authentic.

A New Design of Derailer.

The derailer illustrated herewith was invented by Mr. George L. Mansfield, Mechanical Engineer in the engineering department of the Chicago & Alton. The primary object of the designer was the production of a derailer whose out-of-service position will be below the plane of the top of the rail. The method by which this is accomplished is pretty clearly shown by the drawings. The de-



The Mansfield Derailer.

railer is supported and moved by two pairs of links, arranged as shown. The inner pair is connected to the main line switch. The upper pin holes of this pair are larger than the pins and are given a cam surface, as shown in section at C, to impart a lifting motion to the derailer in order to clear the top of the rail. The sectional views show the derailer with a lip fitting over the inner rounded corner of the rail head. This is a precautionary feature designed to guard against any possibility of movement sideways under load. But as the position of the links and the relation of the parts is such that it is practically impossible for this to occur anyway, as the load would have to be raised in order for it to do so, the device is made with or without the lip, as desired.

The material is malleable iron, with the possible exception of the pins, which may be either of steel or turned malleable iron. The weight is about 85 lbs. The height of rail to which the derailer is to be applied determines the length of the links, of course.

The Mansfield derailer is handled by the Locomotive Appliance Company of Chicago.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX., No. 23. FRIDAY, DECEMBER 8, 1905.

The impression gained from reading that portion of the President's message which relates to railroad rates is that Mr. Roosevelt has clearly defined his ideas to the extent that rate making should be done only by an administrative commission, not by a court. He makes this point well, and he also takes up somewhat in detail the abuses of discrimination and the type of unfairness represented by the private car lines. The President again commits himself to the fallacy that there is a material difference between government rate regulation after complaint and government rate regulation *de novo*, but he dulls the weapon which he places in his agents' hands by expressing the belief that the rate making shall be done by promulgating a series of maximum rates on complaint. To prevent discrimination below the maximum rate he suggests that the commission may seize upon a discriminatory low rate and make that the maximum, thereby terrifying other evildoers and those disposed to be evil. This portion of the President's message, which is really the unfinished business of his first utterance on Federal rate regulation, is clever in evading some of the obstacles which have been shown, but offers no reason for believing that it can accomplish much. The British Railway & Canal Commission has been fixing maximum rates for some years without any really appreciable effect on the way traffic is handled. On the principle of the rebate and discrimination the President is much more convincing, and makes his idea stand forth sharply: "The law should make it clear so that nobody can fail to understand that any kind of commission paid on freight shipments, whether in this form or in the form of fictitious damages, or of a concession, a free pass, reduced passenger rate or payment of brokerage, is illegal." He also calls specific attention to the desirability that the accounts of common carriers should be absolutely open to the inspection of the government, in which we heartily concur. If we may be permitted to look ahead somewhat, we are inclined to prophesy that the portion of the President's address which deals with the strict matter of rate making and which started the extraordinary campaign of education that has been going on ever since the Esch-Townsend bill was brought forward, will produce results exceeding small, while his frank efforts to promote corporate honesty and straight and open dealing will bear fruit out of all proportion to any railroad legislation the country has ever had.

The Cincinnati, Hamilton & Dayton Railway Company was formed in 1895 as a consolidation of the Cincinnati, Hamilton & Dayton Railroad, the Cincinnati, Dayton & Ironton, and the Cincinnati, Dayton & Chicago. The Pere Marquette Railroad was organized in 1899 for the purpose of consolidating the Flint & Pere Marquette, the Detroit, Grand Rapids & Western and the Chicago & West Michigan railroads. The Chicago, Cincinnati & Louisville Railroad is a consolidation effected in 1903 of the Cincinnati, Richmond & Muncie and the Cincinnati & Indiana Western railroads with a projected line from Cincinnati to Chicago (282 miles) most of which has been completed. In July, 1904, the Cincinnati, Hamilton & Dayton Railway acquired control of the Pere Marquette through purchase of 11/16 of its common stock. These two companies then proceeded to acquire jointly the entire outstanding capital stock of the Chicago, Cincinnati & Louisville. In January, 1905, the Cincinnati, Hamilton & Dayton leased for 99 years the Ohio rights and property of the C., C. & L., and also secured the common use of its lines in Indiana, by guaranteeing the C., C. & L. bonds, assuming maintenance of the property in Ohio, and agreeing to pay its proportion of the cost of maintaining the lines in Indiana used in common. In March, 1905, the C., H. & D. leased the Pere Marquette for 999 years, the lessee to assume all obligations of the Pere Marquette and to pay as rental 4 per cent. dividends on its $12,000,000 preferred stock and 5 per cent. dividends on its $16,000,000 common stock. In April, 1905, the Pere Marquette assumed the entire capital stock of the Toledo Railway & Terminal Company. This is a rough outline of the corporate history of this much bought and sold property, embracing 3,099 miles of line owned and 3,668 miles as the total operated, between Buffalo and Ironton on the east, Petoskey, Bay City, Ludington and other Lake Michigan and Lake Huron points on the north, Chicago and Springfield, Ill., on the west, and Cincinnati and the Ohio river on the south—a system reaching a number of excellent traffic points in a comparatively small territory, but under highly competitive conditions and with no through outlet.

Having considered the position of the Great Central route made up of these properties in their central territory, as they existed prior to any outside interference, observe how they got their through traffic outlet, and what became of it. The Erie Railroad reaches the Cincinnati, Hamilton & Dayton, or the Great Central system, at Buffalo, at Chicago and at several points in between. The Erie directors in September, 1905, authorized the purchase of a majority of the capital stock of the Cincinnati, Hamilton & Dayton. This purchase was made through J. P. Morgan & Co., who bought through H. B. Hollins & Co., the Erie obtaining funds through the sale of its $12,000,000 convertible bonds, which had been authorized for

general improvement work. As described in the *Railroad Gazette*, September 22, the respective syndicate operations on the C., H. & D. property, which need not be detailed at this time, steadily raised the prices of the stock to $160 a share, which the Erie is understood to have paid for the majority of it; a price far too high. Now comes the dissatisfied Erie shareholder, who asks sharply about the bargain which his road has made with Mr. Morgan. Thereupon Mr. Morgan, perhaps acting under a species of coercion, following the inspection of the road, takes the property off the hands of the Erie, and an announcement is made that the $12,000,000 bonds will be released for the Erie improvements for which they were originally intended.

When the dust had cleared away it was apparent that several syndicates had made an excellent profit, that the Erie had had a bargain which it did not want, taken off its hands, and that Mr. Morgan has assumed control of a very much over-capitalized property. Announcements at once followed that a receivership had been asked for, and it is probable that the C., H. & D. finances can be very much improved in this way in a short time. It is certainly fortunate for the Erie that it need no longer be concerned with keeping this property out of insolvency. Perhaps no single individual has been more unfortunate in his relations with this tangled matter than Mr. Russell Harding, a strong and efficient railroad officer, who resigned as Vice-President after the property went into Erie hands because there was no apparent place for him in the reorganization, and who, owing to his natural relations with the several successive syndicates, is probably placed in an unfortunate light with the present management. Mr. Harding was exceptionally well qualified for the difficult task he undertook, and it will be hard to find a successor.

THE BAKER BRIDGE COLLISION

A feeling of shame is uppermost in reading the account of the Baker Bridge collision on the Fitchburg division of the Boston & Maine Railroad. There is despair, too, for the simple statement of fact that an engineman has run, with speed unchecked, past two warning and three danger signals, which he saw, shakes our confidence in the fidelity of men and in the value of warning signals. There is also indignation that an engineman of from four to five months' experience should be chosen to drive a fast express. Lyons was a good fireman. His record in that position was clean, and he knew the road—the division on which his work as an engineman was begun only last July. He had the information. He had passed the required examination, but, without any reasonable test of his mental capacity for that peculiar kind of responsibility needed in running fast trains safely, he was put in charge of a heavy fast express. The result was, not what might have been expected, but what might have been feared and guarded against by those who know that implicit obedience is a talent, and that the mental capacity for doing the same thing over and over again, thousands of times, is a higher talent and one that is essential in safe running at high speed.

At first sight, the cause of this accident, the running madly by signals set at danger, impairs our confidence in block signals. The case is singularly like the Westfield disaster, and we need to refer to that in considering the present one. The engineman who ran to Westfield was firm in the belief that he had a ten-minute time interval. His injector choked, his water was running low, and while he was turned from the window adjusting the injector, he became interested, lost count of time and forgot to look. The knowledge which he supposed he had of the time interval was the cause of his undoing, although he was running on a space-interval block-signaled road.

At Baker Bridge time interval signals were the only ones used. At each station, or position, where a man is permanently placed, a green signal is displayed for ten minutes after the passage of each passenger train. The fusees dropped on the track by the passenger train ahead of Lyons were adjusted to burn ten minutes. A possible ten minutes meant to Lyons, at the pace he was making, a space interval of six miles, so he kept a-going, watching, as he says, for the tail lights of the preceding train. Indeed, it is quite possible that he mistook a red tail light for another one of those fusees to which he had become accustomed. There is no limit to the absurdities which will creep in the mind of the engineman who allows himself to be influenced in his action by a belief that the interval between himself and the train ahead can be measured by time instead of by space.

There is nothing in the cause of the disaster at Baker Bridge, or at Westfield, to indicate that block signals and good discipline may not secure full measure of safety in following trains. There is no occasion for hysteria, for the demand for automatic stops, or for a third man in the cab, which is always made in times like this. They are wrong in principle. There is nothing to indicate that manual block signals, in either case, would have worked more for safety than automatic block signals. The accident at Mentor, on the Lake Shore road last July, would probably have been prevented by rail-circuit automatic signals, connected to indicate the position of the turn-out switch.

But block signal indications are useless unless they are obeyed. The British driver slows down when he sees the caution, and stops when he sees the stop—every time—and he does it every working day for thirty years without error. He is economical, saves money, has ambition simply to do his duty, hold his job and leave some money for his wife and children. Inspectors, station masters, gangers (track foremen)—every man on the line is watching. Running over signals is unforgiveable, and the man who does it may go to the poor house. We examine enginemen for eyesight, knowledge of the road and the machine, and then give them a run. So far this is good, and we are not saying that division superintendents are lacking in doing their level best in trying to get discipline. The fault seems to be in method, not in their lack of zeal and hard work.

An automatic attachment to signal posts is a system of automatic discipline, for it records for the information of the superintendent every time a train passes a signal at danger. Its cost and maintainance cost puts it out of the running, but it is a field for inventive genius.

"Surprise checking" is a method of testing the alertness and faithfulness of enginemen, and other men, which has had some astonishing results. It has detected and stopped practices liable at any time to produce accidents. But few roads have adopted this measure in a business-like way. The same principle, inspection without notice, is applied in securing honesty, politeness and neatness. Experience at home and abroad indicates that systematic close inspection is the only way to maintain discipline. This is true of insurance company officers, banks, trust companies—officers as well as employees of all corporations.

It needs to be recognized that in the present state of the art, on many roads, under certain circumstances, the "permissive system" is necessary in order to avoid delays. For example, a heavy train on an up-grade may well pass a red if it keeps its speed down to about five miles an hour, and so avoid being stalled. This simply illustrates that to all rules there are exceptions, but the rule for the engineman, "Thou shalt not pass the red," should have but few and carefully guarded exceptions.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers is holding its annual meeting this week. This is the event of the year for the society, and should be for the mechanical world of the country. The standing of the society is, we suppose, high among foreign associations, including as it does, among its members, men who have done the best work along their own lines that have been done anywhere. It is a pity, however, that an association that should be representative of the very best work of the country, and whose proceedings should be regarded as the embodiment of all that is most valuable, should stand so low in the estimation of many of its own members. As a matter of fact, the proceedings are generally regarded as of little or no value, and many members continue their membership more because they think that there ought to be such an association than because they think it is in any way advancing their own interests or doing much or anything to advance the prestige of the American mechanical engineer. It seems to be a lamentable fact that the management fails to enlist the interest of members who are capable of writing valuable papers or make contributions to the proceedings in the form of discussion.

It must not be understood, of course, that there is absolutely nothing of value in the line of rather bulky volumes that the society has been issuing year after year. Here and there some paper stands out like an oasis in the desert, but the great bulk of what has been published has been profitable chiefly to the printer who prepared the work. Back volumes are crowded with abstruse mathematical calculations that no one reads or studies, or "write-ups" of some new device, of more or less value, whose designer has been shrewd enough to secure its free advertising in the proceedings.

There must be some reason for this lack of interest, and one explanation of it may be found in the wide diversity of interest of the

members. They may all be experts along their own particular lines, but large as the society is, it apparently does not number any great body of men who are experts on the same subject. The result is the discouraging one to an author, that if he prepares and presents a paper of value, the chance of its receiving an adequate discussion is very slim. In fact, throughout the whole range of the society's proceedings it is seldom that the discussion is worth the paper it is printed upon. In this respect the society is working under a great handicap as compared with its two great rivals in the railroad field. There everything that is presented falls under the eyes of experts, and is discussed by them in a manner that develops and establishes the ideas of the writer so as to give them the stamp of approval, or they are submerged beneath an ocean of adverse criticism from which they cannot arise; or as an alternative, they are posted for further investigation and report. Such treatment could not fail to produce the fruits that it has, namely, a line of proceedings that outrank in practical value those of any other associations of the world. The same holds true, in a smaller way, of the railroad clubs.

When the American Society of Mechanical Engineers decided to hold its meeting in Saratoga in June, 1903, a hope was expressed by many that a lesson would be learned and a hint taken from the two great railroad associations in session there at the same time and that some of their life and vigor would be infused into the more sedate, if not more dignified, body. That an impression was made, there can be no doubt, but it is to be feared that the impression was fleeting. One of the past presidents as he walked through the supplymen's exhibit, after attending one of the technical sessions, said that he had heard of these meetings, but had no idea that "they were like this." The mechanical engineers found themselves overshadowed so thoroughly that few knew that they were there, and the regrettable part is that their meetings were neglected and unattended by their own members whose interests led them in anyway towards the other associations.

A lamentable weakness is found in the fact that the precedents of the society forbid it to do anything. It never has done or approved of anything, and, therefore, it never should or will. The reason for this attitude is impossible to understand. Why, if a thing is good or a practice is the best that is known, a great society should not have the courage to give it the attest of its approval, is "one of those things that no fellow can find out." There is no inducement for an individual or a committee to do any work toward the establishment of a standard of construction or practice with the full knowledge of its fate starting out, and the certainty that the matter will receive a desultory consideration and then be dropped. Men like to achieve results, and not have their hard work wasted.

The success of any association depends upon the enlistment of the interest of its members, and this can only be done by getting them to work for the organization. But men will not work for a reward bound up in a page in a volume of dry proceedings. They want their work indorsed or condemned, and until this association will gird up its loins and have the courage of its convictions to say that a thing is good, bad or indifferent, it is to be feared that it will continue in the same uninteresting and valueless rut that has characterized its past.

To criticize is easy, to suggest a remedy is quite another problem. A few years ago a committee of members who were dissatisfied with the general conduct of the society's affairs made an attempt at a regeneration. Although they succeeded in killing an obnoxious measure that was the immediate target of their efforts, they received such half-hearted support from the great mass of the membership that after the meeting they met no more, and matters were allowed to go on in the old way, excepting perhaps for the introduction of some minor reforms in expenditure. The society exists, or should exist, for the purpose of promoting the interests of the American mechanical engineer, and this it certainly is not doing to any marked extent. Its regeneration is in its own hands, for certainly the outsider will not exert himself in the matter. The pity is that there does not seem to be any one who takes enough interest in its existence to stir up an interest in others, and thus make the society what it ought to be—an institution of high value to itself and to the country. The only positive recommendation that can be made is the suggestion that an examination be made into the ways and methods of the railroad clubs and associations, and a lesson be taken in the means adopted to maintain interest not only in the presentation of papers but in the adequate and thorough discussion of them, with final official approval or disapproval of what has been offered for consideration.

"Shop Kinks."

Labor, time, and power saving devices, commonly known as shop kinks, of which a number are found in almost every progressive railroad shop, have much to do with the efficiency of the shop. In many cases with them the time for doing a certain piece of work is reduced as much as from 50 per cent. to 75 per cent. A number of these devices are suggested by, and in many instances have been designed complete, by the mechanics in the shop, but it is seldom that those "higher up" ever credit these men with the origin of any of the kinks. When they are questioned as to who designed such or such a device they invariably answer, "Why, I got that up." Foremen, master mechanics, and even those in higher positions, in many cases seem to be afraid to acknowledge that those under them are endowed with any originality whatever. It would be far better if the feeling were different and instead of trying to hide the origin of such meritorious devices that do originate with the mechanics, they would openly proclaim and credit those with whom such devices originate. This would greatly tend to encourage the practice of originating time and labor saving devices, and at the same time it would produce a better feeling among the mechanics, who, it must not be forgotten, are human and who appreciate "fair play" as well as others who are fortunate enough to hold better positions. From the mere fact that a saving of from 50 per cent. to 75 per cent. is gained by the use of some of the devices it shows that they are of no little importance, and this being the case it seems strange that a record of such devices should not be more generally kept. As a rule, no drawings or records are kept of shop kinks. Rough sketches are made, but these are destroyed as soon as they have served their purpose. More often, however, no sketches whatever are made; the devices are simply made from verbal instructions and, if satisfactory, all well and good; and if not, nothing is said. In many cases devices which have increased the output many times in the shops where they are used are not even heard of in other shops of the same railroad. It seems strange that the mechanical departments do not pay more attention to such details as these. If a device saves from one-half to two-thirds of the time for doing a certain piece of work in one shop why should it not save the same amount in another shop doing practically the same work; and, again, why is it not worth while to see that it is adopted in all of the shops of the entire system? There is no reason why it should not be done, nor is there any reason why a good device used in any one railroad shop should not be used in all railroad shops. Unlike commercial shops, there is practically no competition in shop work among rival railroads, so that a general interchange of designs of good shop kinks would be beneficial, and would tend to increase output. It is common for railroad shop foremen, and even for machinists, to say that they would like to visit other railroad shops, and see what methods are employed for doing a certain piece of work. When asked why they do not go, they answer that they cannot afford to lose their pay. In other cases they answer that the management does not care to have them lay-off.

The practice of letting the men visit other shops should be encouraged. Commercial shops encourage and pay their shop foremen and others of their shop force to visit the shops of their competitors and study their methods, so why should it not be equally advantageous for railroads to do the same? Suggestions picked up by the men on such visits would often greatly increase their earning capacity and would pay for the expense incurred many times over. It is true that the master mechanics and those "higher up" exchange visits, but it is very seldom that a shop or gang foreman is allowed to take a day off for the purpose, unless he does so at his own expense. Yet they are the ones who come in actual contact with the work and they are more apt to notice details than is the master mechanic, whose time is pretty well occupied with a multitude of details; with correspondence and office work. The *Railroad Gazette* has endeavored to help shop men by descriptions of shop kinks from time to time, and is always glad to receive and to publish contributions of this kind.

The news from a number of state capitals during the past week or two has contained a variety of instructive items illustrating the science of rate making by the State. In Virginia the Corporation Commission has been listening to a "brilliant array of counsel" who have argued against a rule reducing to 15 cents the minimum charge for a single shipment of freight. The three principal roads of the State are strenuously objecting to the rate as inequitable and oppressive. The discussion here reported is, evidently, only a preliminary skirmish, as the "actual argument" was to begin December 5. While the objections to these rates are undoubtedly well founded, the railroads may have the consolation of reflecting, in case they are defeated, that many a road in other states has had to make this reduction without a murmur because of the rise of a trolley line alongside the railroad. In Kentucky an inquiry has been begun by the Railroad Commission which in its magnitude makes a 15-cent dispute seem small in the extreme; it is proposed to do nothing

less than gather, *de novo*, everything worth knowing about all the railroads of the state; and after a brief preliminary hearing each company has been favored by the commission with a list of 42 questions which, it seems likely, will require 42 weeks to answer; and the Louisville & Nashville, apparently looked upon as the chief sinner, is asked many more. The railroads claim that their rates in Kentucky at present are reasonable and that there is neither a general demand for reductions nor any legitimate agitation of the subject; and, so far as can be judged from what the newspapers tell us, the attitude of the railroads is correct. Oklahoma is in the happy position of having a law, the Noffsinger Demurrage Law, which was intended to punish the railroads but which the shippers say is unnecessary. Under Mr. Noffsinger's proposition, the railroads are penalized a dollar a day per car, more or less, in case they are unable to furnish cars as asked for by shippers; but, says a prominent grain dealer, who has corn piled high on the ground along the tracks of the Santa Fe road, "What would be gained by applying the law? One might as well sue a hotel for not furnishing him a room when all the accommodations are taken." In other words, the railroads are using their whole stock of cars in the most expeditious manner possible. In Ohio the drummers are so exercised over the fact that the roads of Michigan are furnishing a more convenient interchangeable mileage ticket than that of the Central Passenger Association, south of Michigan, that they propose not merely to invoke the power of the State to whip the Central Passenger Association into the traces, but they are going to mass a battery, so to speak, of three States. They have called a conference to be held in Chicago this week, at which they expect to have present the governors of Michigan, Indiana and Ohio.

The Signal Engineer of the Union Pacific, Mr. A. G. Shaver, is inquiring about the practice and views of other signal engineers in the matter of setting signals in yards where there are side tracks, necessitating either moving the sidetrack out so that the signal can be set adjacent to the main line, or using a bracket post. Mr. Shaver favors moving the sidetrack out to a distance of seventeen feet (centers) from the main track unless there is some unusual obstacle. He finds that it is difficult for trainmen and enginemen to understand the meaning of a bracket post. He holds also that if a bracket post must be used there should not be more than one blind doll; that is, a signal should not be removed farther away than across one track. We suspect that Mr. Shaver will find most of his correspondents in the position of the Maine man on the prohibitory liquor law—in favor of his theory, but against its enforcement—unless the cost of moving out the sidetrack can be made very small or else concealed under some other account. There are many main line signals, no doubt, which are set outside of sidetracks and *not* put on bracket posts; and which have been in successful use for years. This arrangement is now admitted to be theoretically wrong, but in practice it is justified by the unscientific, though often comforting, doctrine that "a signal means whatever the superintendent says it means." That many superintendents have carried out this idea all right with a simple semaphore, without a doll, while the Union Pacific superintendents have difficulty in making a bracket post mean what they say it means, must be attributed to the innate depravity of enginemen. Perhaps on the Union Pacific the trouble is with the "doll"; one with winking eyes and real hair might be an improvement. Seriously, however, we think that the doll would fulfill its function much better if it were somewhat larger—more like a full-size semaphore post—and if at night it carried something better than a blue light. In other words, it should be made more important both by night and by day. There would still remain the question whether it was of any use. The practice of those roads which have for a dozen years used plain semaphores set 10 ft. or 15 ft. outside the ditch, tends to show that the bracket is not worth much—has only theoretical virtue. Mr. Shaver might do well to inquire (of roads using brackets for single signals), how many cases there have been of enginemen going wrong because they did not apprehend the information that the doll was intended to convey to them.

NEW PUBLICATIONS.

Year Book of Legislation: Issued by the New York State Library, Albany, 1905. Price, $1.

This is a book an inch and a quarter thick containing three bulletins issued this year by the Library, containing (bulletin No. 23) a digest of governors' messages of the year 1904; (bulletin No. 24) a summary and index of legislation of the same year, and (bulletin No. 25) a review of legislation. All of these documents have been edited by Mr. Robert H. Whitten, Sociology Librarian. The matter in the messages of the governors (of all the states of the union), including the President's message, is briefly digested and topically arranged. The index of legislation gives data concerning 2,190 laws and constitutional amendments, all elaborately classified. The items are classified and numbered so that the reader can by the numbers follow a subject from year to year in successive indexes, and the numbers are so arranged that it is easy to refer from the governors' messages bulletin to that on legislation, and vice versa. The third bulletin, the review of legislation, is made up of monographs by 40 specialists, each reviewing the year's progress in one particular field. All of the work appears to have been done by careful hands and the Year Book thus furnishes a useful guide to the legislation of the year throughout the whole of the United States. Each of the three bulletins is well indexed and there is at the end a 40-page index of the whole.

TRADE CATALOGUES.

Books Relating to Railroads and Steam Navigation.—The "Railroadiana," a pamphlet published by Edward Baker, contains the names and prices of upwards of 1,500 books, pamphlets, maps, guides, time-tables, etc., connected with the origin, rise and development of both American and foreign railroads. These books, which have taken over 20 years to accumulate and which include many items which it would be impossible to duplicate, are for sale at Edward Baker's "Great Book Shop," 14 and 16 John Bright Street, Birmingham, England. A chronicle of books relating to steam navigation, the navy and allied subjects is also published by Edward Baker.

Electric Emery Grinders.—A new heavy stationary emery grinder, made by the Stow Mfg. Co., Binghamton, N. Y., is illustrated and described in a neatly gotten up folder issued by the above company. "Semi-Portable" might be a better name for this machine, inasmuch as by simply loosening a few bolts it can be readily changed from one place to another without regard to countershafts or lineshafts. It is driven by a multispeed motor, and two wet or two dry wheels can be used, or a dry wheel can be placed at one side and a wet wheel at the other side of the motor.

Steam Shovel News.—The current issue of this magazine, which is No. 5 of Vol. I, has 14 pages of interesting matter pertaining to its limited field. Some interesting steam shovel performances are illustrated from photographs and described, and the opening article enumerates some of the large engineering works of the near future. The issue of the magazine bi-monthly is announced, beginning with this number, with the expectation of later making it a monthly publication.

The Los Angeles Limited, a new train to be put in service on Dec. 17 by the Chicago & North-Western, Union Pacific and San Pedro, Los Angeles & Salt Lake roads, is announced on handsomely engraved cards in script, giving a brief description of the equipment and service and a condensed schedule. The train is to have an observation and a dining car, news bulletins, and all the latest "attractions." The time through Chicago to Los Angeles is about 68 hours.

Water Lifted by Compressed Air.—A general idea of the possibilities of compressed air for pumping water is given in a catalogue which is being distributed by the Ingersoll-Sergeant Drill Co., New York. The theory of the air lift is explained and a number of line and half-tone illustrations show the arrangement of wells and piping which are necessary for its operation. The economy derived from this method of lifting water is also briefly discussed.

Steam Hoisting Engines.—Single-drum, two-drum and three-drum hoisting engines made by the C. W. Hunt Company, West New Brighton, Staten Island, N. Y., are illustrated and described in detail in a neatly gotten up catalogue issued by the above company. Illustrations of a number of interesting hoisting arrangements, including hoisting masts and elevators of both wood and steel construction, are also shown.

The Pennsylvania Special, the 18-hour New York-Chicago train of the Pennsylvania Lines, has been set to music by the well-known bandmaster, F. N. Innes, in a march dedicated to Samuel Moody, General Passenger Agent. A presentation copy of the piece may be had by sending four cents for postage to Pennsylvania Lines Advertising Bureau, 702 Union Station, Pittsburg, Pa.

Motor-Driven Air Compressors.—Stationary and portable motor-driven air compressors for both continuous and intermittent service made by the National Electric Mfg. Company, Milwaukee, Wis., are illustrated and described in a neat folder which is being distributed by the above company.

Drills and Chucks.—The "Rich" flat drills and drill-chucks are illustrated and described in a pamphlet issued by the Geo. R. Rich Mfg. Co., Buchanan, Mich. These drills are of high-speed steel and are capable of operating at high speeds and heavy feeds in hard and tough materials.

The Union Pacific.—The passenger department of the Union Pacific is distributing reproductions of a crayon drawing of "The Oldest

Inhabitant on Line of Union Pacific"—a magnificent buffalo. The print, which is 20 x 24, is in rich brown tones and is unmounted for framing.

Drop Forgings.—A neat and interesting pamphlet containing a historic sketch of Geo. H. Corliss, the inventor of the Corliss engine, is being distributed by Wymon & Gordon, Worcester, Mass., makers of drop forgings.

CONTRIBUTIONS

Foolish Graft.

Richmond, Va., Nov. 25, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I herewith attach a proposition which is one of several which has come to us and which stripped of all trimmings is simply a bribe, pure and simple. As these propositions are being undoubtedly distributed broadcast over the country, and may be the means of starting some man on the downward path, and knowing the attitude of the *Railroad Gazette* on all such matters, I especially call your attention to this and trust you will do what you can to prevent such advertisements going out amongst railroad and other mechanical men.

H. A. GILLIS,
Superintendent, American Locomotive Co.

[Mr. Gillis correctly interprets the following proposition, which is an offer of a gold watch free in return for a trial order for "Electric Belt Dressing," made by the Buffalo Specialty Company, Buffalo, N. Y.—EDITOR.]

APPROVAL REQUEST.

(Place and date) .....1905.

BUFFALO SPECIALTY COMPANY, BUFFALO, N. Y.

Gentlemen:—Send us, free of charge, one 20-year, Solid Gold Filled Watch, guaranteed exactly as shown and described on this sheet.

In consideration of said gift, you may ship us on 60 days' trial and approval, a 60-lb. drum of Electric Belt Dressing at your lowest price of 35 cents per lb. F. O. B. Buffalo (amount of bill, $21.00) with the understanding that after 60 days' trial of the Dressing and Watch we will decide whether we want to keep them or not, and upon said trial and examination if we are not delighted with the watch and the goods we are to return both at your expense. Otherwise we are to pay the bill at the end of said 60 days, and keep the watch, which we understand is a distinct gift, with the first order only. We further agree to observe results closely and if the Dressing proves as you state, to recommend it to our friends when occasion presents itself.

Yours truly,

535 .....

To Prevent Accidents.

New York, Nov. 6, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have just finished reading the editorial in your issue of November 3, "Where Government Control of Railroads Is Needed," and I want to heartily endorse the stand you have taken.

I admire your courage in coming out in the open and saying what ought to be said, and believe and hope that such words coming from you may do some good. I am satisfied that if an investigation of railroad accidents was made by some expert and disinterested person who had authority to compel the adoption of the necessary remedy (recommendatory authority does not count in this country) that our accident list would be greatly reduced. Indeed, the mere knowledge that such an investigation would be made would help to bring about an improvement.

One trouble about Government inspection would be to get competent men for the salaries the Government (it always expects a man of that kind to work for one-third or one-half of what anyone else does) would pay. You are probably aware that all the fire and casualty insurance companies have inspectors to examine risks and that these inspectors really inspect and recommend protective measures on the part of the insured, and that unless such recommendations are carried out the insurance is cancelled, with the result that the protection is taken before and not after the damage is done. If something of this kind were done on the railroads I believe much good would result. Or if the great systems, especially, had officers to make such inspections, as well as investigation of accidents, who were given titles, authority and salaries which would bring them proper rank and respect, I believe that they could do untold good, and cut the accidents and personal injuries account of the railroad companies in two.

I have for years tried to have our General Manager appoint such an inspector to make investigation of the conditions and accidents on our line, who would report direct to him so that he would know the truth about the matter; for, although some claim departments furnish their General Manager or operating department with brief statements of avoidable accidents immediately after they occur, the matter is referred for investigation to the very officers who may be at fault, and who would be more than human if they reported against themselves. But what I believe would do most towards preventing accidents would be the education of employees as to the rules and their duties; why the rules are made, and what will probably happen if they are not observed. As an illustration of the ignorance of employees about the most important rules, I investigated last summer a collision, and out of all the men on the two trains who were not killed (and three of them were) there was not one man who really understood and knew what the flag rule was, and surely that is one of the most important rules in the book; and yet these men, with one exception, had been in the service for some years, and if the rule had been complied with and the fusees put out, as the rule required, which was not done, in all probability the accident would not have occurred.

RAILROAD OFFICER.

The Interstate Commerce Commission Bill.

Following the Foraker bill, the Interstate Commerce Commission has introduced a measure of its own to amend the Act to Regulate Commerce of 1887. The first section as amended differs from the original in striking out the clause "under a common control, management or arrangement" in prescribing the common carriers to whom the provisions of the Act shall apply in interstate commerce; also in the important particular that the term "transportation" shall include cars and other vehicles and all instrumentalities and facilities of shipment or carriage irrespective of ownership or of any contract, express or implied, for the use thereof, and all services in connection with the receipt, delivery, elevation and transfer in transit, ventilation, refrigeration or icing, storage and handling of property transported; and it is added that it shall be the duty of every carrier, subject to the provisions of this Act, to provide and furnish such transportation upon reasonable request therefor.

Section 6 of the Act to Regulate Commerce as amended March 2, 1889, to the effect that common carriers must keep open to public inspection their schedules containing classifications of freight, etc., stating separately terminal charges and any special rules or regulations which affect the aggregate of the entire rate, and that these through schedules must be similarly shown by any common carrier subject to the provisions of the Act who receives freight in the United States to be carried through a foreign country to any place in the United States, in lieu of which such goods shall be subject to customs duties as if the freight were of foreign production—that no advance shall be made in charges except after 10 days public notice, that reductions shall only be made after three days public notice, and that rates and charges must be collected as published—that common carriers subject to the provisions of the Act must file with the Commission copies of their schedules and of contracts and agreements with other common carriers; these stipulations, together with the penalties attached for non-compliance, are amended to read as follows:

"Sec. 6. Every common carrier subject to the provisions of this Act shall file with the Commission created by this Act tariffs showing all the rates, fares, and charges for transportation, as defined in the first section of this Act, between points upon its own route and between points upon its own route and points upon the route of any other carrier when a through route and joint rate have been established by agreement or otherwise; and this provision shall apply when the route connecting two points in the United States passes through an adjacent foreign country, and when the traffic is moving to or from any foreign country. Such tariffs shall plainly state the places between which passengers or property will be carried, shall contain the classification of freight in force, and shall also state separately all terminal charges, including storage, and all privileges or facilities which shall be allowed other than those involved in the transportation of passengers or property, as defined in the first section of this Act, in ordinary course between two definite points, and any rules or regulations which in anywise change, affect, or determine any part or the aggregate of said rates, fares, and charges, or the value thereof, to the shipper or consignee. Every such common carrier shall also file with said Commission copies of all contracts, agreements, or arrangements relating to any traffic or transportation affected by the provisions of this Act to which it may be a party.

"The carrier shall plainly print such tariffs in large type, and shall keep posted, for the use of the public, two copies in two public and conspicuous places in every depot, station, or office of such carrier where passengers or freight, respectively, are received for transportation, in such manner that they shall be accessible to the public and can be conveniently inspected.

"No change shall be made in any tariff of rates, fares, and charges filed and published as aforesaid, unless the carrier shall file with the Commission a statement showing such changes and the date when they shall take effect, and shall post new tariffs, as hereinbefore provided, or plainly indicate such changes upon

those already posted, at least 60 days before the taking effect of such changes; but the Commission may, for good cause shown, allow changes upon less than 60 days' notice, and may do this either in a particular instance or by general order applicable to special conditions and species of traffic.

"The names of the several carriers which are parties to any joint tariff shall be specified therein, and each of the parties thereto, other than the one filing the same, shall file with the Commission such evidence of concurrence therein or acceptance thereof as may be required or approved by the Commission; and where such evidence of concurrence or acceptance is filed it shall not be necessary for the carriers filing the same to also file copies of the tariffs in which they are named as parties.

"The Commission may determine and prescribe the form, subjects to be contained in, and arrangement of the tariffs required to be published and filed, as aforesaid, and may change such form, subjects or arrangements thereof from time to time as shall be found expedient.

"The Commission may, in its discretion and for good cause shown, change or modify the foregoing requirements in respect of the publishing, posting, and filing of tariffs, and may do this either in particular instances or by general order applicable to special or peculiar circumstances or conditions.

"No carrier shall, unless otherwise provided by this Act, receive or participate in the transportation of passengers or property, as defined in the first section of this Act, unless the rates, fares, and charges upon which the same are transported by said carrier have been filed and published in accordance with the provisions of this section; nor shall any carrier charge or demand or collect or receive a greater or less or different compensation for such transportation of passengers or property, or for any service in connection therewith, between the points named in such tariffs than the rates, fares, and charges which are specified in the tariff filed and in effect at the time; nor shall any carrier refund or remit in any manner or by any device any portion of the rates, fares, and charges so specified, nor extend to any shipper or person any privileges or facilities in the transportation of passengers or property, except such as are specified in such tariffs.

"Any freight shipped from the United States through a foreign country into the United States, the through rate on which shall not have been made public as required by this Act, shall, before it is admitted into the United States from said foreign country, be subject to customs duties as if said freight were of foreign production, and any law in conflict with this section is hereby repealed."

Section 13 of the original Act specifies those persons entitled to make complaints and the manner in which these complaints are to be made to the Commission by petition. This section remains practically unchanged except that carriers are included among those who may complain, and it is also specified that the Commission, if required, shall verify the answers made by carriers to charges against them which have been handed them for reply by the Commission.

The crux of the Interstate Commerce Commission's Bill lies in Section 15 as amended. The original Section 15 of the Act to Regulate Commerce reads as follows:

"That if in any case in which an investigation shall be made by said Commission it shall be made to appear to the satisfaction of the Commission, either by the testimony of witnesses or other evidence, that anything has been done or omitted to be done in violation of the provisions of this Act, or of any law cognizable by said Commission, by any common carrier, or that any injury or damage has been sustained by the party or parties complaining, or by other parties aggrieved in consequence of any such violation, it shall be the duty of the Commission to forthwith cause a copy of its report in respect thereto to be delivered to such common carrier, together with a notice to said common carrier to cease and desist from such violation, or to make reparation for the injury so found to have been done, or both, within a reasonable time, to be specified by the Commission; and if, within the time specified, it shall be made to appear to the Commission that such common carrier has ceased from such violation of law, and has made reparation for the injury found to have been done, in compliance with the report and notice of the Commission, or to the satisfaction of the party complaining, a statement to that effect shall be entered of record by the Commission, and the said common carrier shall thereupon be relieved from further liability or penalty for such particular violation of law."

This has been amended to read as follows:

"Sec. 15. If, after full hearing of a complaint made as provided in section thirteen of this Act, the Commission shall determine that any party complainant is entitled to an award of damages under the provisions of this Act for a violation thereof, the Commission shall make an order directing the carrier to pay to the complainant the sum to which he is entitled on or before a day named.

"If, after full hearing of such a complaint, the Commission shall be of the opinion that any existing rate for the transportation of persons or property as defined in this Act, or any regulation or practice whatsoever affecting such transportation, is unreasonable or unjustly discriminatory, it shall be the duty of the Commission to determine what will be a just, fairly remunerative, and reasonable rate, regulation or practice to be charged, imposed, or followed in the future in place of that found to be unreasonable or unjustly discriminatory, and to order the carrier to observe the same; and in so doing the Commission shall have power (a) to fix a maximum rate; (b) to fix a differential and to prescribe both a maximum and a minimum rate to enforce the same when that may be necessary to prevent discriminations forbidden by the third section, but not otherwise; (c) to change the classification of any article.

"If the rate so fixed by the Commission shall be a joint rate, and the carriers parties thereto fail to agree upon the apportionment thereof between themselves within 20 days after notice of the order fixing the same, the Commission may make a supplemental order declaring the portion of such joint rate to be received by each carrier party thereto, which order shall take effect as part of the original order.

"The Commission may also, after full hearing of a complaint, establish through routes and joint rates and fix the division of such rates and the terms and conditions under which such through routes shall be operated, when that may be necessary to give effect to any provision of this Act, and the carriers complained of have refused or neglected to voluntarily establish such through routes and joint rates.

"If the owner of property transported under this Act directly or indirectly renders any service connected with such transportation, or furnishes any instrumentality used therein, the Commission may, after full hearing of a complaint, determine what is a reasonable charge to be paid by the carrier for the service so rendered or the use of the instrumentality so furnished, and fix the same by appropriate order, which order shall have the same force and effect and be enforced in like manner as the orders above provided for in this section.

"The foregoing enumeration of powers shall not exclude any power which the Commission would otherwise have in the making of an order under the provisions of this Act.

"Every order of the Commission shall fix the date when it is to take effect, and shall be forthwith served by mailing to any one of the principal officers or agents of the carrier at his usual place of business a copy of the report and opinion of the Commission, together with a copy of the order; and the registry mail receipt shall be *prima facie* evidence of the receipt of such order by the carrier in due course of mail."

Section 16 of the original Act provides that the Commission may enforce its orders through petition to a Circuit Court sitting in equity in the judicial district in which the common carrier complained of has its principal office or in which the violation complained of shall have happened; also, that the findings of fact in the report of the Commission shall be *prima facie* evidence in the trial and that the Court may issue a writ of injunction, or other proper process, to restrain the common carrier from disobedience; also, that when the subject in dispute shall be of the value of $2,000 or more, an appeal may be taken to the Supreme Court, although such appeal shall not operate to stay or supersede the order of the Court or the execution of any writ or process thereon; that these cases are to be prosecuted by the District Attorney and the costs borne by the United States. The amendment to this, constituting the sixteenth section of the bill now presented by the Interstate Commerce Commission, broadens the range of districts in which a complaint may be brought and provides that after service of the petition there shall be pending in the Court a civil suit for the recovery of the damages which shall proceed from then on in all respects like a civil suit for damages for a breach of contract except that the findings and order of the Commission shall be *prima facie* evidence of the facts therein stated, and that the petitioner shall not be liable for costs in the Circuit Court nor at any subsequent stage of the proceedings unless they accrue upon his appeal. If the petitioner shall finally prevail he shall be allowed a reasonable attorney's fee, to be taxed and collected as a part of the costs of the suit. A time limit of three years is set as an outlawry period for complaints.

Within 30 days after receiving an order, other than an order for the payment of money, a carrier may begin in the Circuit Court proceedings to vacate the order by filing a bill in equity. If the order of the Commission is vacated by the Court, and if the defendant does not appeal to the Supreme Court, the Commission may reopen the case for further hearing and order or it may make a new order without further hearing not inconsistent with the decision and opinion of the Circuit Court. Upon the filing of such a petition to vacate an order the Circuit Court may extend the time within which the order shall take effect, not to exceed in all 60 days from the date of service of the order upon the carrier. The Court may also, if it plainly appears that the order

is unlawful and not otherwise, suspend the operation of the order during pendency of the proceeding or until the further order of the Court. If no proceedings to vacate an order are begun within the time limit or if the effect of the order has not been suspended in any of the ways provided, it becomes known as a final order, and carriers who knowingly neglect to obey a final order shall forfeit to the United States $5,000 for each offence, or $5,000 a day for a continuing violation. The Commission is entitled to apply to the Circuit Court in its own name for an enforcement of an order, and in such a case the Court can enforce obedience by a writ of injunction. It is also provided that copies of schedules and tariffs and the statistics contained in the annual reports of carriers made to the Commission, as required by the Act, shall be preserved as public records in the custody of the Secretary of the Commission and shall be received as *prima facie* evidence of what they purport to be.

A new section is added to the Act to Regulate Commerce following Section 16 and numbered 16A which provides that after a decision has been made by the Commission any party thereto may at any time make application for a re-hearing, to be granted by the Commission at its discretion.

Section 20 of the Act to Regulate Commerce is amended to include the owners of all railroads engaged in interstate commerce as defined in the Act among those from whom annual reports are required. It is also provided that accidents to passengers, employees and other persons shall be reported, together with the causes of them. It is provided that the report shall be for the year ending June 30 and must be filed by September 30 next following, with penalties for non-compliance. The Commission also has authority to require the carriers to file monthly reports of earnings and expenses within a specified period. The Commission may in its discretion prescribe the forms of accounts to be kept by carriers, including traffic movement as well as receipts and expenditures of money. The Commission shall at all times have access to all accounts, records and memoranda kept by carriers subject to the Act, and it shall be unlawful for such carriers to keep any other accounts, records or memoranda than those prescribed or approved by the Commission, which is also entitled to employ special agents or examiners. A severe penalty is laid on any person who shall wilfully make a false entry in accounts, records or memoranda kept by a carrier, or who shall wilfully destroy or by any other means falsify these records. The examiners are estopped by a heavy forfeit from divulging any fact that may come to their knowledge during examination except in so far as they may be directed by the Commission.

Setting Valves with the Walschaert Gear.

BY THOMAS F. CRAWFORD, M.E.

The following method of setting locomotive valves with the Walschaert gear is in use at the Baldwin Locomotive Works:

The first step is to connect all rods and pins with the exception of the eccentric rod. This rod joins the crank pin arm to the base of the link and is left disconnected so that the valve may be moved freely backward and forward in obtaining the various port tram marks on the valve-stem. These are obtained in the usual manner, as are also the dead center marks on the rim of the main drivers. The engine, in this case a Pennsylvania consolidation, was equipped with inside admission piston valves and was therefore supplied with special holes through the steam chest walls so that the port edges of the valve could be placed exactly square with the admission port edge.

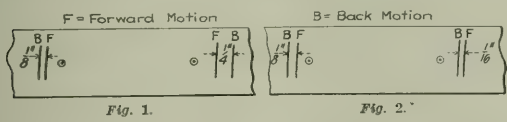


Fig. 1. *Fig. 2.*

Tram Marks on Valve Stem.

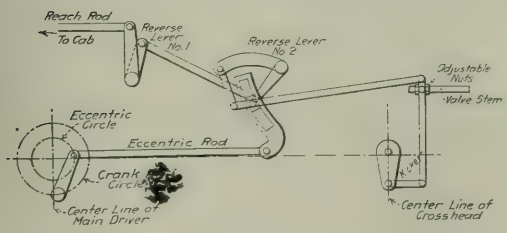


Fig. 3—Walschaert Valve Gear at Half Stroke.

The next step is to connect the eccentric rods on both sides and proceed to catch in succession the various centers for both the forward and back motions with the usual tram marks on the valve stem. For example, suppose the valve tram marks on the stem are as shown in Fig. 1; the back motion lapping the forward on both ends by the amount indicated. This means that the eccentric rod must be shortened, but the amount is the important question. At present it is customary to subtract the differences between the back and front marks at either end and shorten the rod three-quarters of this amount. Difference at front end, ¼ in.; difference at back end, ⅛ in.; ¼ in. — ⅛ in. = ⅛ in.; ¾ of ⅛ in. = 3/32 in. The rod would therefore be shortened 3/32 in. In another case if the marks were as in Fig. 2 the differences would be added and three-quarters taken. The three-quarters is obtained by allowing one-quarter for lost motion in the pins; this with the one-half required for the alteration adds to three-quarters.

A peculiar feature of the Walschaert motion is noticed at this point when making the above changes. The forward motion is direct and the back motion indirect owing to the fact that the link is stationary. When the link block is at the bottom of the link in the forward motion the eccentric rod acts direct on the valve rod through the block; but when the latter is at the top of the link in the backward motion the link acts as a rocker. After adjusting the forward and back motion in this manner it is still evident that the distance from pop mark to tram mark is not equalized; in other words, the lead is not the same at each end of the stroke. This inequality is adjusted by means of two large nuts which turn on the valve stem and face against the valve stem crosshead. We now have the valves set with the reverse lever in both corners, that is, with a link block clearance of ½ in. at either end.

It is desired, however, to obtain the most perfect adjustment for the position in which the reverse lever will be worked during the service of the engine. For this reason the link block is raised (in this case 6¼ in.), and the extreme valve travel is marked. If this varies at either end the valve stem nuts are again adjusted, sacrificing their former equality in order to be perfect at this cut-off.

It is well to mention the fact that the Walschaert motion has constant lead no matter what the cut-off may be. The shop man is therefore relieved from that difficult feature of ordinary valve setting—obtaining the proper lead. When the engine leaves the drawing board it has its lead and this remains unchanged. It is also interesting to note that the "kicker," or portion of the gear attached to the main crosshead, does not play any part in the valve setting. Its sole duty is to open the steam port rapidly at the beginning of each stroke.

From the foregoing description it is readily seen that there is a large amount of time saved in setting a Walschaert valve motion as compared with the Stephenson. In one observed case, with the ordinary run of luck it required four men 65 minutes to complete the whole operation. This included taking the left eccentric rod to the smith fire to be shortened 1/32 in. In this gang two men barred wheels, one man trammed the main drivers, and the other worked at the valve stem.

The above engine had the following dimensions:

Valve travel	6 in.	Cut off	½ stroke
Stroke of pistons	28 in.	Lead	3-16 in.
Diameter of cylinders	22 in.		
Outside lap	⅛-in. neg.		
Inside lap	⅛ in.		

Foreign Rails for Harriman Lines.

The Harriman lines are about to receive a large order of foreign rails. Twenty-one thousand tons, the contract for which was placed during the early part of November with Spanish mills—the Altos Hornos de Viscaya—are intended for use in California. The contract price for the rails, delivered, including import duty, is around $27 a ton. The prevailing price for domestic rails at the mills is $28, and to carry them to the Pacific Coast the total cost would be almost $38. Delivery of the Spanish rails is to be completed by January next. Five thousand tons are now on their way by chartered steamer to Galveston, Texas, and the balance will be shipped to San Diego, Cal.

For the Southern Pacific's extensions in Mexico a rail contract has been placed with the Monterey Iron & Steel Company. The closing of this contract with a Mexican concern is due largely, if not entirely, to the recent tariff imposed. The Mexican price was around $33 a ton, whereas the existing quotations for American rails laid down in Mexico is upwards of $40, the duty being $10 a ton, while the freight charges, etc., are almost $5. Another Mexican road desired to secure a lot of 14,000 tons of rails from the Monterey people, but it was found impossible to supply them within any reasonable time, as the Monterey mills will be busy for some time to come on the Southern Pacific contract. The order has therefore been placed with the Altos Hornos de Bilbao, one of the principal mills in Spain. The price is a shade above $22

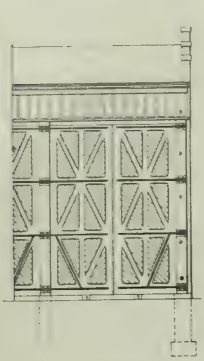
ton f.o.b. Bilbao. Of course, these rails will also have to pay uty according to the existing Mexican tariff, which, with freight harges, will mean that they will cost about $35 a ton delivered, $5 a ton less than the prevailing price for American rails laid Mexico.

Private advices from Mexico are to the effect that it is confidently expected that the import duties on rails and other steel material entering that country will very shortly be largely reduced if not practically removed. The Mexican Government authorities are understood to have decided to order a sweeping revision to be made in the existing tariff with a view to encouraging railroad building, which is now largely hampered owing to the heavy import duties, the Mexican plants being able to supply only a pittance of the big quantities required.

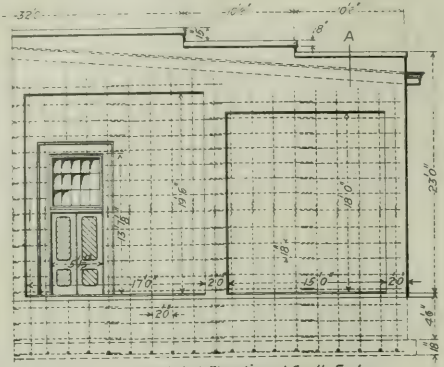
Reinforced Concrete Roundhouse for the Wabash.

The Wabash has under construction in its Landers yard, Chicago, a 20-stall reinforced concrete roundhouse, drawings of which are shown herewith. The side and rear walls of the building are reinforced concrete, the partition and pit walls are plain concrete and the roof is gravel. All walls, both building and pit, rest on piles 18 ft. long, except the piles in the rear building wall on the pit center lines, which are 12 ft. long. The roof-supporting columns each rest on a single 20-ft. pile. The wall footings are 18 in. deep and 3 ft. wide. For 4 ft. 6 in. above this, or up to the rail level, the thickness is 18 in., reducing to 12 in. for the remainder of the height, except at the cornice where there is an increase to 15 in.

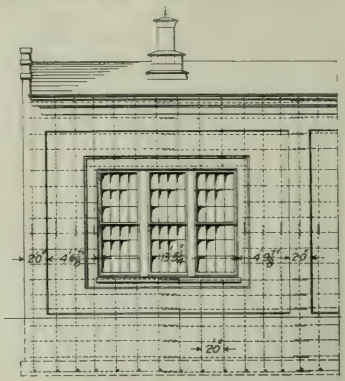
The drawings show the arrangement of the reinforcing steel



Front Elevation.

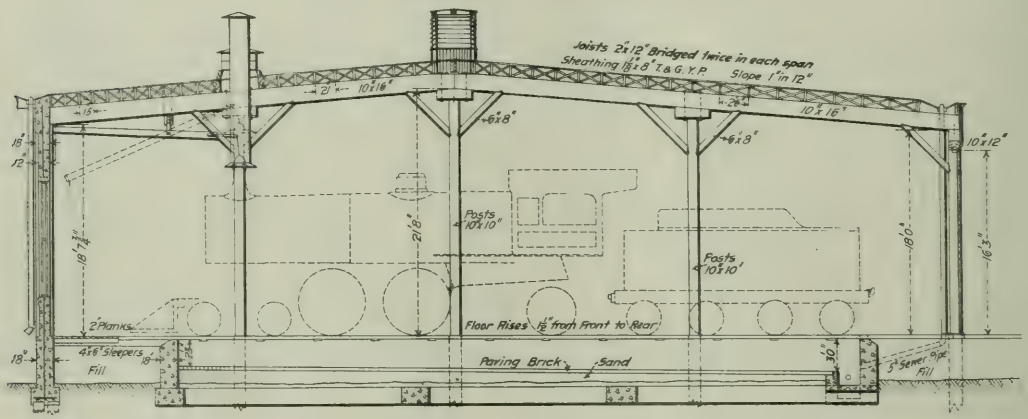


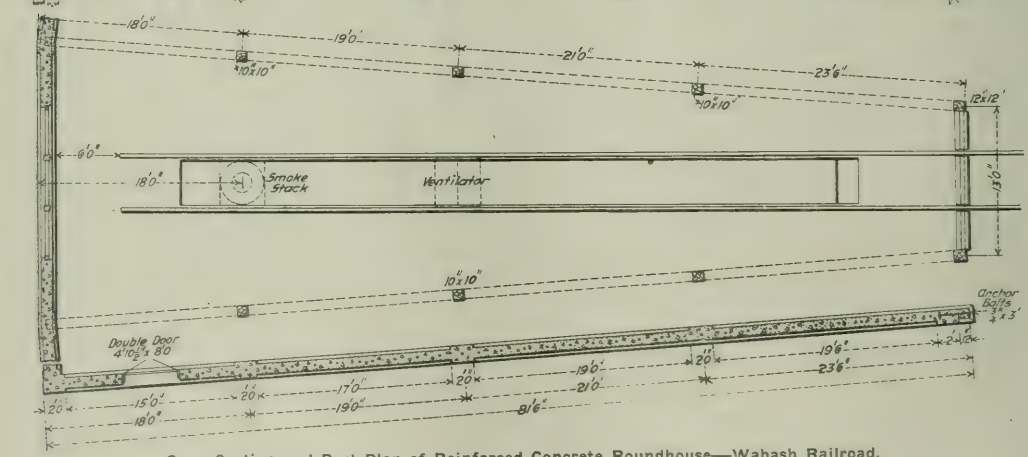
Half End Elevation at South End.



Rear Elevation Showing Rod Spacing.

Details of Reinforcement in Side and End Walls.



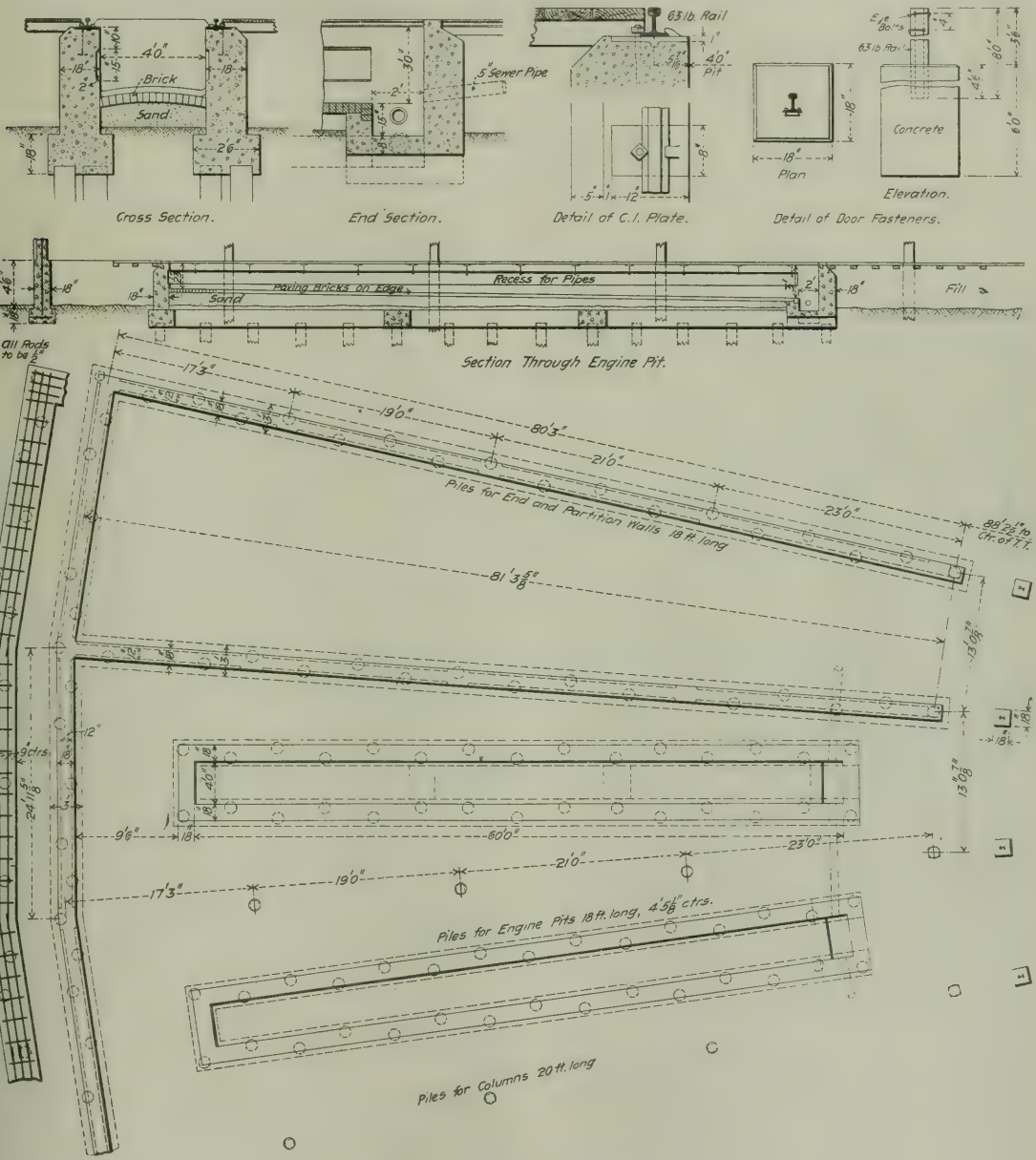


Cross-Section and Part Plan of Reinforced Concrete Roundhouse—Wabash Railroad.

rods, which are Johnson corrugated bars, ½-in. throughout except above the windows, where they are ¾-in. In the footings three parallel longitudinal rows, 9 in. on centers, are laid directly on top of the piles. Short bars 2 ft. 6 in. long are laid transversely to these, the spacing varying from 18 in. to 24 in. In the walls, all horizontal rods are spaced 18 in. on centers, and the vertical rods vary the same as the transverse foundation rods.

The piles supporting the pit walls are staggered, and are 4 ft. 5⅛ in. on centers. The footing and wall dimensions are the same as for the corresponding courses in the building walls. The pit floor is paving brick laid on edge on a sand bed and grouted. The rails rest on cast-iron plates bedded in the top of the wall and spaced 5 ft. on centers. A detail of this feature is shown. A detail of the door fastener also is shown. It consists of an 8-ft. length of 63-lb. rail bedded in a concrete block 18 in. square and 6 ft. high. The top of the block is flush with the ground, the rail projecting 3 ft. 6 in. above. The door is fastened to the latter by hooks.

Above the center of each pit is a louvre ventilator. Dickinson combination cast-iron smoke-jacks and ventilators are used. We are indebted to Mr. A. O. Cunningham, Chief Engineer of the Wabash, for the plans.



Details of Engine Pits and Foundations.

Foreign Railroad Notes.

The reformed passenger tariff now under discussion in Germany allows no free baggage, while at present in Prussia and Saxony the passenger is allowed 55 lbs. free, besides what he may take with him in the passenger car. A great deal of opposition to this abolition of the free-baggage allowance is manifested, especially among commercial travelers. The proposed charges for extra baggage are less than heretofore, yet amount to about $5.70 for a trunk weighing 150 lbs. (our free-baggage allowance) for a distance as great as that between New York and Chicago. In answer to this complaint the interesting fact is cited that on the Prussian State

Railroads in 1903 only about one-seventeenth of the whole number of passengers had any baggage in the baggage cars; the average weight of baggage so carried per passenger having been 3¼ lbs. This is offered in evidence that the free-baggage privilege benefits comparatively few passengers. Doubtless a much larger proportion of passengers in this country have trunks checked; but this is not a fair comparison; for the construction of passenger cars in Germany (and the rest of Europe) permits carrying large quantities of baggage in the car with the passenger; and this privilege, which is not interfered with by the proposed reform, is utilized to the utmost, and often abused.

The Austrian Railroad Ministry has announced that beginning with next January 9½ hours will make a day's work in the State Railroad shops, instead of 10 hours, as heretofore. Work will begin at 7 a.m., and there will be 1½ hours intermission between forenoon and afternoon.

From Japanese sources it is reported that the Chinese Eastern Railway has been destroyed or crippled in so many places by the Russians that a year and a half will be required to put the line in good working order.

The Coal Carriers.

BY FREDERICK E. SAWARD,
Editor of the *Coal-Trade Journal*.

While the ton-mile rate from coal is small, compared with most freight, the tonnage is so readily taken care of, and it is handled in such bulk, that the profit yield in the aggregate is large. Anyone who takes up the reports of the principal hard and soft coal carriers will readily acknowledge this fact, and there is a reason which may not have occurred to many a reader. The coal is vastly important to a carrier from the fact of the great yield from a given territory. It is for this reason that the several lines of road, even those not particularly classed as coal roads, endeavor to secure territory from which tonnage can be had.

In bituminous coal regions, for instance, the average amount of coal to an acre of land is over 5,000 tons. In some sections where the seams are very large or where there are several workable seams on the same property the amount of coal will be two or three times this, but putting the average amount of available coal to an acre as 5,000 tons, and contrasting it with the freight created, for instance on cotton or corn land, we readily see the reason why railroads are struggling to get into the coal regions of the country. On cotton land the usual average yield per acre is not much more than one-third of a bale, which, with the seed, would make about 500 lbs. of freight, or one-quarter of a ton. On this basis it would take an acre of corn or cotton land 20,000 years to furnish as many tons of freight as one acre of coal land. In this comparison no account, of course, is taken of the development of other traffic, freight or passenger, in either case.

While we have used in this comparison an acre of cotton land, an acre of wheat land would not show very much difference, the average yield of wheat for the United States being about 12 bushels an acre. There are some sections where wheat yields 25 or 30 bushels to an acre, so there are some sections where cotton yields an average of a bale to an acre, but this comparison is simply based on the general average of the country.

In this fact, that an acre of coal yields 5,000 tons of freight, while an acre of agricultural land would take some 15,000 or 20,000 years to yield the same amount, is found the reason for the tremendous struggle going on not only in West Virginia, Kentucky and Alabama, but throughout the entire mineral regions of the country in which the railroad builders are seeking to secure dominating positions in the mineral districts.

It is only necessary to take a statistical view of the growth of the tonnage in this country to show its importance, as in the following table of bituminous coal production:

	1869.	1879.	1904.
Total for the U. S., net tons.....	16,206,415	42,713,506	279,153,718

This year is fully 4 per cent. better than 1904, owing to the impetus to the steel and iron industries in the past few months, which call for an immense quantity to be turned into coke for this particular use.

The record of the anthracite companies is shown in the following schedule of only a few recent years. The production of anthracite has increased as follows:

1902.....	41,373,595 net tons.	1904.....	73,156,709 net tons.
1903.....	74,607,068 "	1905 (est.).....	72,500,000 "

It is thus shown that the production for this year will be more than 31,000,000 tons in excess of that of the year of the strike—1902.

The question as to the resources of these anthracite companies is an interesting one, and many tables of longevity have been compiled. They are probably all faulty, for there is an undetermined factor always in judging of things unseen; that they may have a commercial utility longer than many of these estimates indicate, is quite possible, following better and more economical use of the fuel. The day is fast approaching when every atom of the coal that is brought to the surface will be made use of; when the culm bank will be made to yield profit, to even greater extent than at present. With the large proportion of what are commercially the junior sizes, turned into even better prices than now obtains there will be more great profits for the anthracite coal land owners.

In 1895, William Griffith, a well accredited mining engineer, estimated the unmined coal tributary to the different companies to have been as follows:

Companies.	Unmined coal. tons.	Percentage.	Duration years.
Reading	2,143,706,500	42.25	246
New Jersey Central	877,569,700	17.30	163
Lehigh Valley	855,511,750	16.87	116
Lackawanna	332,332,000	6.55	54
Pennsylvania	316,502,750	6.24	63
Delaware & Hudson	115,823,200	2.29	26
Erie & Wyoming Valley	94,876,600	1.82	54
Delaware, Susquehanna & Schuylkill	69,901,200	1.38	35
Erie	38,879,400	.77	21
New York, Susquehanna & Western	26,890,500	.54	18
*Ontario & Western	13,971,100	.28	9

*The Ontario & Western has since made important investments in coal.

The duration of the supply is based on the shipments of coal in 1895, when it was 46,511,000 tons. Later figures would increase the holdings of the larger concerns to a slight degree, even with the increasing shipments.

In no portion of the country has there been so great a development of mineral resources as in those states below the old Mason and Dixon's line. In 1869 the production of bituminous coal was of no great moment, but the following table of its production since then, in net tons, shows how it has grown:

	1869.	1879.	1904.
United States	16,206,415	42,713,506	279,153,718
South	2,785,505	6,093,693	71,554,229

Where would the Norfolk & Western and the Chesapeake & Ohio be but for the coal traffic? Even the Baltimore & Ohio is doing much more than its late President, John W. Garrett, even dreamt of; he had the Maryland tonnage practically controlled with a little in southern Pennsylvania and in northern West Virginia. The Fairmont and Monongahela districts were not heard much of in his day. The tonnage of the two great lines in West Virginia shows that the Norfolk & Western carries a million tons a month and the Chesapeake & Ohio 700,000 tons, while the Baltimore & Ohio, on all its lines, carries nearly two million tons a month.

Comparing with the great annual tonnage of all kinds of freight hauled by the Pennsylvania Railroad, it is interesting to see that the growth of the coal output in Pennsylvania in ten years is more than equal to the present yearly traffic of the Pennsylvania Railroad. It is no wonder that we get tales of woe from the shippers about poor car service; the demand for fuel is so great and grows at such a pace that it is difficult to keep the motive and transportation facilities up to the mark. The Pennsylvania Railroad, in all kinds of coal and coke, handles 45,000,000 tons a year.

Whether there is really a scarcity of cars now, or whether short transportation facilities are only apparent because of the great demand from all branches of the industrial world, the fact remains that coal producers are not able to secure as many cars as they need, and yet not damage the business so far as price is concerned. Every fall brings with it this condition and perhaps always will, but it is worse now than ever before. There is no prospect that it will not be worse next fall than now. Railroad companies are purchasing an enormous amount of equipment, but it must be remembered that all lines of business are increasing in volume and that the railroads are covering more territory each year. Another thing; a large proportion of this equipment goes to take the place of that which is worn out and goes to the scrap pile. The enforcement of the safety-coupler law has driven many cars off the roads. It led to the rule of the Pennsylvania that when the repairs on a car would amount to $250 that car should be sent to the scrap pile, as it would not pay to repair and put on the safety couplers. Again it has had the effect of limiting the orders for new cars by the small roads, and as the smaller roads find it cheaper, or easier, to hold the cars of other roads, at 20 cents a day penalty, than to buy cars of their own, the big roads are short of their own cars.

Any estimate of the value of anthracite coal territory based on a cash valuation of the coal in the ground is apt to be fallacious. The coal must be mined and marketed covering a period of many years during which values would be subject to all the commercial contingencies of any industrial or producing corporation. An estimate predicated on the cash value of coal in the ground when Mr. Gowen bought the Reading coal lands more than 30 years ago might have made the Reading Co.'s stock worth more than a thousand dollars per share.

If one should draw on the map a line from Baltimore to the head of the Cumberland Valley (Harrisburg), from thence to Hornellsville in New York, and thence to Buffalo or Dunkirk on Lake Erie, the region included between that line and the seacoast would form the district in which anthracite coal may be considered

a necessity of life. More than 90 per cent. of the anthracite mined is consumed in that section of the country; less than 10 per cent. goes west or south of the line above given, and the greater part of that small proportion follows the line of the lakes and is consumed in the larger cities and towns, either directly on the lake or within a short distance of some port. Everywhere else bituminous coal is supreme. Even in the district so delineated it is only as domestic fuel that anthracite has an exclusive hold.

The history of the anthracite trade since the strike of 1902 has been a record of extraordinary progress. Production has increased, prices have advanced, profits have become larger, and from a condition of semi-demoralization the trade has been brought to a state of high prosperity, the coal roads making large earnings, and their securities selling higher in the markets. The shipments of each company for 10 months, this year, and their percentage to the total are as follows:

	Tons, 1905.	Per cent.	Tons, 1904.	Per cent.
Philadelphia & Reading	10,408,317	20.57	9,328,635	19.72
Lehigh Valley	8,299,353	16.41	7,840,646	16.57
Central R. R. of N. J.	6,579,344	13.00	5,989,910	12.66
Del., Lack. & Western R.R.	7,706,734	15.23	7,671,039	16.22
Delaware & Hudson	4,727,674	9.35	4,363,538	9.22
Pennsylvania R. R.	4,022,458	7.95	3,939,813	8.33
Erie R. R.	5,160,687	10.20	4,721,084	9.98
Ontario & Western	2,358,837	4.66	2,171,041	4.59
Delaware, Susq. & Schuylkill	1,330,105	2.63	1,279,604	2.71
Total	50,593,504	100.00	47,305,310	100.00

Operators declare that as a result of the settlement of the strike of 1902 the wages of miners have increased 26 per cent. for contract miners and 16 per cent. for company men. The average price of anthracite, according to the American Iron and Steel Association, has advanced from $3.47 a ton in 1900 and $3.80 in 1901 to $4.50. For the retail consumers the advance in price has been even greater. With the increased tonnage and the higher prices there has bene a great growth in the earnings of the coal roads. Reading, which in 1902 earned $28,620,371, and in 1903 $31,708,524, has this year earned $36,852,007. The Lehigh Valley has increased its gross earnings from $23,919,968 in 1902 to $31,275,842 in 1905. These figures are for fiscal years. The Delaware & Hudson in the calendar year 1903 had gross earnings of $29,500,794, and in 1904 they increased to $34,655,133, and the Lackawanna road increased from $21,398,761 to $28,701,991.

The President on Rate Regulation.

The following is a condensed abstract of that portion of the President's message which treats of railroad rate regulation:

I am well aware of the difficulties of the legislation that I am suggesting, and of the need of temperate and cautious action in securing it. I should emphatically protest against improperly radical or hasty action. The first thing to do is to deal with the great corporations engaged in the business of interstate transportation. As I said in my message of December 6 last, the immediate and most pressing need, so far as legislation is concerned, is the enactment into law of some scheme to secure to the agents of the Government such supervision and regulation of the rates charged by the railroads of the country engaged in interstate traffic as shall summarily and effectively prevent the imposition of unjust or unreasonable rates. It must include putting a complete stop to rebates in every shape and form.

This power to regulate rates, like all similar powers over the business world, should be exercised with moderation, caution and self-restraint; but it should exist, so that it can be effectively exercised when the need arises.

The first consideration to be kept in mind is that the power should be affirmative and should be given to some administrative body created by the Congress. If given to the present Interstate Commerce Commission or to a reorganized Interstate Commerce Commission, such commission should be made unequivocally administrative.

In my judgment the most important provision which such law should contain is that conferring upon some competent administrative body the power to decide upon the case being brought before it whether a given rate prescribed by a railroad is reasonable and just, and if it is found to be unreasonable and unjust, then, after full investigation of the complaint, to prescribe the limit of rate beyond which it shall not be lawful to go—the maximum reasonable rate, as it is commonly called—this decision to go into effect within a reasonable time and to obtain from thence onward, subject to review by the courts. It sometimes happens at present not that a rate is too high, but that a favored shipper is given too low a rate. In such case the commission would have the right to fix this already established minimum rate as the maximum; and it would need only one or two such decisions by the commission to cure railroad companies of the practice of giving improper minimum rates.

I call your attention to the fact that my proposal is not to give the commission power to initiate or originate rates generally, but to regulate a rate already fixed or originated by the roads upon complaint and after investigation. A heavy penalty should be exacted from any corporation which fails to respect an order of the commission. I regard this power to establish a maximum rate as being essential to any scheme of real reform in the matter of railroad regulation. The first necessity is to secure it, and unless it is granted to the commission there is little use in touching the subject at all.

Illegal transactions often occur under the forms of law. It has often occurred that a shipper has been told by a traffic officer to buy a large quantity of some commodity, and then after it has been bought an open reduction is made in the rate to take effect immediately, the arrangement resulting to the profit of the one shipper and the one railroad and to the damage of all their competitors, for it must not be forgotten that the big shippers are at least as much to blame as any railroad in the matter of rebates. The law should make it clear so that nobody can fail to understand that any kind of commission paid on freight shipments, whether in this form or in the form of fictitious damages, or of a concession, a free pass, reduced passenger rate or payment of brokerage, is illegal. It is worth while considering whether it would not be wise to confer on the Government the right of civil action against the beneficiary of a rebate for at least twice the value of the rebate; this would help stop what is really blackmail. Elevator allowances should be stopped, for they have now grown to such an extent that they are demoralizing and are used as rebates.

The best possible regulation of rates would, of course, be that regulation secured by an honest agreement among the railroads themselves to carry out the law. Such a general agreement would, for instance, at once put a stop to the efforts of any one big shipper or big railroad to discriminate against or secure advantages over some rival; and such agreement would make the railroads themselves agents for enforcing the law. The power vested in the Government to put a stop to agreements to the detriment of the public should, in my judgment, be accompanied by power to permit, under specified conditions and careful supervision, agreements clearly in the interest of the public. But, in my judgment, the necessity for giving this further power is by no means as great as the necessity for giving the commission or administrative body the other powers I have enumerated above; and it may well be inadvisable to attempt to vest this particular power in the commission or other administrative body until it already possesses and is exercising what I regard as by far the most important of all the powers I recommend—as indeed the vitally important power—that to fix a given maximum rate, which rate, after the lapse of a reasonable time, goes into full effect, subject to review by the courts.

All private car lines, industrial roads, refrigerator charges and the like should be expressly put under the supervision of the Interstate Commerce Commission or some similar body so far as rates and agreements practically affecting rates are concerned. The private car owners and the owners of industrial railroads are entitled to a fair and reasonable compensation on their investment, but neither private cars nor industrial railroads nor spur tracks should be utilized as devices for securing preferential rates. A rebate in icing charges or in mileage or in a division of the rate for refrigerating charges is just as pernicious as a rebate in any other way. No lower rate should apply on goods imported from the American seaboard to destination except in cases where water competition is the controlling influence.

There should be publicity of the accounts of common carriers; no common carrier engaged in interstate business should keep any books or memoranda other than those reported pursuant to law or regulation, and these books or memoranda should be open to the inspection of the Government. Only in this way can violations or evasions of the law be surely detected. A system of examination of railroad accounts should be provided similar to that now conducted into the national banks by the bank examiners; a few first-class railroad accountants, if they had proper direction and proper authority to inspect books and papers, could accomplish much in preventing willful violations of the law. It would not be necessary for them to examine into the accounts of any railroad unless for good reasons they were directed to do so by the Interstate Commerce Commission.

It is greatly to be desired that some way might be found by which an agreement as to transportation within a State intended to operate as a fraud upon the Federal interstate commerce laws could be brought under the jurisdiction of the Federal authorities. At present it occurs that large shipments of interstate traffic are controlled by concessions on purely State business, which, of course, amounts to an evasion of the law. The commission should have power to enforce fair treatment by the great trunk lines of lateral and branch lines.

This legislation should be enacted in a spirit as remote as possible from hysteria and rancor.

The big railroad men and big shippers are simply Americans of the ordinary type who have developed to an extraordinary degree certain great business qualities. They are neither better nor worse than their fellow-citizens of smaller means. They are merely more

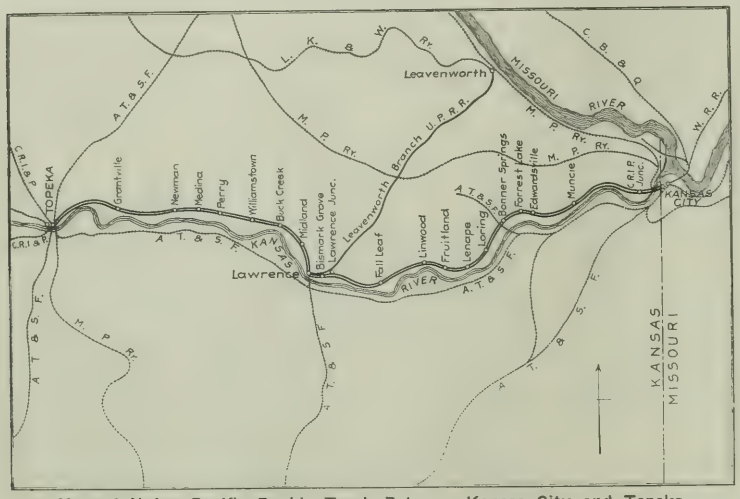
able in certain lines and therefore exposed to certain peculiarly strong temptations.

It is because, in my judgment, public ownership of railroads is highly undesirable and would probably in this country entail far-reaching disaster that I wish to see such supervision and regulation of them in the interest of the public as will make it evident that there is no need for public ownership. The opponents of Government regulation dwell upon the difficulties to be encountered and the intricate and involved nature of the problem. Their contention is true. It is a complicated and delicate problem, and all kinds of difficulties are sure to arise in connection with any plan of solution, while no plan will bring all the benefits hoped for by its more optimistic adherents. Moreover, under any healthy plan the benefits will develop gradually and not rapidly.

Finally we must clearly understand that the public servants who are to do this peculiarly responsible and delicate work must have done as they best could under such conditions accomplishes little. What we need to do is to develop an orderly system, and such a system can only come through the gradually increased exercise of the right of efficient Government control.

Kansas City-Topeka Double Track Work of the Union Pacific.

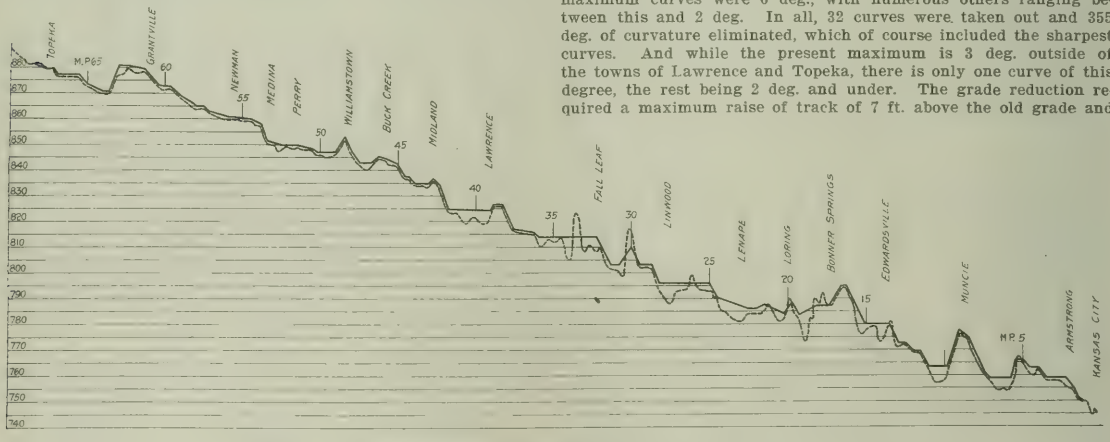
The portion of the Kansas division of the Union Pacific between Kansas City and Topeka is used jointly by the owners and the Rock Island. Although the latter uses it merely as a means of getting into Kansas City, doing no local business of any character between the terminal points, the traffic in recent years has overtaxed considerably the capacity of the single-track line, making a second track a necessity. The line follows the narrow valley of the Kansas river—more generally known, perhaps, as the Kaw—being on the north side of the river, as will be seen by referring to the accompanying map. On each side of the valley, for a considerable part of the distance, the country is high and rugged. At many points it rises abruptly from the river's edge, leaving little room for a railroad, and making necessary heavy rock cutting to get a footing on the hill sides. Therefore, the parallel lines of the Union Pacific and Santa Fe on opposite sides of the river fully occupy the only practicable approach to Kansas City from Topeka. The river itself has all of the characteristics of the streams of this region, being uncertain and shifty and changing channel frequently.



Map of Union Pacific Double Track Between Kansas City and Topeka.

This line of the Union Pacific was built in the '60's. Naturally it was located to make construction work and cost as light as practicable, and contained many heavy grades and bad curves, and although there have been some improvements of these features from time to time, the general characteristics of the line have remained much the same as originally built. The present work, therefore, in addition to double tracking, has amounted practically to rebuilding the line by converting it into one having easy grades and light curves. It also involved raising the grade wherever necessary to bring it above all high water except that of the great flood of 1903.

A condensed profile is given herewith which shows the old and the revised grade lines. The previous ruling grades were 1 per cent. This maximum has been reduced to .35 per cent. The average adverse gradient is only .25 per cent., however, there being a total of only about two miles of the maximum. The former maximum curves were 6 deg., with numerous others ranging between this and 2 deg. In all, 32 curves were taken out and 355 deg. of curvature eliminated, which of course included the sharpest curves. And while the present maximum is 3 deg. outside of the towns of Lawrence and Topeka, there is only one curve of this degree, the rest being 2 deg. and under. The grade reduction required a maximum raise of track of 7 ft. above the old grade and a maximum drop of about 10 ft. The minimum raise was 9 in. for rock ballasting. The basing point for the revised grade line was the 1904 high water level, the minimum distance maintained above that line being 2 ft. to top of rail.



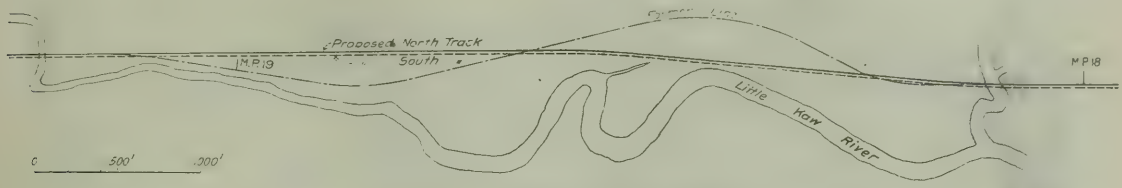
Profile of Old and New Double Track, Kansas City to Topeka, U. P. R. R.
Broken line shows former grade, and solid line revised grade.

The line changes required considerable new location work, incidentally effecting a saving of 1,000 ft. in total distance. A typical example is found in the change west of Bonner Springs, shown herewith, where a heavy reverse curve was replaced with almost

themselves be of the highest type. But while I fully admit the difficulties in the way, I do not for a moment admit that these difficulties warrant us in stopping in our effort to secure a wise and just system. They should have no other effect than to spur us on to the exercise of the resolution, the even-handed justice and the fertility of resource which we like to think of as typically American, and which will in the end achieve good results in this as in other fields of activity. The task is a great one and underlies the task of dealing with the whole industrial problem.

But the fact that it is a great problem does not warrant us in shrinking from the attempt to solve it. At present we face such utter lack of supervision, such freedom from the restraints of law, that excellent men have often been literally forced into doing what they deplored because otherwise they were left at the mercy of unscrupulous competitors. To rail at and assail the men who

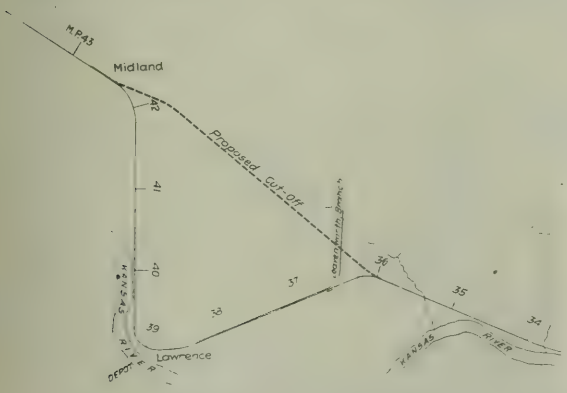
a tangent. These changes made new right-of-way necessary, but little had to be bought, as the road owns a 400-ft. right-of-way for 26 miles west of Muncie, which is part of the original land grant of the Government to the Kansas Pacific Railway Company. The road has only occupied such portion of this width as was needed, much of the remainder being made use of by the farmers owning the adjacent land. In the present changes, where it was necessary to take possession of strips that had been appropriated thus, any improvements on them of value were paid for at a fair price.



Change of Line West of Bonner Springs.

In connection with these line changes a map is shown of the Lawrence situation, from which it will be seen that the line makes something more than a right-angle to get into the town, the north side of which is situated in a sharp bend in the river. It is probable that some time in the near future a cut-off will be built as shown by the map, which will complete and form the base of the triangle, two sides of which already exist. This cut-off will be 4.1 miles long, and will save about 2⅓ miles in distance. It will be used by all Rock Island trains and all through freight trains of the Union Pacific.

The present second track work begins a short distance east of the Rock Island junction in Armstrong yards and extends a little west of the Topeka passenger station; but when the work now under way is completed the double track will extend to Union Station, Kansas City, the plan including the remodeling of Armstrong yards, which will be done after the present work is completed. The double-track line will therefore be approximately 67 miles long. However, the ultimate purpose of a second track to

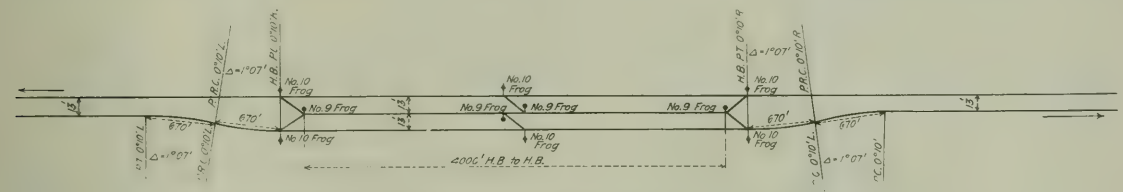


Proposed Cut-off Near Lawrence.

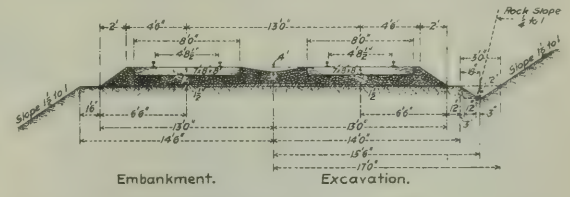
Denver is kept in mind in all new work that is done west of Topeka, which is laid out for double tracking.

In the execution of the second track work a traffic averaging 60 trains a day had to be taken care of, adding much to the difficulty. In general, the plan followed—except, of course, in entire new location—was to use the old line as a working track for the new second track and then reverse the relation when changes were necessary in the old track. As soon as sections of the second track could be placed in suitable condition for service they have been used as passing tracks, thus affording continuously increasing relief to the congestion of traffic. The new track is laid throughout with 80-lb. rails, "Continuous" rail joints and "Burnettized" Texas pine ties. Each tie is marked with a date nail and is tie-plated. The tie plates are much larger than any previously used by the Union Pacific, weighing about 6½ lbs. apiece, and having flat bottoms. All curves 2 deg. and over are spirated and super-elevation put in according to Union Pacific tables. The line is being rock ballasted, with a minimum depth under the ties of 9 in. This ballast is obtained from a quarry just west of Loring, where the railroad company has a 1,200-yd. crusher. A gravity track, having capacity for 25 cars, enables the cars to be dropped down to the crusher for filling, and then continued on down, across a scale, to the standing track from which they are taken out.

There are 18 stations on the line between Armstrong and Topeka. All are quite small, however, except Lawrence, which is a little more than half way. Complete changes have been made in the facilities at all of these small stations. Passing tracks were located about every 12 miles, bringing them at Muncie, Bonner Springs, Linwood, Perry and Grantville. Each station is given a business track 2,000 ft. long, and at Linwood a "potato" track 2,050 ft. long was put in, as large quantities of potatoes are raised in this region, making a special track for the potato cars desirable and necessary. New depots were built at Muncie, Fall Leaf, Buck Creek and Newman, and the Bonner Springs building was remodeled. These new stations are frame on a concrete foundation, and contain a waiting room, ticket office, freight room with a space partitioned off for express, and living rooms for the agent. The platforms are 700 ft. long. They are earth covered with Sherman gravel, which is disintegrated granite obtained by the Union Pacific in Wyoming. The Bonner Springs station was built with two waiting rooms, and its freight room was extended. At all other small points the station was moved or some change made. All of these small stations likewise have stock pens for loading cattle except Muncie, which is too close to Kansas City to need one. The rearrangement required these pens to be moved in all cases and new pens and chutes, much more substantial than the old, were built to replace them.

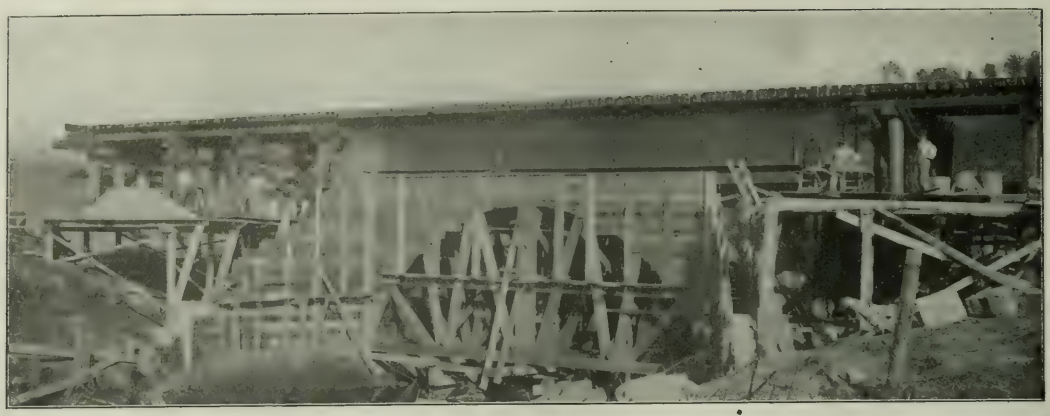


Sketch of Standard Passing Track Arrangement on Union Pacific Double Track.

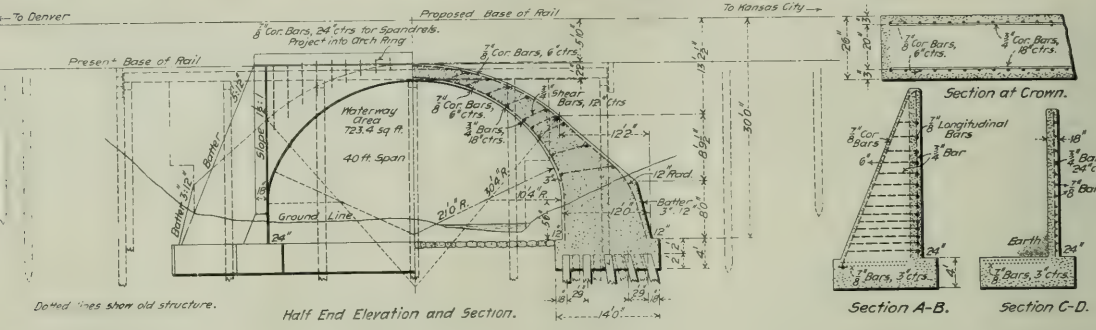


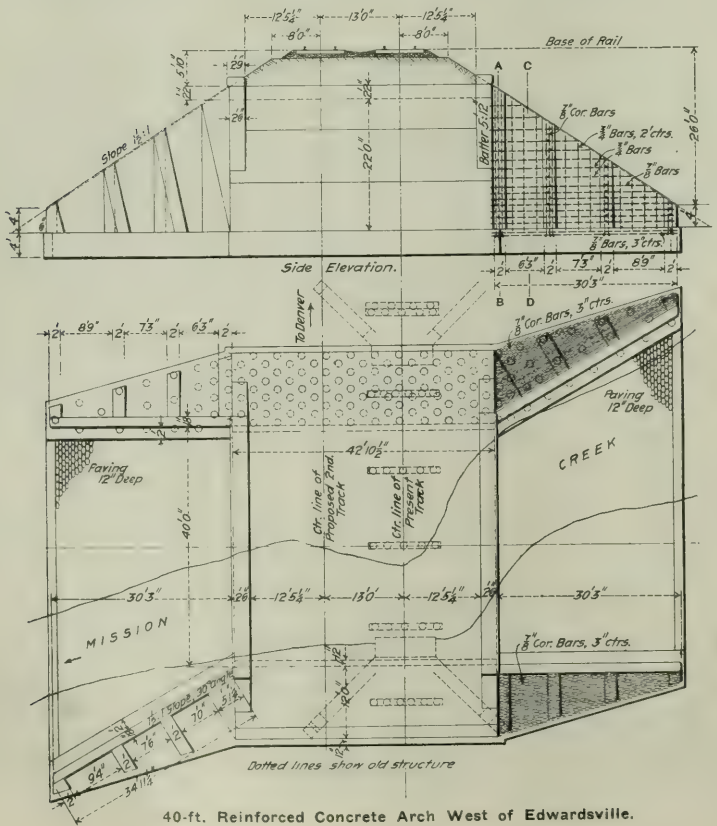
Harriman Lines Common Standard for Double-Track Roadbed With Broken Stone Ballast.

A sketch of the standard passing track arrangement adopted for this work is shown, from which it will be seen that the passing track is placed between the main tracks. The track adjacent to the station—the north track in the sketch—is left straight



Forms and Centering for 40-ft. Reinforced Concrete Arch Over Mission Creek.





40-ft. Reinforced Concrete Arch West of Edwardsville.

to give the operator a clear view, and a 13-ft. offset is given to the south track. The approach curves to the latter are only 10 min., permitting a train to go through at full speed. These passing tracks are 4,000 ft. long in the clear, and crossovers from the main tracks are placed midway. The flexibility of operation which this plan permits is readily apparent.

The proximity of track and river at several points along the line has already been alluded to. A typical case occurs north of Lawrence, best seen in the map showing the proposed Lawrence cut-off. So much trouble was experienced holding the river in its channel at this point, where it was endangering the roadbed by cutting away the left, or east, bank, that two winters ago the railroad company built four stone and three pile dikes about 60 ft. long out into the river, which checked effectively the encroachment. The railroad company also built one 150-ft. and two 50-ft. dikes for the county further north. Seven new dikes will be built between Armstrong and Lawrence—one east of Muncie, one between Loring and Lenape, three just east of Linwood, and two a short distance east of Lawrence. Two of those east of Linwood will be 100 ft. long, starting from the shoulder of sub-grade, and the remainder 60 ft. Forty-six-foot piling will be used with a stone and brush filling.

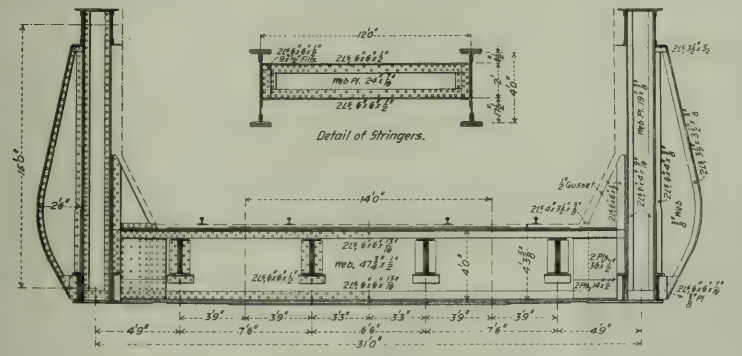
There are a large number of bridges on the work, embracing a variety of types. Illustrations of typical structures are shown, including a view of the Kaw river bridge at Kansas City. This bridge, which was completed in the spring of 1904, is 552 ft. long, being composed of three double-track through pin-connected spans 180 ft. 2½ in. long c. to c. of end pins. After the destruction of the old bridge a temporary double-track pile bridge was put in to carry traffic, which served as falsework in the erection of the new. The old substructure was used, the

only change being to cut down the tops of piers and abutments to provide for the lower bridge seats of the heavier structure. The bridge was erected in three months in the face of a heavy traffic, including, besides the regular train movements of the Union Pacific and Rock Island to and from Union Station, all stock yards and commercial switching of the Union Pacific. While a traveler was used some in erection, most of the work was done by a derrick car.

The next largest bridges on the line are the through riveted truss spans over Stranger and Delaware rivers, the former being just east of Linwood and the latter just west of Perry. One of these spans is 137 ft. 9½ in. c. to c. of end pins. It is a Pratt truss with subdivided panels. These bridges, which replace old single-track through lattice girder designs, were erected on falsework by the derrick car. The old bridges rested on dimension stone abutments, which were extended with concrete for the new double-track structures. The grade at Stranger river was raised 4 ft. A 110-ft. span of the same design as the foregoing was placed at Big Muddy creek just east of Grantville, and a 125-ft. span at Soldier creek just east of Topeka.

96-ft. Pony Truss Over Turkey Creek.

Between Muncie and Edwardsville, where there is a change of line on a new location, there is a 96-ft. pony truss, latticed span over Turkey creek, drawings and a photograph of which are reproduced. Just west of Bonner Springs is Wolf creek, which formerly was crossed by a 125-ft. single-track through latticed truss skew span. This was replaced by two deck plate girder double-track spans, 60 ft. and 65 ft. long respectively, skewed at the center and square at the ends. The pier at the center and the extensions to the dimension stone abutments are plain concrete.



Detail of 96-Ft. Pony Truss Over Turkey Creek.

There are a considerable number of concrete structures, the largest being a 40-ft. reinforced concrete arch over Mission creek, west of Edwardsville, replacing a wooden trestle. It is a three-centered arch 22 ft. high at the center and 26 in. thick at the crown. Johnson corrugated steel bars, ⅞ in. and ¾ in., arranged as shown by the drawings, are used for reinforcement. The concrete mixture is 1:2½:5. In building, the foundations and abutments were completed, after which a light single-track girder span was put in to carry traffic while one-half of the arch ring was completed. The track was then shifted to that side and the remaining half finished. The grade was raised about 6 ft. at this point.

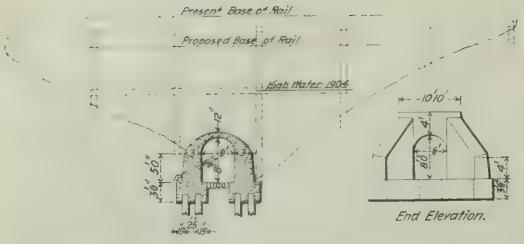
The ballasted floor spans were built of concrete and I-beams, a typical example being shown in Bridge 42 at Edwardsville, except that it is a double-span bridge and has a hand railing. The floor beams are 12-in., 55-lb. I-beams, 19 ft. long, the tension side of the slabs also having 1-in. corrugated bars between the I-beams. The slab is 1:2½:5 concrete, and the abutments and pier 1:3:6.

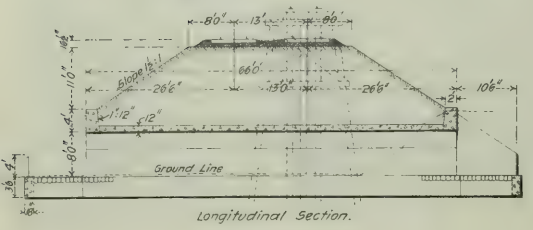
Drawings of two designs of 15-ft. and a 6-ft. plain concrete arch are shown. All pipe culverts were built with concrete end and wing walls.

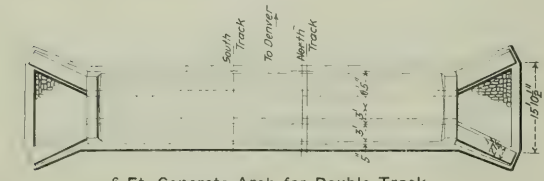
As already mentioned, the steel bridges were erected with a derrick car. This car did the unloading and erection work on three bridges, including the through riveted truss spans over Stranger and Delaware rivers, in a month, or an average of nine

138-ft. Riveted Through Truss.

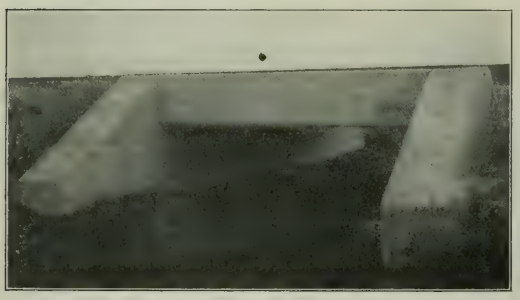
Kaw River Bridge at Kansas City.



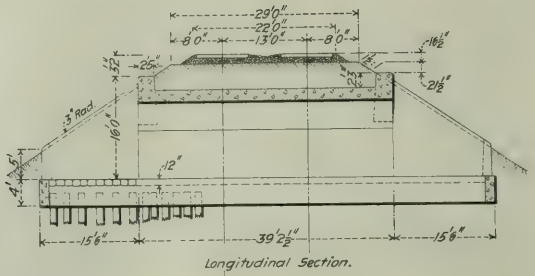


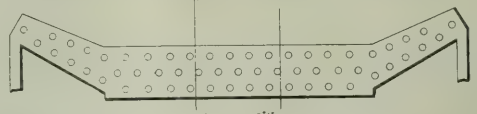


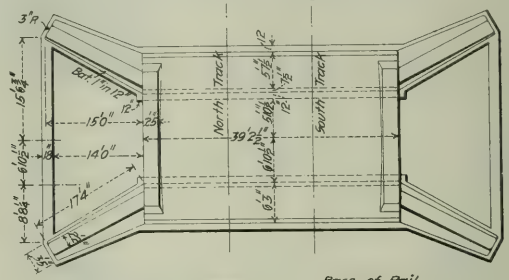
6-Ft. Concrete Arch for Double Track.

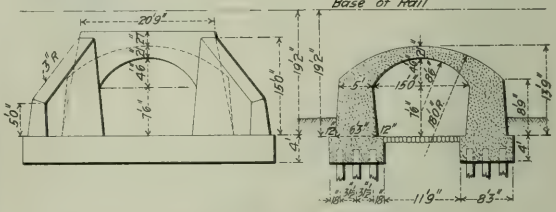


I-Beam Concrete Ballasted Floor Span.

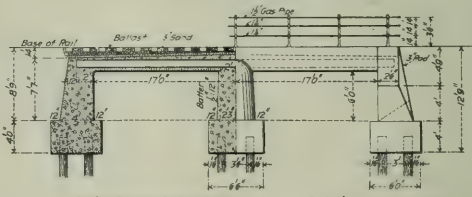


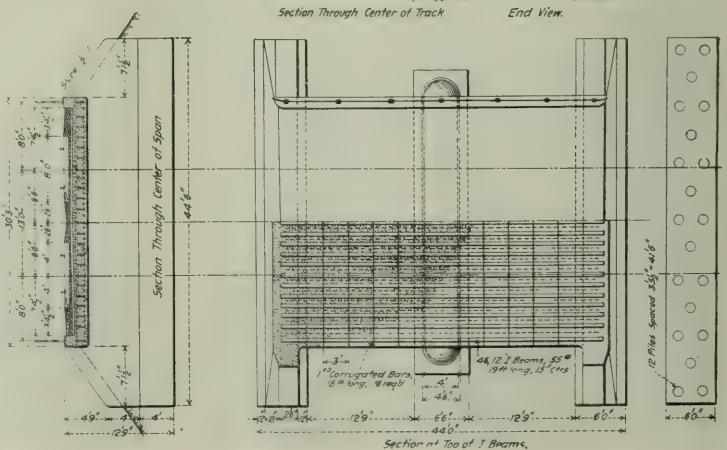






15-Ft. Flat Arch for Double Track.





I-Beam-Concrete Ballasted Floor Spans.

days to the bridge. Gangs followed behind to do the riveting by compressed air. This car, which is self-propelling, was designed by the Union Pacific and built by The American Hoist & Derrick Company two or three years ago.

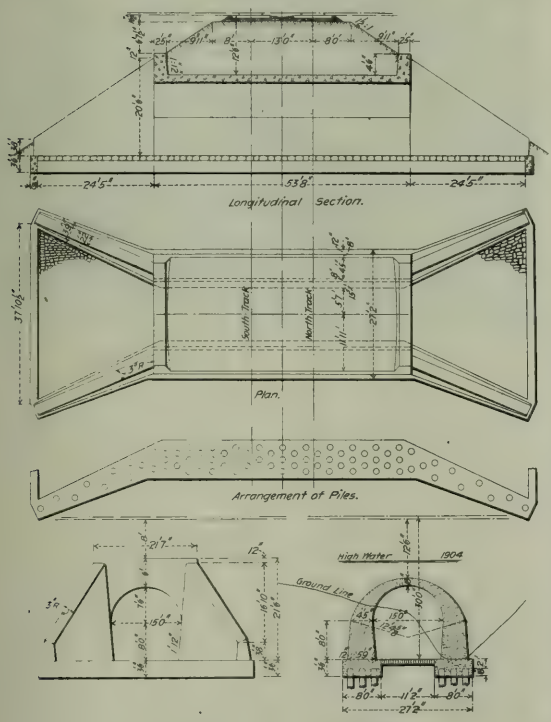
The entire line is to have electric automatic signals, and interlocking plants at railroad crossings and at the two Rock Island junctions. New steel water tanks of 65,000 gals. capacity will be built at Linwood and Topeka. They will be the Harriman Lines' standard for cold climate. The tanks will be placed at one side of the station grounds and the locomotives supplied from stand-pipes, thereby getting rid of the obstruction of tanks adjacent to the main tracks. Besides the new tank at Topeka, there have recently been built a new elevating coaling station and a Kennicott water-softening plant. Next year the yards at Armstrong, Lawrence and Topeka will be remodeled.

The work of double-tracking and revising the grades and alinement involved 1,150,000 yds. of embankment, 280,000 yds. of earth excavation, 33,000 yds. of loose rock and 60,000 yds. of solid rock; also cleaning 244-100-ft. squares and grubbing 87-100-ft.

squares. The grading was done by contract, all other work being done by company forces. The total cost of the work will be about $2,250,000. It is expected that the entire second track will be ready for service by the end of the year.

The work was planned and the most of it executed under the supervision of Mr. J. B. Berry, Chief Engineer of the Union Pacific until Nov. 10, when he became Chief Engineer of the Rock Island. Mr. Russell L. Huntley, who was actively identified with the work as Principal Assistant Engineer, is now in charge, having succeeded Mr. Berry as Chief Engineer. Mr. J. C. Beye, Resident Engineer, Kansas City, is in immediate charge of the work. The through riveted truss span and pony latticed truss span bridges, also the Kaw river bridge at Kansas City, were designed by Mr. James Keyes,

Bridge No. 42 Near Edwardsville.



15-ft. Concrete Arch at Edwardsville.

Engineer of Bridges. The remaining steel bridges are Harriman Lines' common standard. Mr. Walter Dennis, Chief Draftsman in the Resident Engineer's office, designed the concrete structures under the latter's supervision. Mr. A. G. Shaver, Signal Engineer, will have charge of the installation of the signaling and interlocking apparatus. The contract for the grading was let to W. C. Bradbury, Denver, Colo. We are indebted to Mr. Berry and Mr. Beye for the data for this article.

The Austrian manufacturers of rolling stock have made an arrangement with the State Railroads which will enable them to exhibit cars and locomotives at the Milan exhibition next spring. The state will order them and pay for them when the show is over.

The Baker Bridge Collision.

The collision which occurred at Baker Bridge on the Fitchburg Division of the Boston & Maine, 18 miles from Boston, Sunday night, Nov. 26, was one of the most appalling that has happened in New England in this generation. It took place about 8.13 p.m., when the westbound Montreal express, consisting of nine cars—mail and baggage coaches and sleepers—drawn by two heavy engines, running at a speed of 35 to 40 miles an hour, crashed into the rear of the Marlboro local, consisting of an engine and two cars of passengers. The momentum of the express train was so great that the forward engine plowed its way entirely through the rear car, and half way through the next car of the local before coming to a stop. The rear car was fairly well filled with passengers, many of whom were killed outright, or severely injured. Coals from the forward engine were scattered about, and almost immediately set fire to the wreck with the result that some who were left alive in the rear car but were pinned down by timbers were burned to death. Sixteen were killed on the spot, or died on the way to the hospital, and one of those removed has since died; more than 30 others were injured, of whom six are still on the danger list.

The scene of the disaster was at a flag station about 1½ miles west of Lincoln. The track here is straight, and the roadbed is in a cut. The local had just started from Baker Bridge, and was slowly moving. The interval of 30 minutes between the two trains on starting from Boston had been gradually diminished until it was not more than five minutes at Lincoln, and probably much less. That the rear brakeman faithfully carried out the fusee rule is shown by the fact that three 10-minute fusees, still burning, were passed by the express. The first of these was nearly three miles from the scene of the collision, and another about 1½ miles away, while the third had just been thrown off. There are no block signals. Mr. Tuttle's use in his newspaper statement of the term "spacing block-signals," was incorrect, as the signals which he spoke of are designed only to maintain a space of *time* between trains at a given point.

At each place where a man is permanently stationed (as at some telegraph offices, highway crossings, etc.) a green flag by day and a green light (by night) is required to be displayed for five minutes after the passage of every passenger train, and for 10 minutes after every freight train. Two such lights (and probably three) were in position at the time the Montreal express passed, the first of which was about 9,500 ft. east of Baker Bridge, and the second about 5,800 ft. away.

The engineer of the leading engine of the express, Horace Lyons, was but little injured in the collision, but was badly shaken up, and was found afterwards about the scene of the accident, on the verge of mental collapse, and unable to account clearly for his escape. The fireman was instantly killed, and the railroad officers think the engineer must have jumped from his engine, or he would have met a similar fate. He acknowledged to Superintendent Cheever, of the Fitchburg Division, and his assistant, Mr. Smith, that he saw the three red and two green signals set against him, but says he does not know why he did not stop for them; he was expecting, he says, to see the red tail-lights of the local train, which he knew was but a short distance ahead. He disappeared for a time and the efforts of the Superintendent and of the state police to locate him were for two days unsuccessful. It is known that he was much affected by the results of his carelessness, and it was feared he had left the state, or that his mind had become disordered, but on Tuesday evening a message was sent to Master Mechanic Todd saying that Lyons was at a certain house in Chelsea. The foreman went to the spot indicated by the message and found Lyons there. He talked freely, and said he was willing and anxious to testify at the inquest the next day at Concord, and he did so. At the conclusion of the testimony (which was not made public) Lyons was placed under arrest, charged with manslaughter. His bail was fixed at $10,000, in default of which he was taken to jail.

It is reported that Engineer Wade of the second engine of the express noticed the high speed of the train when the green warning signal at Lincoln station was passed, and remarked to the fireman that if they were going by the signals like that they would have to "drag him along," and he closed the throttle of his engine.

Engineer Lyons entered the service of the Boston & Maine in 1899 as a fireman, previous to which he had been a conductor on the West End Street Railway (Boston) for about eight years. His service was satisfactory, and he had the confidence and respect of his superiors. The Locomotive Superintendent and Division Superintendent both speak highly of him, and they regarded him as exceptionally capable and reliable. His record has been clean, and when examined for promotion last July passed creditably and was given an engine, but had not yet been assigned to a regular run. His habits were good, and he did not use intoxicants.

It is the rule and practice of the Boston & Maine to train a fireman on one division only, and when promoted to be an engineman the fireman is given a position on the division where he has

received his training, and that rule was followed in this case. Lyons was therefore thoroughly familiar with the locality, and he had been for several months running as an engineer on that division, much of the time on fast trains.

A Boston newspaper printed a statement which was attributed to Lyons' friends, saying that he had been overworked; that for many weeks he had been called out for extra duty nearly every night, and was therefore much exhausted. This statement was pronounced by President Tuttle to be absolutely without foundation; the division officers, he says, are careful to protect their engineers and firemen from overwork; and they find much more difficulty in preventing it than would be experienced in providing for extra runs, as the men are usually very glad to increase their wages in this way. The road has men enough, and it is not necessary for engineers to work without proper and sufficient intervals of rest. Lyons had done no work that day before taking out the express. When asked by Superintendent Cheever if he was asleep when the collision occurred, Lyons said: "Asleep! No; I had just started out."

This failure to do at that moment a duty which was quite plain and simple, and with which he was thoroughly familiar, and was in the habit of doing many times every day, is a mystery on which as yet no light has been thrown. It is not explained by the theory that the engineer was reckless and was deliberately taking chances; that might conceivably be true in cases where there was no special risk to run, but in that of an engineer who is perfectly aware that in case of a collision with a train ahead he will be the first to suffer, he will not voluntarily run the risk of death by the neglect to hold his train in check when he knows he is closing up the gap between himself and the preceding train.

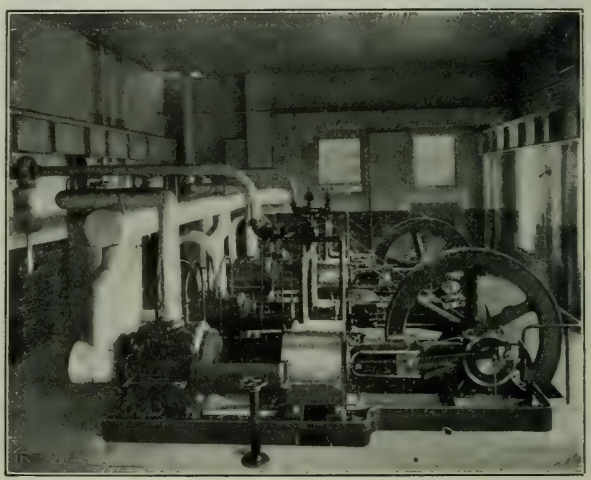
Air Power In the Union Pacific Shops at Omaha, Nebraska.

In the shops of the Union Pacific Railway at Omaha, Neb., air power has been carried to a degree of application probably equaled in no other shop in the country; and the extent of its use has made necessary an air compressor installation ranking among the largest for this purpose. The buildings comprising the various departments of these shops are compactly grouped beside the yards of the company and the power house is at the south of the main group, and was one of the shop buildings under the scheme in effect before the late improvements and rearrangement. This fact accounts for some features of power house arrangement which differ from usual practise where the building is designed to suit the work. A longitudinal fire-wall separates the engine and boiler rooms. The boiler equipment was selected to meet the conditions of very limited space, and for this reason it is made up of six marine shell boilers, with internal fireboxes. These units are rated at 250 h.p. each, giving a total capacity to the plant of 1,500 boiler horse power. The boilers are fired by hand, the coal being dumped on the fire-floor from cars on a side track which parallels the power house.

The engine room contains two class "GC" Ingersoll-Sergeant air compressors made by the Ingersoll-Rand Company, New York. They are of the duplex pattern, with cross-compound steam and air cylinders. The steam cylinders are sheathed and insulated and are equipped with the Meyer balanced adjustable cut-off valves. A reheating steam receiver between high and low pressure cylinders draws live steam from a by-pass inside the throttle. The standard Sergeant "Air Ball" governor regulates the speed and pressure by throttling the steam supply. A by-pass pipe taken from the steam pipe inside the governor leads to the low pressure steam chest. It has a pressure reducing valve which ordinarily is closed. But when the governor throttles the steam supply and the pressure on the high pressure cylinder reaches a certain minimum, this valve opens, admitting live steam direct to the low pressure cylinder through the by-pass pipe, thus equalizing the work in the two steam cylinders. The main frames are of girder type and the main bearings are large and heavy. The cranks are of the balanced disk pattern and a solid sole-plate, with a rim for catching oil, supports the entire compressor on a solid concrete foundation. The high and low pressure air cylinders are water-jacketed on the heads and barrels, and both cylinders are fitted with the Sergeant piston inlet valve. The discharge valves are of the vertical direct-lift pattern, readily accessible. A somewhat novel style of air intake is used. The inlet tubes of the low pressure cylinders are surrounded by a sheet iron case, leading to a vertical riser of sheet steel pipe which connects with a main intake header carried to an opening outside of the engine room on the northeast corner. Traps in the intake casing give easy access to the piston tube and stuffing box. The intercooler of each unit is of the vertical receiver type, with tinned brass tubes for the cooling water and an ample air storage capacity. Proper provision is made for withdrawing condensed moisture and the entire intercooler and connecting air pipes are covered with insulating material. Each compressor has a free air cappacity of 2,216 cu. ft. p. m., when running at 120 r. p. m. The air pressure is maintained at about 110 lbs. on the receiver, giving an average working pressure of 100 lbs. throughout the shops. Air cylinders are 16¼ in. and 24¼ in. in diameter. The steam cylinders are 16 in. and 24 in. in diameter and the stroke is 18 in.

The primary receiver is mounted on the outside of the power house on the north side. Its dimensions are 6 ft. by 30 ft., giving an exceptionally large storage capacity. The main air pipe passes underground to the shop buildings and radiates to the several departments. All piping in the buildings—air, water and gas—is carried in shallow conduits in the floor with removable covers and branches with valves rise at each post for connection with the shop appliances.

The applications of air in the shops are those common to railway repair work. In the locomotive shop, air drills in various sizes are used for drilling, reaming and tapping; chipping and riveting hammers have their usual place, and pneumatic stay bolt cutters assist in dismantling fireboxes. A small rotary air motor drives gearing for turning locomotive drivers in setting valves. Another operates a cylinder boring machine. Air hoists and air jacks assist in the handling of heavy parts. A number of pneumatic presses are also used for various classes of work. In the air brake testing department, air pressure is drawn from the main plant. An interesting device here is a pneumatic pressure



Air Compressor Room at the Omaha Shops of the Union Pacific.

coupling which holds the valves under test against the supply pipe thus saving the time and trouble of screwing them in place.

In the yards, warehouse and foundry air hoists are used extensively. In the car shops pneumatic drills and air jacks are used and the cars are sand-papered, and paint is removed and applied, by air appliances. The majority of the cleaning is also done by the air blast system.

Washington Correspondence.

Washington, Dec. 5.—That part of President Roosevelt's message which deals with the subject of railroad legislation is rather more conservative than had been generally expected by Senators and Representatives. It shows that he has changed his position somewhat since he wrote his message of last year. He is now careful to make it plain that he would have the authority of the Commission to make rates limited to the fixing of maximum reasonable rates. A year ago he favored having a new rate made by the Commission go into effect "immediately," and remain in effect "unless and until it is reversed by the court of review." Now he recommends that it should go into effect "within a reasonable time" and "obtain from thence onward, subject to review by the courts." Under some interpretations placed upon this language it is held that a bill that would provide for a judicial review prior to the taking effect of an order of the Commission would not be in conflict with the President's recommendation.

The shifting of his position has not attracted so much attention or caused so much comment as those sentences in the message that indicate Mr. Roosevelt's growing appreciation of the difficulties involved in the problem of railroad regulation and his evident desire to impress upon Congress the necessity for cautious and conservative action. He says, for instance: "I am well aware of the difficulties of the legislation that I am suggesting, and of the need of temperate and cautious action in securing it. I should emphatic-

ally protest against improperly radical or hasty action." Evidently having in mind the way in which the House of Representatives was swept off its feet last year, when the Esch-Townsend bill was jammed through practically without consideration, and the criticism to which the Senate Committee was subjected for insisting upon knowing something about the subject before undertaking to act, he says: "This legislation should be enacted in a spirit as remote as possible from hysteria and rancor." These indications of a rather more conservative attitude on the part of the President and his evident willingness to concede something to the judgment of Congress have led to a generally more hopeful view as to the possibility of the administration and the leaders in the Senate and House getting together upon some reasonably conservative bill that will provide more efficient means for dealing with rebates and discriminations, especially when they are obtained through the medium of private car lines, private terminals, or other subterfuges, and that will provide for the correction of unreasonable or exorbitant rates without depriving the railroads of the right to a day in court.

Senator Elkins of West Virginia, Chairman of the Senate Committee on Interstate Commerce, to-day made the first movement looking to a compromise. He discussed the situation with leading Senators, and this evening gave out the following as a summary of what ought to be contained in a bill to confer upon the Interstate Commerce Commission authority to fix a reasonable rate and put it into effect promptly and, at the same time, give the railroads the protection of an adequate judicial review:

"Whenever any rate, fare, or charge fixed by any common carrier for any service shall be unreasonable or unjustly discriminatory or otherwise in violation of any provision of the act approved Feb. 14, 1887, entitled, 'An Act to Regulate Commerce,' or any act amendatory thereof, the Interstate Commerce Commission shall have power, after investigating the facts and hearing the parties affected, to make an order modifying such rate, fare, or charge so far as may be necessary in order to remove the unreasonableness, unjust discrimination, or other illegality thereof; and such order shall take effect at the expiration of such time as the Commission shall prescribe not less than (blank) days after the publication thereof.

"Any party affected by such order shall be entitled to institute a proceeding to review such order in the Circuit Court of the United States for any District through which the line of the carrier may run; and if the court in such proceedings shall find that the rate fixed by such carrier was not unreasonable, unjustly discriminatory, or otherwise unlawful it shall enter a decree setting aside such order; but if the court shall find that such order modified the rate, fare, or charge fixed by the carrier either more or less than was necessary in order to remove the unreasonableness, unjust discrimination, or other illegality of such rate, fare, or charge, then the court, by its decree, may modify or correct such order accordingly."

It is apparent that this proposition of Mr. Elkins raises some nice constitutional questions, and the advocates of a more radical plan are criticizing it to-night on the ground that it would be unconstitutional, as well as on the ground that it would not be effective, but would lead to prolonged litigation. Senator Dolliver, one of the leading advocates of more radical action, declared that the Elkins plan would not be a compromise, and that he would prefer the Foraker bill to it.

The message cuts the ground from under both the Interstate Commerce Commission bill and the revised Esch-Townsend bill, if the preliminary reports as to the nature of the latter bill are correct. It does this by proposing to limit the power of the Commission to the fixing of a maximum reasonable rate. The Commission bill proposes to authorize the making of both maximum rates and the fixing of differentials. It is understood that the revised Esch-Townsend bill contains practicallly the same provision. A considerable element among the advocates of governmental rate making will not be satisfied with anything that falls short of giving the Commission power to fix the relative adjustment of rates affecting rival localities either by the making of absolute rates or by the making of both maximum and minimum rates. On the other hand, there are members of both Houses of Congress who believe it would be both dangerous and unwise to give the Commission the vast power over the industries and commerce of the United States that it would possess if clothed with authority to fix differentials. It is feared that the Commission, whether making rates by rule or by favor, would so use this power as to build up some communities or sections of the country at the expense of other communities or sections. It is probable that the debates in Congress will develop a heated controversy between the advocates and the opponents of the proposition to give the Commission power over differentials.

One feature of the President's message, which he seems to have adopted from the annual report of Attorney-General Moody would indicate that some phases of the railroad problem have not been very profoundly studied by the administration. This is the recommendation, most clearly set forth by the Attorney-General, that, upon proof that one shipper has been given a preferential rate, the Commission shall prescribe that rate as the full maximum rate to be given all shippers in like situations. The President and the Attorney-General seem to think that this would solve the problem of suppressing rebates through the exercise of the rate-making power. They lose sight of the fact that there is no inducement for a road to grant preferential rates on other than competitive traffic, and that, if the Interstate Commerce Commission should compel the road that had granted a preferential rate to one shipper to give the same rate to all shippers, all competing roads would either have to put in the same rate or cease competing for that class of traffic. It is apparent that this would punish the innocent roads for the act of the guilty. The proposition is not new. It has been before the committees of Congress in former years, but it has been so apparent that it would work unjustly that it has never been seriously considered. Its indorsement by the President and Attorney-General will not lead to its being given any serious consideration at this time.

J. C. W.

The Origin of Four-Cylinder Balanced Compound Locomotives.

BY CHARLES R. KING.

The origin of the balanced compound locomotive in current use at the present day is less difficult to trace than the first creation of four-cylinder engines—balanced or not balanced—which have been introduced and subsequently abandoned without their leaving much record in the history of the steam locomotive. Having regard to this it is hazardous to say positively which was the first of all four-cylinder engines and which of these was the first to be "balanced" in the sense of that term as it is, somewhat incorrectly, employed to denominate locomotives at present.

Of the numerous examples of four-cylinder engines shown at the London International Exhibition of 1862, it may be suggested, subject to correction, that the first four-cylinder balanced engine built was Haswell's "Duplex No. 169," constructed for Austrian railroads. This Glasgow engineer from the year 1838 controlled the design of locomotives turned out from the works at the Sudbahn terminus in Vienna—to-day owned by the firm of K. K. Landesbefugten Maschinenfabrik der Privilegirten Oesterreichisch-Ungarischen Staats-Eisenbahn-Gesellschaft, Vienna. The cylinders were superposed, two on each side of the engine, bolted outside of the frames. There were four cranks, each pair standing at 180 deg. to each other on one side of the locomotive and each set forming an angle of 90 deg. with the set on the opposite side of the engine. The conditions realized all that we now consider necessary to justify the appellation "balanced," and something more besides: for by reason of the trimmed cylinders converging to drive upon the same center there was a difference in the moments of maximum tangential force of 6 deg. on the same side of the engine, or of 12 deg. for the aggregate on both sides of the engine. The ideal balanced reciprocating engine should, as we know, have a difference of 40 deg. in crank positions of maximum tangential moment—an arrangement impossible in steam locomotives. In John Haswell's balanced four-cylinder locomotive the cranks on each side of the engine drive the same pair of wheels (Crampton type), the two cranks, main rods and pistons lying in different vertical planes in order to permit of the overlying of the two main rods which worked upon the same side of one wheel. This engine had four turning points—a decided advance upon the two-crank engine of Mallet (1879) and the Vauclain (1896).

As far as can be traced the first practical application of the balanced compound system in passenger locomotives was made in the year 1884 on a simple expansion engine named "Vulcan," belonging to the Hind, Punjab & Delhi Railroad. The old cylinders of 15¾-in. diameter were removed and replaced by two others of 17-in. diameter, for the second expansion, while, for the high-pressure, two new cylinders of 11¾-in. diameter were bolted outside the frames. The stroke of the four pistons was 24 in. and the diameter of the four wheels, connected, 60 in. Each group of cylinders on the same side had its cranks standing at 180 deg., those of the second group, on the other side also standing at 180 deg., the angle formed between the two groups being 90 deg.

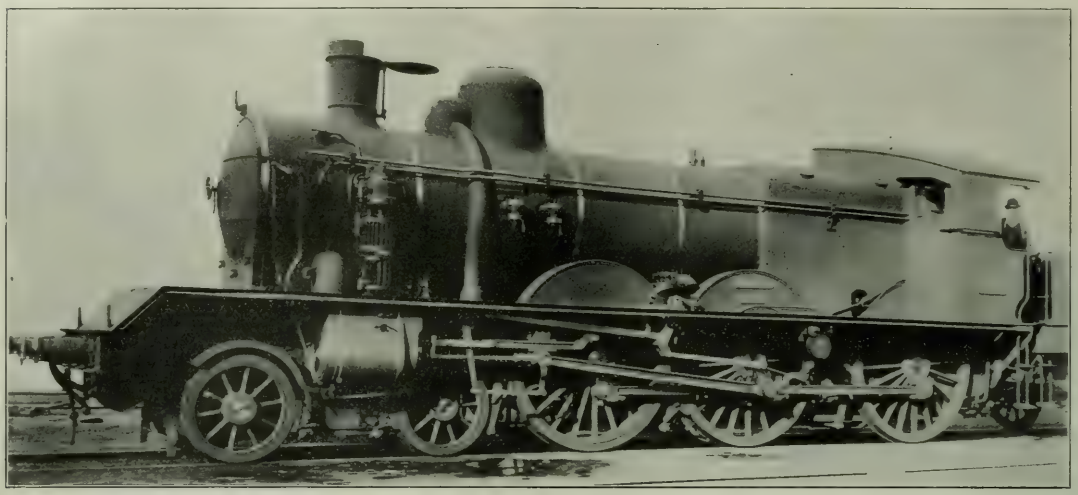
From this description we have the origin of the modern balanced compounds of central Europe which, to-day, represent the most intelligent and advanced practice in locomotive design and which carry all the records for high speeds (90 miles per hour up grade), as also for fast heavy haulage in pulling, at express speeds, five tons of train per ton of locomotive and tender in average condition of service. Of the Indian prototype the only published record of the results it gave were coal economy and augmented power.

At this stage credit must be given to those who conceived the first four-cylinder compounds. The project of Ebenezer Kemp "proposed arrangement for compounding locomotive engines," Feb. 13, 1860, appears to be the first of all multiple-cylinder compounds having only two cranks. The engine to which it was supposed to be applied was one of the Caledonian Ry. single driving-wheel engines. It may be described as a double tandem having two high-pressure cylinders one at each end of a low-pressure cylinder into which they exhausted. Passing over the Austrian engine already noted and certain abnormal "Nord" types exhibited at London in 1862, we come to the really remarkable patent, No. 1,857, June 20, 1872, of William Dawes. Three types of four-cylinder compounds are comprised. 1. Tandem. 2. Four-cylinder cross compound with

cranks at 180 deg. 3. Four-cylinder compound with two pistons driving one pair of wheels, and the other two pistons driving a second pair of wheels "without the intervention or use of coupling rods." Here, evidently, is the prototype of the first Webb compounds and of the experimental de Glehn compound "No. 701," neither of which was a balanced engine, and the only difference between which was that in the de Glehn engine the single low-pressure cylinder of the Webb compound was divided into two.

In the same patent is to be found the origin of many a starting-gear now in use, that is, for the admission of boiler steam direct to the low-pressure cylinders automatically, by connecting any form of valve or cock, necessary for this admission, to the reversing gear, and in such way that only at full gear—as in starting—are the live steam cocks opened. Needless to add that this invention has since been repatented by others in all parts of the world, and also applied in many differing modifications.

Subsequently the tandem type, in different forms, was patented in France by M. F. de Diesbach in 1873, and also by Jules Garnier in 1874, and suggested by "the father of the compound engine," Anatole Mallet, in 1879, as communicated by him to the British Institution of Mechanical Engineers. Some new arrangements for the same type of compound, and applications of these types, were made on the Boston & Albany Railroad in 1883, and, later, on the North British Railway and English Great Western; also by M. du Bousquet on the French Nord line—in this latter case the machine being of the Woolf system in which the ratio of low-pressure cylinder volumes was three, a ratio which to-day is generally admitted to be the correct one for steam pressures of over 200 lbs. But this type of engine is, as are the Vauclain type and the prototype of the Vauclain invented by M. Mallet in 1879, out of the scope of this paper except as a historical landmark. For the same reason the three-cylinder locomotives proposed by Jules Morandière (1886), and the first three-cylinder compounds actually built at the Struwe works, Kolomna, Russia, in 1881, as also the project of Webb for such engines in June, 1879, realized in practice in 1881, must all be passed over with the mere mention. For the same reason also the great improvement on Webb's engine made by means of an added cylinder by M. de Glehn in the experimental engine of the Nord "No. 701," proposed in 1884 and turned out of the Belfort shops in December, 1885, must be omitted, because it was not a "balanced" compound, and this simply from the insignificant detail that the side rods were not applied any more than in the Webb compounds.

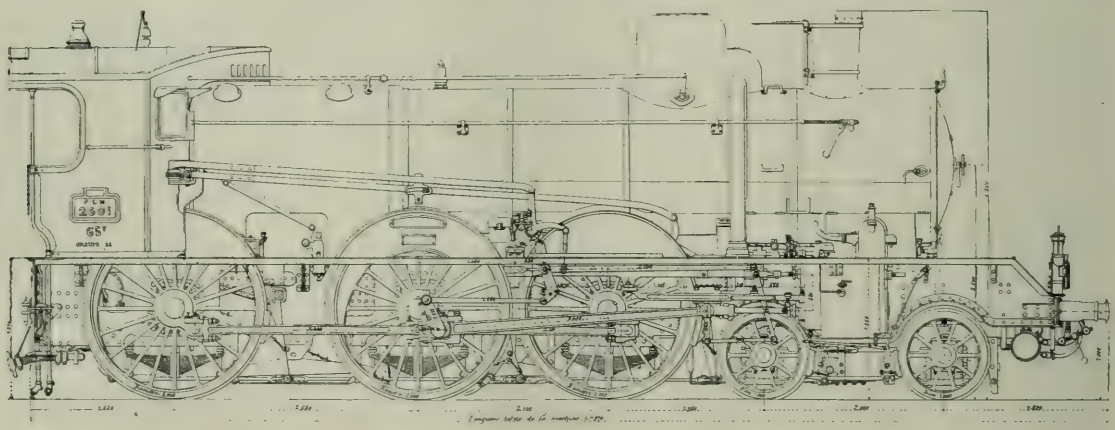


The First Four-Cylinder Balanced Compound in Europe. Built for the Paris, Lyons & Mediterranean.

The first four-cylinder balanced compounds ever built outside of Asia, that is, in Europe or America, so far as can be found, and the first regular series of four-cylinder express engines in the world—balanced or not balanced—were designed in the year 1888 by Monsieur Charles Baudry, principal mechanical engineer under Monsieur Henry, the late Chief Engineer of Motive Power of the Paris, Lyons & Mediterranean Railway of France.

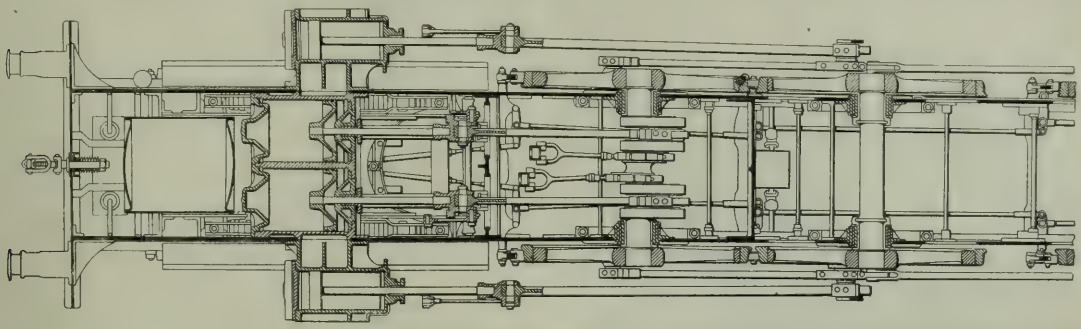
These compound engines were built to the number of six for both passenger and freight service, and three of the types were shown at the Paris Exhibition (Champ de Mars) in the year 1889, the first standard types of four-cylinder compounds having four cranks, and almost perfectly balanced, that were ever constructed. These facts do not, of course, agree with the popular idea of the origin of four-cylinder compound engines, but in this case there is no alternative—other than the truth.

Not only that, but these first balanced compounds possessed original features which have in part since been embodied in the



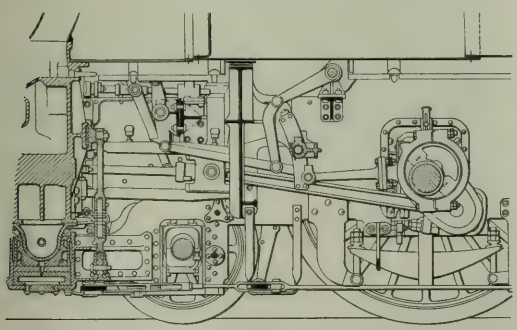
Side Elevation of Original Four-Cylinder Balanced Compound on the P., L. & M.

practice of central Europe. As with all French locomotives built since that time, they took from the Webb compounds the principle of dividing up the driving effort between two separate axles. With a certain difference the location of all four cylinders underneath the front end of the boiler is just that which has since become the standard practice of central Europe. The "certain difference" just stipulated was this, that although all cylinders were bolted together *en bloc*, the inside cylinders were advanced half a length in front of the outside cylinders in order to increase the length of the inside main rods without unduly increasing the length of those outside. More displacement of the two groups in respect to each other (as for instance in the Cole locomotive) could have been effected, but this would have led to one of the notable inconveniences of the de Glehn arrangement—that is the difficulty of access to parts requiring attention while on the road, only in this case with the difference that it would have been the "little ends" and piston rod packings which would have been difficult of access instead of as in the de Glehn arrangement the "big ends." The Henry-Baudry solution in 1888 is to be seen repeated in the newest types of Belgian four-cylinder compounds known as Class 19 A. There is an instructive similarity between the pioneer balanced compounds of the P. L. M. and the recent engines of the G. N. R. (England), the "Cole," the Belgian "19 A," and still others which reflects much credit upon the designer of the first balanced engines, who is the present Chief Engineer of Mechanical Power of the P., L. & M. Railway (Dr. Baudry).



Arrangement of Cylinders of First Four-Cylinder Balanced Compound, Showing Inside Cylinders Set Ahead of Outside Cylinders.

The experimental compound of M. de Glehn was engine "No. 701," introduced on the Nord under the direction of Chief Mechanical Engineer M. Edouard Delebecque. On this railroad as many as 13 side rods broke in service during the year 1886, and each of which might, as in the Loughor accident in England (1905), have caused serious disasters. It was held, then, that side rods were undesirable but very necessary. Finally M. Ferdinand Mathias, who had since become Chief Engineer, said at the Railway Congress of 1889: "If we adopt compound engines we will do like M. Henry, and accept side rods, whatever be the system." At last the plans for the Nord's first four-cylinder compounds were prepared under M. du Bousquet in 1890—who had, in the meantime, been promoted Chief Engineer—and the first engine was delivered from the Belfort works of the Societé Alsacienne in the course of 1891. Two such engines were built without side rods, but they had to be fitted afterwards with these rods, as were also the first regular series of Nord balanced compounds (2,123—2,137) built in 1893, or four years after the the P. L. M. balanced compounds. Of the remarkable speeds made by these Nord locomotives the writer, at that time living in France, was the first to draw the attention of engineers through English periodicals in the year 1892. There is no doubt that the pioneer compounds of the P. L. M. would have done at least as well, but the conditions demanding high speed and also permitting it have always been more favorable on the French Nord than anywhere else on the Continent. This important fact is, however, never heeded by many—especially so with those who would rather never know, and they, too, are numerous.



Section Between Frames Showing Inside Rock Levers.

Instead of taking into account the splendid and easy conditions of the Nord line many persons attribute the high velocities to the use of two sets of valve gears. It is therefore of great interest to note the fact that the Societé Alsacienne de Constructions Mécaniques, of Belfort and Mülhausen, actually planned the new "Nord" machines with only one set of valve gears (according to present-day modern practice), the outside valves being driven direct and the inside valves reversed in direction, in order also to give outside admission for the slide valves, by means of rock shafts. But M. du Bousquet insisted that two independent valve gears should be fitted and that an intercepting valve should also be applied in order to be able to run the machine, if desired, as a four-cylinder single-expansion machine.

From this point it is needless to continue the "origin" of four-cylinder balanced compounds. The subsequent machines on the Continent were either modeled after the Henry arrangement or the de Glehn arrangement, and either embodied the main principle of the Webb compounds, but with added side rods, or else followed the Indian prototype, according to the present most approved practice of central Europe, that is, cylinders on one transverse line, one driving axle (cranks at 180 deg.), and one set of valve gears. It is not easy to fix the development of this type. Monsieur Edouard Sauvage, former Chief Engineer of the central shops of the Nord at Paris, probably contributed his share on the compound engine No. 3,101 shown at the Paris Exhibition of 1889, alongside the P. L. M. pioneer balanced compounds. In this type also there was but one motor axle and the cylinders were all placed in line—but of these there were only three.

A very curious fact to remark is that while Mr. Webb in his three-cylinder compounds gave all the elements of cylinder disposition and double motor axles to nearly all existing four-cylinder French compounds, yet his own first four-cylinder compounds were arranged precisely according to the most approved European practice at the present day. Thus the two most divergent and principal forms of locomotive compound engines—the one employed in France and the other throughout the European Continent, are typified in Webb's first and Webb's second compound engines, and the merits of the one and the other are about to be investigated in the most complete, scientific and practical manner by the State Railways of Belgium with Central European types, Henry Baudry types and de Glehn types. The most interesting of all engine systems of the Central European type, that is, the "Adriatic," whose mechanical efficiency remains without an equal, does not figure in the list of newly-built Belgian balanced compounds.

From the foregoing it will be observed that it is neither the originality of a locomotive type, its relative simplicity of construction, economy in coal and maintenance, and general handiness in operation that have impressed these qualities upon the notice of the popular mind; it has been the sole item of high speed, with light load or heavy load that is of no consideration—it is the mere speed. Nor is it taken into account that 19 out of 20 unheard of locomotive types would be able, upon roads permitting it, and under conditions calling for it, to sustain the same velocities with an identical average pull at the drawbar as those of which we have heard so much from France. At present the records of highest speeds with enormous paying load (train load) per ton of engine are held by locomotives of the "Adriatic" type. If we compare the speeds attained elsewhere upon the basis of car-load per

ton weight of locomotive we shall be severely disappointed. For mere speed alone—automobile speed—without consideration of the weight hauled per ton, locomotive history shows that the highest average velocities are attained by very old types of locomotives. For instance, in the trials of the engines which followed the exhibition of locomotives at Paris in the year 1889 it was not the Henry balanced compounds, nor any other modern engine, which carried off the record for extremely high speed—it was an old Crampton engine!

In the present article the term "balanced" compound is employed in the popular sense which so denominates a four-cylinder locomotive having four crank points at 90 deg. The really balanced engine remains yet to be built. With cranks which attain their moment of maximum force twice at each revolution—once at 85 deg. or much less, and once, on the return stroke, at 190 deg. or much more—no present-existing form of locomotive allows of such an appellation other than in a relative sense. The first four-cylinder locomotives that the writer can trace as having the cranks attaining their moment of maximum tangential force at the same degree of the cranks' revolution on opposite sides of a vertical line drawn through the axle center, were the express engines built in 1862 for the Chemin de fer du Nord when M. Jules Petiet was the Chief Engineer. But as these engines were specially built to avoid the use of side rods the engines were in reality less "balanced" than those of to-day. In the case mentioned there were two driving axles—one at each end of the locomotive, and the cylinders were placed at each extremity of the frames. In recent times a perfectly balanced four-cylinder locomotive with connected driving wheels and cranks attaining their moment of maximum force at corresponding degrees on each side of a vertical line drawn through the crank-axle center, was designed by Signor Scappini, of the Breda Locomotive Works, Milan, Italy. At the present time the writer is unable to say whether this scheme has materialized. It is generally in old marine engines that we find the most frequent examples of cranks attaining their moments of maximum tangential force at different degrees of the crank shaft's revolution.

The Henry balanced compounds of the year 1888 have been reproduced up to this day with less difference of main features or of details than has been the case with other French compound systems. The first balanced compound of Class C-1 was exhibited at Paris in 1889. The last balanced compound of the same system, of which there are nearly 600 at work, is shown this year at the Liege Exhibition. The cylinder disposition remains as in the pioneer engines of Class C-1. Piston valves giving inside admission have replaced the flat slide valves then used. Those inside the frames of Class C-1 were, however, placed underneath the inside or high-pressure cylinders. There were no inside eccentrics, motion for the Walschaert's valve gear being derived from a point on the main driving rod—as in the Joy system. The larger cylinders were placed outside of the frames and there is no doubt that at no distant date French builders will be obliged to return to this practice to provide adequate volume of cylinders for the second expansion. The pioneer balanced compounds had four valve gears, but the reversing mechanism was specially arranged so that the engineer could not alter the relative degrees of cut-off in the high-pressure and low-pressure cylinders other than in the fixed degrees allowed in the shop adjustment. In the new engines the valve travel of the low-pressure cylinders is made invariable at 63 per cent. and the high-pressure can be varied at will from 20 to 88 per cent. The long admission up to nearly 90 per cent. in starting and with cranks at 180 deg. dispenses with that troublesome appliance, the intercepting valve for exhausting the h.p. cylinders direct to the air. The invariability of the low-pressure valve travel, or else a higher fixed proportion for its degrees of admission as compared with the high-pressure valve travel, is necessary for free steaming when the low-pressure cylinders have an insufficient ratio of volume. In one case two sets of valve gears are necessary and in the other case one set suffices. The most approved practice to-day is one set of valve gears giving nearly identical cut-offs to cylinders having volume ratios of 1-3, and if this practice is adopted in France it will be either the Est or P. L. M. to take the first step. The special arrangement of the P. L. M. engines for reversing the engine and automatically setting the low-pressure valves for a cut-off of 63 per cent. in backward gear consists of a trip and self-locking gear on the low-pressure reversing bar which is quite free between the two points of 63 per cent.—back and forward—to prevent accidents to the gear if the engine be reversed. While under motion the low-pressure bar is connected to a dash pot or moderator bolted to the firebox covering. The cylinder is filled with oil and the piston plunger is perforated with holes so that any violent movement of the shaft is prevented.

The Walschaert valve-gear is reversed in the position of the radius rod on the advanced or lead-lever, as is readily distinguishable on the general view, in order to give central admission to the piston valves. The same disposition for the independent set of valve gears inside the frames is realized through vertical rocking levers. The low-pressure valves are 280 mm. in diameter and the high-pressure 200 mm., the l.p. having a full travel of only 125 mm. and the h.p. of 145 mm. The lap given is 19 mm. for the h.p. and 34 mm. for the l.p. The lap on exhaust for the h.p. is negative 3 mm., and for the l.p. line-and-line. The cylinders have diameters of h.p. 340 mm. and l.p. 540, the piston stroke being 650 mm. The ratio of cylinder volumes is, in consequence, only 2.52. The receiver volume has been reduced to 4.95 cu. ft., and smaller clearance volumes have been adopted for the piston valves than is usual for French slide-valve engines. These average 10.1 per cent. for h.p. and 6.22 for the l.p. cylinder working volumes.

The valve gears and motion generally are neatly designed and simple in composition. Single guide bars are used—an unusual practice in France. Double bars are employed for the shorter inside main rod cross-heads. The outside guide bar is cut away to allow the lead lever to pass through its center line which lies in the same vertical plane as the valve spindle. By this means torsional strains are eliminated from the articulations of the valve gear. The guide bar is bolted to a special outside frame of cast-steel which also carries the whole of the valve motion.

To assist the engine in starting boiler steam can be admitted to the receiver by a simple non-automatic cock under the hand of the engineer and by the pipe which is visible in the outline view of the engine. As usual four suction valves are provided on the receiver at each side of the engine and others in connection with the l.p. exhaust. A relief-valve, set at 80 lbs., is also mounted on the receiver.

The pilot truck is of a novel arrangement without swinging links for carrying the pivot. It has, however, an equally flexible movement and allows of universal rotation about its spherical pivot and 34 mm. of direct lateral displacement on each side. On curves the engine is, by helical guides in the pivot box, pitched in towards the rail of shorter radius. The trailing connected pair of wheels is provided with axle boxes working on inclined planes allowing 7 mm. lateral displacement on each side. The boiler is fitted with a pair of silent action safety-valves, and is fed by two Sellers injectors of 8½ and 9½ mm.

The newest machines are designed to pull trains of 300 metric tons up grades of 0.8 per cent. (P. L. M. maximum for lowland lines) at a speed of 50 miles per hour. They are noteworthy for many interesting details and their outward aspect although less pleasing to the eye than the handsome locomotives of the de Glehn type, is still an advance upon previous models, and there is no doubt but that in a parallel service with de Glehn engines they would attain equally high speeds.

They have 3 sq. meters of grate area; 221.17 sq. meters of heating surface; boiler pressure of 215 lbs., and weigh 65.2 m. tons empty, or 70.7 m. tons fully loaded, the weight under each pair of driving wheels being 16,850 kgs.

The preceding description of the Henry-Baudry balanced compounds does not include another type employed by the P. L. M. R. R. Co. wherein all four pistons drive upon a single motor axle. Of these there are 140 machines, or a total of 731 balanced compound engines in the service of this road.

Freight and Express on Interurban Lines.

In a paper read before the Indiana Interurban Railway Association, Mr. E. Graston, Superintendent of Freight and Express of the Indiana Union Traction Company, said that the handling of freight and express on interurban lines is being found profitable and does not, in the least, interfere with passenger traffic. Even on a small scale it is showing good results, although it is yet in its infancy. An immediate hindrance to its growth is the fact that at present all companies are confining their traffic to their own lines. This is a great drawback in competition with steam railroads, as shippers naturally prefer to divert their long-haul traffic to lines where, through the interchange of traffic, they can make their shipment with only one change and consequently a minimum of expense. If the electric roads would get together and agree on through rates between their respective lines on the same basis as the steam lines and arrange for an interchange of traffic, they could handle through traffic without any noticeable increase in expense per mile, and so compete with the steam roads on equal terms. One of the greatest difficulties experienced at present is to convince shippers that the electric road is prepared to handle all kinds of freight traffic. Most of them assume that it cannot take any kind of freight except small packages. Another handicap in this competition is the lack of facilities at transfer stations. The proper freight stations and platforms should be provided with floors on a level with the floors of the freight cars; this makes it possible for the trainmen to handle freight more quickly and carefully, and makes it also more convenient for transfer men to load it on their drays. Mr. Graston says that his road is losing considerable traffic at stations not equipped with these high platforms, and that the shippers at these points say they would gladly give the road their

business if its station facilities were on a par with those of the steam roads. Good sidetrack facilities are also an important item to the traffic department in the same manner that proper stations are. They enable loaded trains to be started on the road with the least possible delay and they keep the operating expenses down to a minimum. The official classification, as agreed to by steam railroads in the territory concerned, is recommended, with the exception of the rates on a few articles which, owing to their nature, necessitates a different rate in order to be carried profitably by interurban roads. Household goods in particular are classified too low.

In making out the waybill used by the I. U. T. three carbon copies of the original are made at one writing. The waybill shows the station from, destination, date, car number, name of consignee consignor, description of articles, weights, rate and amount of freight. The original and one copy are delivered to the conductor, who checks his freight to and from the car, and when he gets the freight to its destination delivers both to the agent. The agent, on the delivery of the freight, signs the original, which is his expense bill, and delivers it with the goods to the consignee, who signs the copy as a receipt. One of the two remaining copies is sent by the forwarding agent to the auditor, and the other is kept for his file.

Cars intended for hauling freight traffic should be from 45 ft. to 50 ft. long, and motor cars should be so equipped that they can handle trailers without difficulty. Box car trailers are recommended to take care of carload business, and as much business as possible should be handled with them, as they keep down operating expenses.

Railroad Shop Tools.

MILLING MACHINES.

(*Continued.*)

The accompanying illustration, Fig. 1, shows one of the latest designs of heavy rod milling machines made by the Newton Machine Tool Company, Philadelphia, Pa. The spindles are 6 in. in diameter. It has an adjustment on cross rail for convenience in setting cutters, and has a direct worm and worm-wheel drive. The worm-wheel is of phosphor bronze, and the worm of case-hardened steel running in a bath of oil through gearing by a 35 h.p. motor or is driven by a four step cone as desired; the cross-rail is of an inclined face designed to throw the thrust of the cut on the upright, and the center of the spindle is carried 4 in. below the point

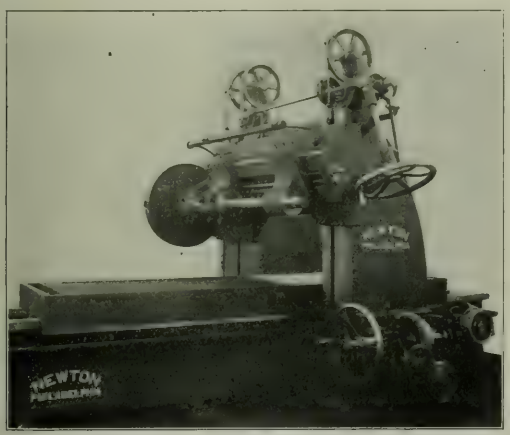


Fig. 1—The Newton Heavy Rod Milling Machine.

of the rail for "necking" rods. The design of the rail as shown, overcomes to a large extent the tendency to drop in when running from a wide to a narrow section, and being provided with a long bearing on the upright eliminates a great deal of chatter so prevalent on the older designs of tools. The uprights carrying the cross rail are made one wide and one narrow, the wide upright being 25 in. width of face and the narrow upright 12 in. width of face, the wide upright taking the strain of the drive. The cross rail is counterweighted and has both power and hand adjustment. The carriage ways are each 6 in. wide and the carriage is of extra deep section and is operated by a spiral pinion and rack. It has power quick traverse in either direction and may be fitted either with a friction disc, fed as shown, or a gear box, having nine changes of positive feed as desired. The carriage of the machine is 36 in. wide and can be made to mill any desired length; the table shown is to mill 10 ft. long, and the uprights will admit work of 40 in. wide, and the center of spindle can be raised 30 in. from the carriage. This design of machine is made in several sizes, as a standard heavy slab milling machine, any of which can be fitted with an auxiliary vertical spindle. The operation of the machine is then the same as the machine just described. The vertical spindle provided is 4 in. in diameter, and has an independent vertical adjustment of 2 in., and is unclutched by slipping the driving pinion out of mesh and remains idle when not in use. This is particularly adapted for milling the front frames for locomotive work, and can also be used for any job within the capacity of the machine. If desired, a power feed will also be furnished for feeding the vertical spindle across the carriage. This spindle is an auxiliary feature of the machine, and is arranged as a part of the outboard bearing. A similar spindle can be fitted to the main horizontal spindle bearing when desired. The Newton Machine Tool Company has just received an order from the Amer-

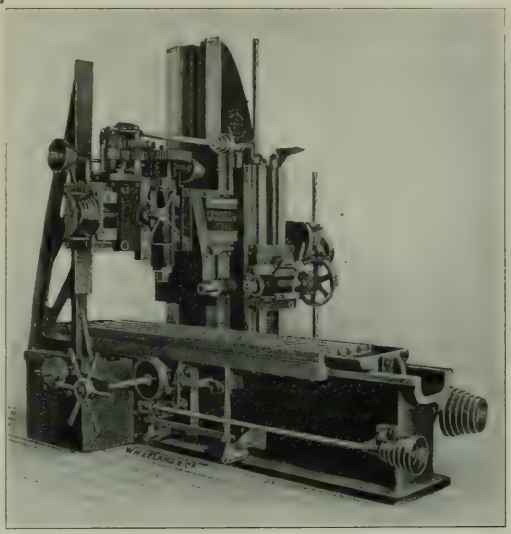


Fig.2—The Beaman & Smith Combined Vertical and Horizontal Spindle Milling Machine.

ican Locomotive Co., Pittsburg, for two of these machines having a geared feed, and have just shipped one each to the Rock Island and C., B. & Q.

Fig. 2 shows a combined vertical and horizontal spindle milling machine made by the Beaman & Smith Company, Providence, R. I. This machine is adapted to meet the requirements of a great variety of work, due to the fact that it has two spindles, one vertical, the other horizontal. Also that the outer support for the cross-head or overhanging arm can be removed so that work can be done that would not pass between the uprights. A detachable revolving table which is not shown can also be furnished with this machine. With this attachment circular pieces can be machined with either the vertical or horizontal spindle. Any shape of milling cutter can be used with the machine. Both the horizontal and vertical spindle heads are provided with adjustments in the saddles which have horizontal and vertical movements respectively on the over-hanging arm and on the upright.

The spindles have tapered ends for face milling cutters, also taper holes for cutter shanks and arbors with retaining bolts through their centers. With them any form of cutter can be used to advantage. They can be driven in unison, or singly, the horizontal in either direction; and as the double back-gearing for each is attached to its respective head, it admits of different speeds being used simultaneously. The table is provided with power quick movement in either direction, and also is provided with automatic feeds arranged so as to maintain a desired rate at any spindle speed. It has five tee slots and six rows of holes for stop pins. The cross-head, or over-hanging arm, is substantial and is capable of supporting the spindle when the left-hand upright is removed, it being detachable to facilitate operating on larger work than would otherwise be the case. The cutter arbor support for the horizontal spindle is also detachable. The table has a working surface 24 in. wide, 8 ft. long and 9 ft. movement on bed, and is provided with a power quick movement of 15 f.p.m. The feeds of the table vary from 1 in. to 8 in. per min., and the feeds of the vertical spindle saddle on the cross-head varies from ½ in. to 4 in. per min.; in either direction the total cross feed is 32 in. The power is transmitted by a 5-in. belt on a four-section cone from 14 in. to 20 in. diameter, through gearing in the ratios of 6⅝ and 16½ to 1, pro-

viding eight speeds from 12 to 64 r.p.m. The spindles each have tapered ends 3¼ in. diameter, and also have a No. 12 Brown & Sharpe taper hole. They have 6 in. of independent adjustment.

The following figures will give a general idea of the capacity of this machine. The center of the horizontal spindle is 6 in. in advance of the vertical spindle. The distance from the top of the table to the spindle varies from 3 in. to 36 in. The distance from the end of the spindle to the detachable upright is 40. The distance from the end of the vertical spindle to the table varies from 0 to 54 in., and the distance between the uprights is 41 in. The countershaft has one tight and one loose pulley 18 in. diameter for a 5½ belt to run at 300 r.p.m. The weight is approximately 26,000 lbs.

(To be continued.)

Railroad Development in Japan.

BY GEORGE E. WALSH.

While the large orders which Japan has recently placed for electrical equipment and heavy machinery of all kinds are only preliminary to the awakening of the country, they indicate the line of development which the people of the empire are likely to follow. Accepting only the best and most modern machinery, their industrial progress must be characterized by great strides. In respect to its steam railroads, Japan starts with the handicap of many miles of narrow gage road and a good deal of old machinery and track equipment. However, this will not long remain true, for the shipment of modern American locomotives and coaches to Japan has been going on steadily now ever since last winter. Even during the uncertainty of the recent war Japan was buying American cars and locomotives, besides track equipment and other accessories, and the danger of capture by Russian ships did not interfere with this traffic. Including the repairs and extensions of the railroads in Korea and Manchuria, Japan has been a most diligent railroad builder during the last year, and this was carried on when her people had a great war on their hands, and in the face of great financial difficulties.

Japan has borrowed her ideas of railroad building from her two greatest friends—England and America. Her railroad and construction engineers received their education in one or the other of these two countries, and many of them have visited the shops and plants in this country within the current year to renew their acquaintance with the best railroad practice. The country is physically unsuited to great railroad development. The mountain systems break it up into many small districts, so that railroads have either to climb steep grades, cut through mountains or skirt their bases in the most exasperating way.

Yet Japan is preparing for complete reorganization of its railroad system. In 1902 it had upward of 5,000 miles of railroad, but to-day, if we include the Korean and Manchurian possessions, has more than 8,000 miles. There are upward of 2,000 locomotives. 6,000 modern carriages or coaches, and 20,000 freight cars or wagons for carrying goods. American locomotives are gradually displacing the old type of engines that were designed in England, Germany or the home shops. More English coaches, with side doors, are found in Japan than those of the American type, but the latter are steadily making headway. In their friendly sympathy with England the Japanase railroad companies placed orders for freight cars and coaches with English firms, but their leaning to advanced types of all machines and implements has lately convinced them of the superiority of the American cars. A few recent orders have even included American pressed steel freight cars, and these have been placed on the new lines running to the interior mines.

The leading roads have adopted the American engines almost entirely. There are over 30 engines in the Government railroad service built in this country in 1902, and more than a dozen more have been ordered since. These locomotives were built at Schenectady by the American Locomotive Company, with 60 in. drivers, and cylinders 16 x 22 in. They are used for the ordinary first class trains which travel on comparatively level stretches of track. On trunk lines, where the grades are heavy special mogul engines have been in use for two or three years. The first of these mogul engines were made in England, but the later ones were built in this country. American representatives of the railroad companies are now in Japan making careful estimates of the needs of the new lines of roads projected and contemplated. Owing to the sharp grades of some of the new lines it will be necessary to use engines of large size and power. Japanese engineers who have been in this country in the past year to study railroad conditions expressed themselves as pleased with the type of locomotives used in the Rocky Mountains. From present indications it seems likely that Japan will order a number of similar locomotives for their heavy grade work.

Before the war with Russia the Japanese engineers had established a locomotive building and repair plant at Kobe. From this shop several good consolidation engines were made and are now doing service. This plant was largely of an experimental nature, but it is now working overtime to supply the demand. The most recent orders from this shop are compound, two-cylinder engines, weighing 40 tons, with 15 x 22 in. cylinders, and driving wheels 53 in. in diameter. The completion of these engines was considered an important day for Japan, and their maiden trips were made amid a good deal of enthusiasm and public recognition. But while this plant has performed some excellent work, and duplicates of it are likely to spring up in other places, it is not likely that Japan can depend upon its home manufacturers for many years.

The early railroads of Japan were very crude affairs, and they have had to be torn up and rebuilt over their entire length. Flimsy wooden bridges and trestle work, and very imperfect roadbeds characterized the routes. They were, however, well laid out, and they must continue to be the main arteries of traffic. The replacing of the wooden bridges by iron and stone structures has been carried on steadily ever since 1870, when the railroads were partly reorganized by the order of the Emperor. The iron bridges were made at home and in England. The latter country for a time had a monopoly of bridge building, and English engineers designed most of the structures in Japan of this character. Stone, concrete, and iron bridges have now been placed over nearly all of the important streams and mountain chasms.

One of the largest and most important of the bridges is over the river Tenriu. This is a bridge of 19 spans, and is about three-quarters of a mile long. It is built entirely of iron and steel, with solid stone and concrete foundations. Another bridge, over the river Oi is of 16 spans. The railroads cross the rice fields in many places, carried either by trestle work or by numerous small bridges joined together. Valleys, rivers and tunnels are frequent, and one travels through an ever changing panorama. The rivers and small streams with sources in the steep mountains rise with great rapidity in the rainy seasons, and the bridges have to be made large and strong. In all railroad engineering in Japan the bridge, culvert and tunnel problems stand out conspicuously, as do also the questions of route and grade. The country rises abruptly from the seashore, and it is difficult to provide easy grades to the interior."

At one point where a mountain range has to be crossed there is a rise of 1,138 ft. in less than 12 miles. To climb this steep grade the best American mogul engines are used, and they perform their work with general satisfaction. Along another part of this route gradients of 1 to 40 extend over a distance of 15 miles. In crossing the Sekigahara Pass there is a rise of 750 ft. within a ride of 12 miles. The constant rise and fall of the grade causes a good deal of wear and tear to the rolling stock, but none of these steep grades can be avoided without extensive blasting and boring of tunnels.

Unfortunately for the future of the Japanese railroads they adopted the 3 ft. 6 in. gage, and the question of replacing the most important tracks with standard American gage has been seriously considered. It seems only a question of time before these roads will fail to accommodate the increasing traffic of the country; but for the present there is little likelihood of a change. Japan needs more roads, and money will be invested in these rather than in tearing up old tracks. The inconvenience of the narrow gage has been partly offset by increasing the width of the rolling stock so that freight traffic is not so seriously handicapped. The most apparent drawback as a result of the gage is the limit of the speed. This is placed at 40 miles an hour for the better class express train service.

The Japanese engineers have been progressive in their adoption of modern equipment of operation. Block signal systems are used on the main government lines, and the vacuum brake is pretty generally employed. The tendency is to improve the rolling stock so that any disadvantage of curves and roadbed can be partly overcome. Electric alarm signals at crossings and even electric train lighting have been installed on some of the short lines. One thus finds examples of the best English and American practice, and to a traveler many such pleasing reminders of home cannot fail to impress him with the advanced methods of Japanese railroading. Courtesy is characteristic of the Japanese, and the railroad employees and officials are models of propriety, and obliging servants.

The minuteness of the regulations on the Prussian State Railroads may be inferred from a recent order, adding to the instructions for preventing accidents recently issued from the ministry. This directs that in powdering carbide and the preparation of poisonous colors, the making of dust must be avoided, and the workmen must wear respirators. Instructions are given for the preparation of such colors, and especially of lead colors. The workmen engaged in such work must not smoke, chew or take snuff while at work. They must avoid soiling and working clothes with the colors, and hair, beard and finger nails must be kept cut short. They may not eat or drink nor leave the place where they work until they have changed their working clothes, brushed hair and beard, and washed face and hands thoroughly with soap, where possible with pumice stone or marble-dust soap, cleansed the nostrils and rinsed out the mouth; and then the eating and drinking must not be in the room where they work.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XXXIX., No. 24. FRIDAY, DECEMBER 15, 1905.

With undoubted inaccuracy it is related that the United States Fish Commission, casting about for an expedient to mitigate the bony structure of the shad, once crossed the breed with jelly fish, and obtained thereby a bony jelly fish. This parable is suggested by the anti-rebate plan of the New York Board of Trade and Transportation, which sees a simple and efficacious remedy for discrimination in vesting the Interstate Commerce Commission with authority to fix a discriminatory rate as the maximum which may be charged for one year by the offending carrier. When the New York organization first brought forward this happy thought, its attention was promptly called to the fact that its new maximum rates would affect not merely the specific road that had sinned, but all others competing with it, since the wicked, pilloried rate would get all the business until it was met. In answer to this, the suggestion is now made, in a draft of proposed legislation, that the innocent roads who have been made to suffer by the establishment of such a maximum rate on the lines of a competitor, shall be allowed to collect damages by suit at law: "—nothing in this act shall preclude any party injured from instituting and maintaining an action at law for the recovery of damages against the road, corporation or carrier making an unlawful rebate or discrimination." We may add that nothing in the common law at present precludes any carrier from instituting suit to recover damages in such a contingency, yet, in practice, the remedy remains unsought. It is noteworthy that the Attorney-General indorsed this plan of a pilloried discriminatory rate, without apparently so much as considering the effect on competitors.

From the standpoint of the superintendent—through whose eyes we must look if we are to consider effectual remedies—the radical defect in the engineman at Baker Bridge, without doubt, was his inexperience; and the collision three days later at East Everett (reported on another page) appears to have been due to the errors of another engineman with the same defect. We are not informed as to the record of this second negligent runner, but the fact that the master mechanic cautioned him to be careful, because it was a rainy night, telling him to make sure that no accident occurred, betrays a lack of confidence in his competence. In both cases these comparatively green men were running helping engines. Do we sometimes overlook the fact that though "helper," as defined in the dictionary, means a secondary person, it in reality here means the person of first importance? The runner of the leading engine of a double-header cannot be made secondary. To be such he must put his engine behind the other one. The superstition that because a disaster occurred on the Boston & Maine Nov. 26 there must needs be two more within a few days (there was a bad butting collision of freights on a New Hampshire division of the road on the 26th) may or may not have had its usual prominence in the gossip of the cabooses; but whether there were three, or three dozen, this one element of the remedy is as plain as a pikestaff. Many of the most vital features of an engineman's training seem to be gained only by the slow growth that we call experience. The best book-examination in the world is in many of its features little more than an index, to guide the examiner in looking as far as possible into the candidate's habits of mind. It is true that a man does not experience the difference between fast-train work and slow-train work until he actually tries the fast train; neither can a helper know the responsibility of a leader until he actually leads. It is also true that the happy balance between education by observation and education by doing the actual work is not always easy to manage. The benefit of an adviser in the cab with a young runner soon finds its limit. But the fact that a duty is difficult does not relieve us from doing it. A man of fair intelligence who fires for six years is very likely to learn nearly everything that is necessary to make him a good engineer, so far as it is possible to learn by looking; but to have the assurance that he knows quite everything that the rules require, we must do more than count months on the calendar. It may require the careful assignment of each fireman to different classes of trains, perhaps on different divisions; his regular examination on his acquirements, and this probably more than once a year for three years; a similar carefully prescribed variety of assignments when he becomes a runner; and, perhaps, service under a monitor for a number of runs. We have used "perhaps" and other qualifying words because of the different kinds of men to be dealt with. Bright men learn

without much teaching; but in default of brightness the teaching is a necessity. Is there any escape from this conclusion?

A STANDARD COUPLER.

In 1904, in his annual address to the Master Car Builders' Association, President Brazier recommended the adoption of a standard coupler. Last June the standing committee on coupler tests, acting on this suggestion, recommended the appointment of a special joint committee of members of the association and of representatives of the coupler manufacturers to consider what could be done toward bringing about this much-needed but most difficult standardization. The Executive Committee of the Association appointed, on August 14, six members of the Association and five representatives of the coupler manufacturers, as follows: F. W. Brazier, New York Central, Chairman; T. S. Lloyd, Rock Island; J. T. Chamberlain, Boston & Maine; R. P. C. Sanderson, Seaboard Air Line; A. Stewart, Southern Railway; C. E. Fuller, Chicago & Alton; S. L. Smith, National Malleable Castings Co.; S. P. Bush, Buckeye Steel Casting Co.; H. C. Buhoup, McConway & Torley Co.; W. L. Jacoby, Latrobe Steel & Coupler Co.; F. D. Huntley, Gould Coupler Co. On December 11 they held their first informal meeting in New York. They have a hard task ahead of them.

We pointed out in these columns more than a year ago (August 5, 1904) the need of a standard coupler and the saving which would eventually be made possible by its adoption. As time goes on the need for standardization grows greater and the difficulty of bringing it about grows less. Five years ago there were perhaps more than 30 different makes of couplers. To-day 95 per cent. of the business is confined to less than a dozen makers, and not more than six or seven of these are making couplers that conform in whole or in part to all of the requirements prescribed by the Association. The whole responsibility rests with these few manufacturers. The railroad interests are unanimous in wanting a standard coupler.

Will those of the manufacturers who own patents on coupler details, which are essential in designing a standard, combining the best qualities of all of them, undertake to make a plan for pooling their patents? There are many ways of doing this: They may interchange licenses, they may go farther and pro-rate outputs, they may go still farther and form a combination. To quote from President Hadley: "Trusts are dangerous, but not necessarily injurious."

It is hopeless to attempt to design an entirely new coupler unless they do so, for it would conflict at points with existing patents.

The work of the committee must wait on the action of the manufacturers, while at the same time the manufacturers need the experience, advice and assurances from the railroad men, for they will meet with opposition by some of their associates, and the Committee's support will aid them to accomplish this important step. Further work on the part of the committee would be useless. There is sure to be some remonstrance on the part of the manufacturers to waiving rights which are one of the most valuable parts of their assets, and possibly it may be so concerted and strong as to prevent any further consideration of the question just now. How strong it may be will develop when the committee meets for the first time. There can be no just complaint if the manufacturers protest against a measure which, if carried out, they could claim would deprive them of a greater part of the profits, theirs by right, which they now enjoy from the conduct of their legitimate business. Their products have survived the elimination trials of service, and are satisfactory each in themselves. Each company has a large sum invested in patterns, foundry equipment, fitting rooms, etc., suitable only for the particular type of coupler which it makes; and more than this, its employees have learned from long experience every detail of the manufacture of that one coupler, knowledge which would have to be learned all over again if the company should abandon its own make of coupler for a standard of different design. If all the makers are willing to begin afresh on an equal basis, with or without a pool or agreement to pro-rate the output of each plant on an equitable basis, and thus practically eliminate competition, then the first great stumbling block will be removed. There must be perfect harmony and good will all around. There is the precedent to follow which was established in 1887 when the Association adopted the Janney type of coupler as standard, but then only one maker waived rights. Now there are several competitors who must do likewise, and each is sure to suffer some pecuniary loss at first. The question must be looked upon purely as a matter of business policy, not philanthropy or generosity.

If, however, all agree to waive patent rights, there still remains the design of a standard coupler, mechanically perfect and meeting every service requirement of the present and the future. This in itself will be no easy task. Whatever design is made, it should have no weak points to be discovered later when the coupler is put in actual use. There is no need to hurry in the matter, and as far as possible every condition of future service should be anticipated and provided for. If the coupler makers will contribute their knowledge of the details of manufacture and material and the members of the Association will suggest essential points from their observation and records of couplers in service the committee will have all of the data necessary to begin on the design of a standard. They would have a free hand in designing mechanical details and should be given every opportunity of testing the design under the most severe conditions in service. When every one is satisfied then the Association could safely adopt it as standard.

THE UNION PACIFIC AND THE C., M. & ST. P.

The Union Pacific and the Chicago, Milwaukee & St. Paul are to-day examples of two very different kinds of railroads. The Union Pacific is a great through line; the St. Paul, a strong and compact local railroad. The Union Pacific was built with the one idea of connecting the east with California and the Pacific coast, and it is therefore not strange that it is still above everything else a through route. It has a through line from Omaha to Ogden, Utah, thence over the old Central Pacific to San Francisco; also a through line from Kansas City via Denver to a connection with the Omaha-San Francisco line at Cheyenne, Wyoming, and over the Oregon Short Line and the Oregon Railroad & Navigation, a through route from its main line in western Wyoming to Spokane, Washington, and Portland, Oregon. The efforts of its present owners have been directed first and foremost to the acquisition and improvement of main lines. The reorganized Union Pacific was formed in 1897 with the Oregon Short Line under its control. In 1899, entire control of the Oregon Railroad & Navigation Company, previously held jointly by the Northern Pacific, Great Northern and Union Pacific was acquired, bringing the whole through route to Portland into direct control. In 1901, the Southern Pacific with its thousands of miles of line was bought, primarily to obtain control of the Central Pacific, the Ogden-San Francisco connection. This was simply saying louder than words that the Union Pacific must command its own through line to California. Control of the Southern Pacific also carried with it ownership of the only through line between San Francisco and Portland. These represented main line acquisitions. At the same time a policy of main line improvement was steadily and expensively carried out. In less than two years (1899-1900) the old Union Pacific main line through Wyoming was radically rebuilt. This involved abandoning over one-third of the old roadbed, the building of 159 miles of entirely new line, and great savings in distance, grades and curvature. More recently the Ogden-Lucin cut-off across the Great Salt Lake was accomplished in spite of great difficulties and repeated failures. This enormously expensive piece of railroad building was carried out for the sole purpose of saving a certain amount of main line distance and a large amount of expense of main line operation on the San Francisco route. Main line improvement of this thorough-going sort was carried on on all parts of the system. As a result the Union Pacific has its main lines to-day in splendidly efficient shape.

Meantime, although some branches were acquired or built, branch line construction had, as a rule, to give way to the all important object of securing first-class main lines. The map of the road proves this plainly enough. West from Omaha on the north side of the main line there are only three branch line junctions in the 1,068-mile stretch between Council Bluffs and Pocatello, Idaho, on the Oregon Short Line. These three are all within less than 200 miles of Omaha, so that in the 872 miles from Kearney, Nebraska, to Pocatello, there is not a single mile of feeders to the north. On the south, with the exception of the connection with the Kansas line, 38 miles west of Omaha, which includes a 53-mile branch, and the two Denver connections at Julesburg and Cheyenne, there is not a branch line of any sort in the 854 miles between Omaha and Granger, Wyoming, the junction with the Oregon Short Line. On the south side of the Kansas City-Denver line there is only one branch line, 36 miles long. On the north side of the Central Pacific from the Great Salt Lake to the Pacific slope of the Sierra Nevada mountains the nearest approach to a branch line is a short cut-off in western Nevada. From Tehama, California, to

Eugene, Oregon, 436 miles, the Southern Pacific's San Francisco-Portland line has not a single branch. Clearly, main, rather than branch line development has been the Harriman policy in the northwest. Contrast the map of the Chicago, Milwaukee & St. Paul or the Chicago & North-Western, for instance, and the results are by contrast most clearly evident. Financially, this policy of bringing main lines to a very high standard of efficiency has already proved itself remarkably successful. There is no road in the United States which has of late shown more surprising increases in earnings than the Union Pacific. The raising of the dividend rate on the common stock last summer to 5 per cent. represented only a small part of the increases in earnings. The surplus from recent current earnings has in certain months been at the rate of from 15 to 20 per cent. annually, and for the year ended June 30 was 11.40 per cent. upon the common stock. So far as the present is concerned, the Union Pacific's policy of main line rather than branch line development may be put down as wonderfully successful.

Most of the railroads which now form the Chicago, Milwaukee & St. Paul were built as local railroads to serve local centers. There was little idea of their being eventually part of a through route. The road was originally the Milwaukee & St. Paul, even a Chicago connection being not a first consideration in its history. There is a suggestion of the number of original independent railroads which it now includes in the five railroad companies whose names began with Dubuque, nine whose names began with Chicago, and 16 which had Milwaukee as their real or alleged starting point, which are among the component parts of the present Chicago, Milwaukee & St. Paul road. This process of consolidation is likely to have been obscured in the public mind by the fact that the Chicago, Milwaukee & St. Paul has no leased lines nor permanent subsidiary companies, all such lines being as soon as practicable absorbed outright into the system. There is no way to get an idea of the extent of the road's branches, feeders, connecting and main lines, except by studying the map. They cover the splendid traffic territory northwest of Chicago, reaching as far north as Fargo, North Dakota, and as far west as Evarts and Chamberlain on the Missouri river in South Dakota, with three other north and south branches from the South Dakota line into North Dakota and multitudinous connections and short branch lines throughout the rest of the territory. In the St. Paul's case, development of branch lines rather than main lines has plainly been the established policy. Like the opposite policy on the Union Pacific it has been remarkably successful in financial results. Seven per cent. dividends are regularly paid on both preferred and common stock and gross earnings increased last year a million and a half dollars over 1904.

Here, on two railroads in adjoining territories, is an exceedingly interesting contrast in general theory of construction and operation, with the added fact that the two opposite policies have each been most successful. The Union Pacific has subordinated everything to through business; the St. Paul has spent its main efforts in building up its hold on local territory. Primarily, the reason for this difference is, of course, the difference in the country through which the two roads run. Along with the settler, the ranchman, the farmer and, last of all, the manufacturer, the St. Paul has occupied Wisconsin, Minnesota, Iowa and the Dakotas as far west as the Missouri river. A corresponding westward movement of population has not yet reached most of the Union Pacific's territory. Up to a very recent time the country through which it runs has been only a barrier between the Missouri valley and the Pacific coast.

Recent happenings are significant of the movement of population in the United States and of the fact that the two roads have each learned something from the example of the other. An era of competitive railroad building has been predicted by the President of the Union Pacific. Following close upon this prediction, the directors of the Chicago, Milwaukee & St. Paul have formally authorized the building of an extension to the Pacific coast. Each road apparently plans to supplement its present strength by matching the policy of the other. The Union Pacific has splendid through lines and a wonderfully profitable through traffic, yet, looking toward the future, it needs feeders and the development of its own local territory. The St. Paul has numbers of local lines reaching local territory already profitable and with immense future possibilities, yet it lacks, and has come to lack more and more, the profits which come from a through line and through business.

The Union Pacific's plans are generally understood to have as their central object the rounding out of the present territory of the Harriman lines by building branches, feeders and connecting lines. As one correspondent puts it, "Branch lines are what Mr. Harriman is after." The following statement in the annual report of the company just issued is the first official announcement in this direction:

> "The expenditures for betterments and additions in past years have been principally for the main lines and a considerable outlay is now necessary to bring the condition of the branch lines up to relatively the standard of the main lines. Towards these improvements $500,000 has been appropriated from this year's income.
>
> "In order to develop and protect the territory tributary to and served by these lines, there has been authorized, since the close of the fiscal year, the construction of about 320 miles of new railroad, estimated to cost, including equipment, about $12,000,000, and other important extensions are under consideration."

Within a week, the director of maintenance and operation of all the Harriman lines has announced a program of branches and extensions, projected or under way, totaling 863 miles of new line. Of this, 201 miles are to be built by the Union Pacific, 140 by the Oregon Short Line, 135 by the Oregon Railroad & Navigation Company, and 387 miles by the Southern Pacific.

There is no doubt about opportunities for future railroad development in Nebraska, Kansas, Wyoming, Utah, Nevada and Oregon. A line striking east from the Southern Pacific's San Francisco-Portland line, across central Oregon, such as is likely to be one of the Harriman projects, would cross a railroadless territory larger than all New England. North of the Union Pacific main line in Wyoming is an unoccupied territory almost as large. Idaho has only one mile of railroad to every 57 square miles of territory (New York has one mile of road for every 5.7 square miles), and with the exception of its northern rim next the international boundary is all tributary to the Oregon Short Line and Oregon Railroad & Navigation. Besides these territorial empires open to invasion, there are numbers of local points where branch lines will at once or very soon be profitable feeders. The Union Pacific has not, we believe, suddenly awakened to opportunities of which it has been either neglectful or ignorant. It has first of all devoted every effort to bringing main lines to the highest point of efficiency. As a result, the company's credit, on which new railroad building with profit largely depends, has grown strong even faster than main-line roadbed. For a railroad which less than nine years ago was in receivers' hands, the Union Pacific has come into a remarkable prosperity. It is to-day wonderfully prepared for a railroad building campaign.

The purpose of the St. Paul to build to the coast has been believed for some time to exist, but up to the recent formal action of the directors it has never been in any way officially announced. Examination of the facts of the case makes it seem surprising that the actual beginning of work on this extension comes so late. As was shown in the review of the annual report of the road in the *Railroad Gazette*, October 20, the St. Paul has been getting all too small an average freight haul. With a mileage of nearly 7,000 miles it carried its typical ton of freight in 1904 only 185 miles. Last year, with over 7,000 miles of line, the average haul was only 175 miles. The average haul on the Union Pacific is 386 miles, more than twice as long, and increased last year 33 miles over 1904. For the St. Paul to be carrying freight on the average less than one-thirty-fifth of the total mileage must in itself have been argument enough to determine the directors upon a line to the Pacific coast. The St. Paul, as it stands to-day, is an aggregate of local railroads —strong, well situated and more than self-supporting, but nevertheless primarily local roads. With what must be trifling exceptions, a haul of less than 500 miles is the longest which it receives on trans-continental freight west, northwest or southwest from Chicago. Council Bluffs, Minnesota Transfer and Kansas City—all within 500 miles of Chicago—are the St. Paul's present trans-continental terminals. If the road were receiving all or the largest part of the freight passing through these gateways, so short a haul could perhaps be permanently endured. There are, however, between Chicago and Omaha seven other competing routes and between Chicago and either St. Paul or Kansas City at least six other competitors. If it were known exactly how much of the freight through these gateways is now being carried by the St. Paul it would probably be found that the proportion is not large compared with the tonnage of some of the other roads, and that it has of late been proportionately decreasing. To and from Tacoma and Seattle, which are to be the Pacific terminals of the new extension, the St. Paul will get a haul of over 2,000 miles instead of less than 500, and will be one of three instead of seven or eight competing routes. Is it any wonder that years have been spent in planning the most available through route for a Pacific outlet?

This matter of securing a longer haul and a larger amount of through traffic may be considered the present and compelling reason for the extension, yet, if the past development of the west proves anything, it proves that as great advantages will probably

ultimately come from local traffic to be developed along the new main line. With the experience of the St. Paul management in developing local territory by branch lines, it is not likely that they will be content with a main line and nothing more. In fact, it has been unofficially announced that along with the Pacific extension something over 1,000 miles of branch lines are already included in the construction plans. The possibilities of the territory between Evarts and Puget Sound are strong arguments for branch line construction. Up to this summer the Missouri river has been the western boundary of east and west lines in South Dakota. The moment the Missouri is bridged at Evarts, the St. Paul will strike into a territory as large as the state of New York, not mountainous and untouched by a single railroad, which would, with railroad facilities at the same rate as Massachusetts, contain some 13,000 miles of road. This covers the adjacent portions of North Dakota, Montana, Wyoming and South Dakota, bounded by the Northern Pacific on the north and west, the Burlington's Montana line and the Chicago & North-Western's extension now under way from Pierre, South Dakota, to Rapid City, on the west and south, and the Missouri river on the east, including some 50,000 square miles. This accounts for less than 400 miles of the Pacific extension. Further west it will undoubtedly reach the mining regions of Montana and run through the undeveloped fertile country in the north of Idaho. The richest of the territory through which it is to pass is said to be in the State of Washington. The precise route of the extension has not yet been made public, but these are some of its possibilities.

The length of the new main line from Evarts to Seattle has been variously estimated at from 1,200 to 1,700 miles. On the Great Northern, Minot, and on the Northern Pacific, Bismarck, North Dakota, correspond roughly with Evarts, South Dakota, in distance from Seattle. By ruler measurement, it is 975 miles from Minot to Seattle. The Great Northern takes 1,302 miles to cover the distance. Bismarck is 1,000 miles air-line from Seattle; by the Northern Pacific, 1,468 miles. That is, the Great Northern takes to reach the coast one-third, and the Northern Pacific nearly one-half as much again as the air line distance. From Evarts, the starting point of the St. Paul's new line, the air line distance is 1,040 miles to Seattle. The St. Paul's line will proportionately probably not be quite as short as the Great Northern, nor quite as long as the Northern Pacific. If it requires two-fifths more than the air-line distance to reach the coast, it will be 1,456 miles long. The fact that the other roads had earlier choices of all possible locations may somewhat increase this amount. Assuming that the new extension will be 1,500 miles long, the distance by it from Chicago to Seattle via Milwaukee and La Crosse, Wisconsin; Hastings, Minnesota, and Evarts, South Dakota, will be 2,296 miles as against 2,260 miles from Chicago to Seattle by the Burlington and Great Northern, and 2,340 miles from Chicago to Tacoma by the Burlington and Northern Pacific. The new line will be the longest single piece of railroad under construction in the United States, about 500 miles longer than the Western Pacific, to be built from Salt Lake City to San Francisco. Terminal property in Tacoma and Seattle has been acquired along the water front and a right of way from the Columbia river across the state of Washington secured by the Pacific Railroad, of which the late General Manager of the St. Paul is President. Following its usual policy of concentration, it is probable that the whole line will be built directly by the St. Paul company instead of by subsidiary companies to be taken over on completion of their respective lines. When the whole extension is finished, it will make the Chicago, Milwaukee & St. Paul in the north as the Atchison, Topeka & Santa Fe is in the south, the only road running over its own rails from Chicago to Pacific tidewater.

The characteristic thing about this project is the fact that success seems solidly secured before a rail is laid on the 1,500 miles of new line. From the moment of its completion, through business over it should make it exceedingly profitable. Once built, it cannot fail to develop an increasing amount of local traffic. The territory through which it is to run is probably the best undeveloped territory in the country, and the coming of the St. Paul should mean progress to very large undeveloped areas. In the old days, railroads built west into the prairie country hoping to develop traffic fast enough to live through the lean years while the country was being settled up. To-day the prosperity of the Pacific coast makes it possible for a railroad to project a 1,500-mile link with the practical certainty that through business over it will make it pay from the start, and that local business can be at once developed to make it increasingly profitable. The Union Pacific, though in another way, is in the same fortunate situation. There can be no question but that branch lines can be built with profit at various points on the Harriman lines. It is striking to observe the way in which each road is starting upon a campaign of railroad building based upon the long established policy of the other.

The Montreal Express of the Boston & Maine dashed full speed into a local train that was standing at Baker Bridge station, near Lincoln, with the result that 19 were killed and many injured. The local train caught fire, and some of the passengers, it appears from the account, must have been literally roasted to death—than which nothing more awful can be imagined. An effective block system is what is required, as such a system would reduce the possibilities of an accident nearly to nothing. Yet because the block system would be a little more costly, and at times slower than the present system, many of the railways will not adopt it, and prefer to take chances. The Canadian Railway Commission has been inquiring into the cases of railroad accidents, and is understood to be prepared to insist upon the block system or something like it being universally adopted in Canada. The sooner something of this sort is done the better will it be for the lives and limbs of the traveling public. We have been harrowed too long and too often by preventable railroad horrors, which are the cause of much widespread misery and suffering. The rule of holding trains at a station until a train preceding has arrived at the next station ahead would have prevented this accident. The Canadian Pacific insists upon this rule being kept.—*Montreal Witness.*

The block system, "or something like it," is what the Canadian Railway Commission proposes to demand. Whether or not this statement is official we do not know; but it will be recalled that public officials in this country have in their official utterances betrayed the same indistinct notion of what the block system is. There is not anything like it! It is *sui generis*. It is so simple that laymen who are otherwise intelligent seem to stumble over it. To keep each train at A until the one ahead of it has reached B is a proposition which any man ought to comprehend at sight; and that is all there is to it. Perhaps railroad men are to blame for unnecessary mystification, because so much of their talk on the subject is in other than simple terms. Apparently the principal reason why railroad men put so much dignity, detail and darkness into their talk about signals is that the apparatus costs a good deal of money; but that is no reason for wanton or thoughtless sacrifice of simplicity. When one has approved a big appropriation which causes momentary inward groanings it is natural to try to impress the office force with the dignity and importance of what has been done; but in this case there is danger of fictitious importance. The block system has a dignity of its own; and this is not impaired by its simplicity.

The action of the Railroad & Warehouse Commission of the State of Illinois in ordering a horizontal reduction of 20 per cent. in the freight rates of the railroads of that State is so radical, and has such a spectacular air that it will be necessary to see how the order is carried out before forming an opinion concerning its reasonableness. The Commissioners have been "considering" the question for two or three years, but in such an indecisive way that no one has been able to guess what their reflections would amount to. Now it is said that they have acted because the Governor desired them to act. It is said that inequalities in rates are sufficiently common to justify some action by the State, but no one seems to have taken the pains to set forth reliable evidence on this point. The probable decrease that this order will cause in the earnings of the principal roads has been guessed at by reporters and others, and these estimates have been printed, but they are so vague as to be utterly worthless. One reporter says that some of the roads will "take their medicine" rather than tackle the task of making a suitable protest before the Commission.

The bill to require the use of the block system on all the passenger railroads of the United States, which was introduced in Congress a year ago by Representative Esch, of Wisconsin, (*Railroad Gazette*, Feb. 10, 1905, page 114) has been again introduced in the Fifty-ninth Congress and is numbered H. R. 3063. The substance of Mr. Esch's new bill is pretty nearly the same as that of a year ago, except that the dates in the second, third and fourth sections have been changed. The bill now requires, in brief, the use of the block system on one-fourth of every railroad by July 1, 1908; one-half by July 1, 1909; three-fourths by July 1, 1910, and the whole of the road by July 1, 1911. On a road or part of a road having yearly passenger earnings of $1,500 a mile, or total earnings of $3,000 a mile, the Commission may shorten the time of introduction by two years. The first draft of this bill, as given in the Annual Report of the Interstate Commerce Commission, was printed in the *Railroad Gazette* of Jan. 1, 1904, page 14.

Atlantic Coast Line.

East of the gulf states the southern railroad business is primarily in the hands of three great companies—the Southern Railway, the Atlantic Coast Line and the Seaboard Air Line, including roughly with the Southern the Central of Georgia. Of these three properties the Atlantic Coast Line, as its name denotes, occupies the coast strip and occupies it very completely, with a joint interest in the Richmond, Fredericksburg & Potomac, which gives it a Wash-

ington connection, and a network of lines reaching Norfolk, Newbern, Wilmington, Charleston, Savannah, Brunswick, Jacksonville, St. Augustine and Tampa. The Southern Railway fills the hinterland of the same great territory of which the coast strip is taken care of by the Atlantic Coast Line, while the Seaboard Air Line competes with both, having neither as good a coast line as the A. C. L. nor as good interior connections as the Southern, although the new Birmingham extension into the heart of a tremendously rich territory, which may be considered quite undeveloped as yet, in view of its possibilities, is a strong asset. Comparisons can be logically made between these three roads, for although many differences in location and environment can be pointed out, they are subject to many similar conditions.

The business of these roads is peculiar, and has important differences from that of the other great systems of the country. The Atlantic Coast Line, through its Louisville & Nashville purchase, has extremely important interior connections which bring it much valuable general traffic. Apart from this, it relies on its freight business in lumber, naval stores, fertilizer, cotton, cattle, fruit and garden produce, the Louisville & Nashville also specifically contributing much grain. These statistics are not shown in the company's

Atlantic Coast Line.

report, but they may be accepted as roughly describing the business done by the road. It will be seen that coal, the universal aid to traffic density for the northern and western roads, does not figure especially prominently. In fact, not so very much coal is carried by the Atlantic Coast Line except that for its own use and for minor local distribution; the Southern Railway differs from it in this respect. The Seaboard Air Line has about the same problem. As a result of this lack of coal, and of its light branch line business, the Atlantic Coast Line hauls its freight in small train loads but gets a high ton rate and makes a showing of net earnings per revenue train mile far better than the interior road. The comparison in this respect may be roughly shown as follows:

	Southern.	A. C. L.
Revenue train load	190 tons.	157 tons.*
Freight earnings per train-mile	$1.771	$2.095
Average ton-mile receipts	.933 cent	1.33 cents.
Net earnings per revenue train-mile†	39.6 cents.	69 cents.

*The Atlantic Coast Line report does not specifically state whether its train-load includes company freight or not.
†All trains

The item of net earnings per revenue train mile in the above table has to include passenger trains, as there is no really fair way of pro rating operating expenses between passenger and freight. By the method adopted, operating expenses are divided by the entire train mileage, with the result as shown.

The same situation is reflected in the figure showing freight density. The Southern Railway, with an average mileage of 7,164, had in 1904 a freight density of 449,227 tons per mile of road. The Atlantic Coast Line in 1905, with an average mileage worked of 4,307 miles, excluding the Louisville & Nashville, had a freight density of 256,463 ton miles per mile of road. The Seaboard Air Line, with its 2,611 miles, had a freight density of 296,626.

But in spite of density, small train loads and a considerable mileage of pretty thin traffic territory, the Atlantic Coast Line is extremely profitable to its shareholders. The company was formed only a few years ago as a collection of a number of small lines in Virginia and the Carolinas, and its expansion really began in 1901, when the Savannah, Florida & Western and the other Plant properties were absorbed. Early in 1902, as is well remembered, the Louisville & Nashville determined to take advantage of high prices and sell stock before it was listed. This resulted in speculative buying by Gates, and an ugly corner was created, for the reason that the unlisted stock was not a legal delivery, so that more stock had been sold than was in existence, from the standpoint of the stock exchange. Mr. Morgan came to the rescue, and the Atlantic Coast Line, in October, 1902, took control of the property by a majority purchase of the $60,000,000 outstanding capital stock. The Atlantic Coast Line now holds $30,600,000 of Louisville & Nashville stock, for which it paid $35,000,000 in 4 per cent. bonds, $10,000,000 in cash, and $5,000,000 in its own common stock. The cost of the control to the Atlantic Coast Line, therefore, aggregates at the present stock dividend rate, $2,050,000 a year, while it receives from the Louisville & Nashville stock at the present 6 per cent. basis, $1,836,000 a year, although at the time the purchase was made Louisville & Nashville was paying 5 per cent. and bringing in $1,530,000 a year. On the present basis, therefore, it is apparent that the Atlantic Coast Line gets the extremely important benefit of Louisville & Nashville through traffic at a cost of some $214,000 a year, while there is a considerable equity in the stock as well. Besides this great traffic feeder in the south and west, the Atlantic Coast Line also owns one-sixth of the Richmond-Washington line, so that its connections are complete, north, south and west.

Throughout this surprising era of enlargement by absorption of railroad properties, large and small, the Atlantic Coast Line management has financed its property in a very conservative way and has not been led into extravagance. The entire capital stock of the system (excluding, of course, the Louisville & Nashville, from which the tangible balance sheet returns are shown only in income from securities held) amounts to only about $10,612 a mile, and the capital debt is about $30,646 a mile, giving a total capitalization of some $41,258 a mile. The Southern Railway has $25,125 of stock per mile, $21,277 of bonded debt per mile, and a total capitalization per mile of $52,648. The Seaboard Air Line has $23,937 stock per mile, $22,242 funded debt and a total capitalization of about $50,190. As a result of this financial conservatism, the capital stock of the Atlantic Coast Line now sells around 161. In November, 1904, the directors declared an extra dividend of 5 per cent., payable in 4 per cent. certificates of indebtedness of the Atlantic Coast Line Company, in which surplus net earnings had been, in part, invested; also a dividend of 20 per cent., payable in common stock, and authority was given the directors, at their discretion, to declare an additional 20 per cent. dividend out of net earnings. It must be recollected that the Atlantic Coast Line Company is a holding company which owns the stock of the Atlantic Coast Line Railroad Company.

Looking more in detail at the statements of earnings and expenses, it is seen that while the Atlantic Coast Line freight traffic for the year ending June 30, 1905, increased 7¼ per cent., the passenger traffic increased almost 14 per cent. The Florida roads are picking up a large and important winter traffic from New York out of all proportion to that which existed a few years ago, and this is no doubt reflected in this increase. Besides this, the south seems to be well entered into an enduring period of great prosperity which must bring large profits to the railroads that have sufficient reserve in their financing to enable them to keep abreast of the increasing business. Total earnings for the year were $22,222,902, as against $20,544,975 in 1904, operating expenses and taxes aggregated $14,189,768 as against $12,827,094, an increase slightly higher than the increase in earnings. The property seems to have been fully maintained according to the standard of the country and of the traffic, and more than half of the entire increase in operating costs was in the maintenance accounts. The report shows considerable orders of new rolling stock to provide for the new traffic and also the purchase of a large tract of land in Jacksonville for new freight terminals to provide for the opening up of the yellow pine timber territory in Florida. It is evident that all the roads in this territory must face the gradual disappearance of the lumber which is now a very profitable source of income for them, but it

is fair to expect that the general industrial development will supply new traffic at a faster ratio than that at which the old lumber business drops off.

The following table shows the principal statistics of the year's operation:

	1905.	1904.
Average mileage worked	4,307	4,192
Freight earnings	$15,383,093	$14,336,934
Passenger earnings	4,893,331	4,295,548
Gross earnings	22,222,902	20,544,975
Maint. way and structures	3,147,650	2,790,234
Maint of equipment	2,225,363	1,846,282
Conducting transportation	7,478,765	6,882,190
Total operating expenses	14,189,768	12,827,094
Net earnings	8,033,135	7,417,882
Gross income	10,309,884	9,833,036
Net income	4,669,712	4,283,482
Surplus for the year	2,567,627	2,364,647

Union Pacific.

The brilliant history of the Union Pacific since the reorganization in 1897 has often been referred to in the *Railroad Gazette*. In the issue of July 28, on the announcement of the increase of the common stock dividend rate to 5 per cent., the record of the road since the appointment of receivers in 1893 was briefly reviewed in the editorial columns. In the current number the success of the Union Pacific's policy of main line development and its opportunity for extending its influence by branch lines is commented upon. It is a wonderful record of the upbuilding of an antiquated and discredited property into one of the two or three most powerful railroad systems in the country. With all the success which has come in the past, the prosperity of the company has never been as great as that shown in this year's annual statement. It is probably safe to say that no railroad in the country has presented so satisfactory a showing for the late fiscal year. This is the more remarkable because it follows great prosperity in the year preceding, when most of the western roads were feeling the results of poor crops or industrial depression. Coming on top of the exceptional showing of 1904, the 1905 report is a brilliant example of further progress.

The upbuilding of the property has been a twofold development —the physical upbuilding of the railroad and the expansion of its influence and credit. Each of these phases has, of course, had a share in the other, but they may be roughly differentiated to correspond to income and capital accounts.

The report combines results for the Union Pacific, Oregon Short Line, and Oregon Railroad & Navigation Co. Income account shows plainly enough the prosperity of the recent year. Gross earnings of rail lines were $58,756,845, against $54,264,878 in the year previous. This increase of $4,491,967 follows an increase of over $5,000,000 in the previous year. Along with this noteworthy increase in total earnings, operating expenses increased only $1,829,912, against $2,183,950 in 1904, leaving net earnings $28,969,811 in 1905, and $26,307,756 in 1904. Net earnings last year increased $2,662,055, and in 1904, $2,822,915. Including earnings from water lines ($568,103), results for the year are even more favorable. It will at once be observed that the net earnings are a little less than half gross earnings; in other words, that the operating ratio is very low. This, of course, means exceedingly profitable operation. A company that can carry on its business for 51.5 per cent. of its gross earnings, as the Union Pacific did in 1904, and in the next year get the proportion down to 50.7 per cent., is making money on railroad operation faster than it is ever given to most railroads to do. The only important road which has cut down the ratio lower than the Union Pacific is the Great Northern, which last year reduced its proportion from 51.4 per cent. in 1904, about the same as the Union Pacific's figure for that year, to 49.26 per cent., a very exceptional figure. In both cases economy of operation is in the main due to a past and present policy of spending large sums for all sorts of betterments and improvements. How thorough has been this work on the Union Pacific no one who has not known the road from personal acquaintance during the last 10 years can realize. One concrete evidence is the increase in the average car load and train load since the end of the first year under the present organization. In 1898 the average car load was 12½ tons, and train load 278 tons. Last year the average loaded car carried 21 tons, and 507 tons was the lading of the average train. The steady reduction in the operating ratio proves that expenditures for improvements have been larger than sufficient to keep up with the growth of traffic. Money has been spent so liberally and so farsightedly that not only can the great amount of new traffic be handled, but it can also be handled more cheaply.

Per mile, gross earnings were $10,967, an increase of 8 per cent., and net earnings, $5,407, an increase of 10 per cent. Net earnings per mile had in 1904 increased 11 per cent. over 1903. At this rate, with no increase in mileage, net earnings would double in less than 10 years. Gross income was $65,821,708, an increase of about $6,250,000 over 1904. Operating expenses and taxes brought this down to $33,958,993, fixed and contingent charges to $22,785,507, and dividend payments to $11,698,446, the amount of the surplus after dividends. From this sum, $2,479,165 was appropriated for betterments and additions made, $500,000 for betterments and additions to be made on branch lines, and $1,500,000 reserved for the purchase of new equipment—a total appropriation out of income of $4,479,165 for betterments. This left a final profit surplus of $7,200,000, against $4,700,000 in the preceding year. Incidentally, it is worth noting that fixed and contingent charges showed a decrease of $1,278,000 from the 1904 figure, and that on this account and because of increased earnings, the surplus, after charges and before dividends, increased $6,188,000 over 1904. This surplus—$22,785,507—is equivalent to 4 per cent. on the preferred (which was paid), and 11.4 per cent. on the common stock (against 5 per cent. paid). Even this does not represent all the income, for of the deferred payment of $4,260,160 in dividends from the Northern Securities Company, $1,252,988, the proportion which would naturally have been paid in the preceding fiscal year, was kept out of the income account entirely and transferred to profit and loss. Including this, the surplus, after dividends, amounted to something over 12 per cent. on the common stock.

Such a remarkably successful income showing cannot be credited entirely to outside circumstances such as good crops or general prosperity. It must reflect as well economical and farsighted management.

The statement of operating expenses makes this very clear. The increase of $1,829,912 in the total is due almost entirely to larger maintenance expenses. The cost of getting and moving the traffic shows an actual decrease. Maintenance of way and of equipment each increased over 12 per cent. from the liberal estimates of the preceding year. Maintenance of way was $1,290 per mile of main and second track, against $1,192 in 1904, and $941 in 1903. The splendid condition in which the roadway was kept during those earlier two years is well known. It is not hard to get an idea of the liberal expenditures on the line in the fiscal year, 1905. In maintenance of equipment the same reasoning holds good. Repairs and renewals of locomotives cost $3,791 per locomotive, against $3,565 in 1904; of passenger cars, $1,272 per car, against $813 in 1904, and of freight cars, $103 per freight car, against $75 in 1904. One does not need to be told that the item of repairs and renewals includes a large charge for account of equipment sold, destroyed or condemned, or that the Union Pacific's equipment is being maintained in a high order of efficiency.

Conducting transportation presents a remarkable showing. There were 42,300,000 more passengers carried one mile than in the previous year, and 768,800,000 more tons of revenue freight, yet that operating expense, which is supposed to respond most quickly and vary most directly with changes in traffic, shows a slight decrease for the year. Here is where the economy of recent liberal expenditures for improvements is apparent. The foresight of those who inaugurated the improvement policy is shown most of all in the loading of trains. First of all, 1,980 lbs. more was put into each loaded car than in the previous year; second, there were two more loaded cars or 56 more tons in each train (the train load was 451 tons in 1904 and 507 tons in 1905); third, the average cost per mile run by locomotives for wages, fuel, water, and all other supplies, was considerably reduced. Thus although the locomotives hauled more and there was an increase in locomotive mileage, there was a decrease of $182,500 in the cost of locomotive service. There was a similar decrease of $22,000 in the cost of train service. An increase of $103,139 in payments for injuries, loss and damage, was the largest increase under conducting transportation. It is in this account that many another railroad has most to learn from the Union Pacific. To be able to get and move the traffic for only 23.7 per cent. of gross earnings is an ideal which, if it could be realized, would turn a railroad like the Rock Island from a gigantic experiment into a solidly prosperous property.

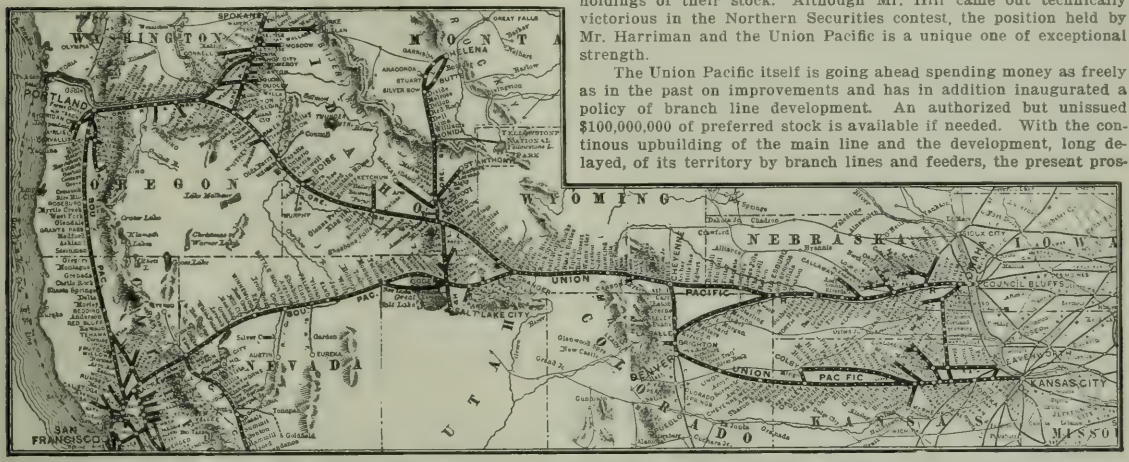
Following the general rule of the Harriman lines, no statement of kinds of traffic carried is included in the report. With this exception, however, the document is an admirable presentation of the condition of the railroad. The traffic statistics which are given, show that there were 4,128,435 passengers carried—98,794 per mile of road. The average passenger traveled 128 miles against 126 miles in 1904. The average passenger, of whom the average train carried 60, enriched the company by $2.75, another sign of the long distance travel over the road. Per passenger mile the company received 2.14 cents.

The freight carried totaled 14,740,130 tons (including 3,535,000 tons of company freight), or 1,062,300 tons one mile per mile of road. This is an increase of 18 per cent. in freight density. Freight is three times as much of a long distance commodity as passengers, for the average ton was carried 386 miles in 1905, an increase of 33 miles over 1904. The average amount received from each ton of freight was $3.83, and the average receipts per ton mile, 8.9 mills.

Capital account shows the financial strength and the widespread extent of the Union Pacific system. The item, "Cost of railroads, equipment and appurtenances," has decreased $1,700,000 since 1904—this at the same time with the extensive improvements which have been under way, at a charge of $2,479,000 to capital account. The decrease in the item comes about by deducting appropriations from

income of $2,479,000 (canceling the capital charge), $1,685,000 received from the sale of lands applied under the provisions of the railroad and land grant mortgage to improvements, and two small adjustments, making a total deduction of $4,188,753. Under this unusually conservative method of bookkeeping, $5,780,982 was in 1904 similarly deducted from the company's assets.

Stocks and bonds owned are carried in the balance sheet at $159,275,326. This represents their cost and takes no account of later advances in value. Allowing for the present market value of the securities, the value of these investments probably amounts to something like $225,000,000. The securities owned on June 30, 1905, included $90,000,000 common stock and $18,000,000 preferred stock of the Southern Pacific, $18,665,259 stock of the Great Northern, $24,295,152 stock of the Northern Pacific and $12,850,000 stock of the Northern Securities Company. Assuming that this Northern Securities stock has since been converted, the Union Pacific should now hold $22,503,336 Great Northern and $29,290,885 Northern Pacific stock. Another large holding, for the first time made public, is $10,340,100 preferred stock of the Chicago & Alton, acquired during the year and held under an agreement announced to secure important and substantial advantages to the Union Pacific. During the year, the $18,000,000 preferred stock of the Southern Pacific was also subscribed for. These two items principally account for an increase of nearly $20,000,000 in the cost price of stock and bonds owned. During the year there was also advanced to the San Pedro, Los Angeles & Salt Lake Railroad $5,440,000, making the total investment in that road to date, $20,400,000. Payments of $1,739,688 were made for the construction of new lines, and there were $3,725,500 face value more old bonds retired than new bonds issued, making a total capital disbursement on these accounts of $10,905,188. Funds for the large stock purchases of the year and these capital payments were principally obtained from the repayment of loans to other companies and from the sale in the open market of $7,150,100 stock of the Northern Securities Company. Counting in securities of the auxiliary companies (O. S. L. and O. R. R. & N.), the par value of stock owned on June 30th was $258,000,000 and of bonds $98,724,500, a total holding of over $356,000,000 in securities.



Union Pacific, Oregon Short Line and Oregon Railroad & Navigation Company.

The Southern Pacific lines west of Ogden and south of Portland are not treated of in the report.

In the 12 months of the fiscal year $56,071,000 of convertible 4 per cent. bonds were converted into an equal amount of common stock. The bonded debt was further reduced by the payment of $10,000,000 Union Pacific 5 per cent. collateral notes, which fell due on February 1st. The bond conversion and the increase of one of the two dividend payments from 2 to 2½ per cent., increased the dividend requirements for the year by $2,754,515. A side light on the company's financial strength is the profit and loss balance for the year, which was $34,943,194, an increase of $8,937,512 over the 1904 figure.

As an operating railroad, the Union Pacific has, by large expenditures for betterments in all departments, brought about a very high standard of economy and efficiency. It has become a principal transcontinental highway. As a holding company for the securities of other railroads, the Union Pacific has had almost equal success. Taking no account of the Chicago & Alton, or the San Pedro, Los Angeles & Salt Lake, the Harriman system comprises some 15,000 miles of line. As yet the Union Pacific's investment in $90,000,000 common stock of the Southern Pacific pays no direct dividends; but, indirectly, control of the Southern Pacific lines constitutes a very great strategic advantage, and the time cannot be far distant when, with the large expenditures which have for years been made out of earnings on that company's property, it will be in shape to make a return on its common shares. As part owner in the Northern Securities Company, even though a loser in the contest for control of the Northern Pacific, the Union Pacific, through its large holdings of Great Northern and Northern Pacific stock, exchanged for Northern Securities, gets a large share of all the prosperity of those two very prosperous northwestern railroads. Thus the statement that his two bitterest competitors are working for Mr. Harriman has justification. In fact, all railroads west of Chicago contribute to the prosperity of his investments. The greater the traffic of the granger lines, the greater will be the prosperity of the Union Pacific itself. Even supposing their transcontinental traffic goes by some other road (unless possibly by the Canadian Pacific) he gets a share of the receipts. The Southern Pacific is his property. His investment in the Santa Fe is in all probability by no means a small one. He has a half interest in the San Pedro, Los Angeles & Salt Lake and a large share in the earnings of the Northern Pacific and Great Northern, through his large holdings of their stock. Although Mr. Hill came out technically victorious in the Northern Securities contest, the position held by Mr. Harriman and the Union Pacific is a unique one of exceptional strength.

The Union Pacific itself is going ahead spending money as freely as in the past on improvements and has in addition inaugurated a policy of branch line development. An authorized but unissued $100,000,000 of preferred stock is available if needed. With the continous upbuilding of the main line and the development, long delayed, of its territory by branch lines and feeders, the present prosperity of the Union Pacific and even greater prosperity for the future seem assured.

The principal statistics of operation follow:

	1905.	1904.
Average mileage	5,358	5,353
Freight earnings	$42,962,238	$39,452,068
Passenger earnings	11,343,339	10,508,897
Gross earnings	58,756,845	54,264,878
Maint. way and structures	7,341,905	6,497,270
Maint. of equipment	6,883,676	6,111,552
Conducting transportation	13,927,128	13,975,075
General expenses	1,634,236	1,373,224
Total expenses	29,787,034	27,957,122
Net earnings from operation	28,969,811	26,307,756
Gross income	65,821,708	59,546,074
Net income	22,785,507	16,597,092

NEW PUBLICATIONS.

Instruction Papers of the American School of Correspondence at Armour Institute of Technology, Chicago. Size, 6⅞x9¾ in.

Copies of new instruction papers on several different engineering subjects have been sent us by the American School of Correspondence at Armour Institute, Chicago. Two papers on "Railroad Engineering," just from the press and forming only a part of this subject, are by Walter Loring Webb, the well-known engineer, who prepared the papers especially for the students of this school. They form Parts I and II of the subject and deal with surveys, construction, railroad structures and track work. In the 200 pages which they comprise, it is, of course, not possible to do more than treat briefly the fundamentals of the various subjects and their sub-divisions. In doing this, however, the papers serve acceptably the purpose for which they are designed, which is to meet the needs of the practical man of limited education. A 65-page paper by Mr. Webb on "Plotting and Topography" instructs simply and clearly in the definitions, in the methods employed in the field and in the proper execution of the office work. Five plates are included, two of which show conventional signs and the remaining three reproduce work of the U. S. Coast and Geodetic Survey primarily to illustrate the application of these conventional signs, one of the plates being in colors. The papers also include Mr. Webb's "Trigonometric Tables," which are reprinted from his work on "Railroad Construction."

A paper on "Masonry Construction" is prepared by Austin T.

Byrne. Two parts have been printed. These are also elementary in their scope, the two parts comprising 117 pages. A student having no previous acquaintance with the subject can obtain from these papers a brief general knowledge of the more important features, and of present practice; although some things have been omitted that should have been included, as, for instance, under sheet piling no mention is made of the steel variety, reference being confined to wooden sheet piling only. Reinforced concrete construction, or concrete-steel masonry as the author calls it, is given only two pages at the end of Part II, and is confined almost entirely to the briefest possible mention of several systems of arch construction. A paragraph is given to the method of building reinforced concrete walls.

"Water Supply," in two parts, was written by Prof. Frederick E. Turneaure, C.E., of the University of Wisconsin. This subject being less broad than the other two, is dealt with more in detail. Like the others, it omits all but the simplest mathematics, such formulæ as are necessary being given in most cases without reference to their derivation. Prof. Turneaure presents the subject entertainingly and it should hold the interest of the student from the outset. A paper on "Hydraulics" by the same author is an elementary treatise of 55 pages on the subject. A more advanced knowledge of mathematics is required for its study than for the other papers, the student needing to understand trigonometry.

The papers are illustrated with half-tones and well-executed line engravings, and their typographical excellence should be noted, although several typographical errors were observed. A list of examination questions is given at the end of each part of each paper.

TRADE CATALOGUES.

"From Pike's Peak to Morro Castle."—This is the title of a prospectus prepared by the United States Construction Company, incorporated under the laws of Oklahoma, principal office in Kansas City, Mo. The company was chartered to build a line of railroad between Colorado and New Orleans, which it proposes to do in three separate sections under different names, as follows: The Guthrie, Fairview & Western, chartered to build northwesterly from Guthrie, Okla. T., via Kingfisher, to a connection with the K. C., M. & O.; the Guthrie, Shawnee & Shreveport, and the Colorado, Oklahoma & New Orleans, chartered to build from Denver, via Trinidad, to connection with the Guthrie, Fairview & Western. The prospectus sets forth in considerable detail the advantages of such a line, estimated cost of construction, traffic possibilities and possible earnings, etc., and offers for sale a major part of the capital stock at par. The prospectus states that construction work has already begun.

Brake Beams.—An attractive catalogue is being distributed by the Buffalo Brake Beam Co., New York. In it is described and illustrated the various sizes and designs of brake beams made by the above company, including special brake beams for passenger and freight equipment, and special brake beams for use where space is limited. A full size section of the Buffalo brake beam is shown, and a table with diagrams of different shaped sections shows the comparative strength and percentage of increase in strength of the Buffalo section over other sections. Illustrations of the Buffalo one-piece and two-piece forged fulcrums are also shown.

Track Drills.—The Buda Foundry & Mfg. Co., Chicago, sends a new catalogue illustrating the new features of its track drills and giving a complete price list of Paulus, Buda, Harvey, Wilson and Rich drills, which it makes. The catalogue also gives views and complete lists of repair parts and drill bits. The final pages are devoted to the Paige Iron Works department, making switches, frogs, crossings, derails, etc.

CONTRIBUTIONS

Telephones When Wrecked in the Wilderness.

New York, Dec. 6, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the *New York Herald* of Saturday last it is stated that Brakeman Headman, of the Central Railroad of New Jersey, who was caught in the wreck of his passenger train, which fell down a bank and lodged in the river, near Penn Haven on Friday night, and had his arm broken and suffered other injuries, performed the heroic service of securing help by immediately walking four miles to Penn Haven Junction. As soon as he gathered himself together, says the report, and knowing that no help could be had from another train on the bleak mountainside for three hours, he started back for Penn Haven junction, where, on the opposite side of the river, he knew was the only telegraph office for miles around. He made his way, in spite of the bitter cold, to the place, and wired to Mauch Chunk for relief trains and physicians.

I call this incident to your attention merely to say that a telephone on the train, with provision for telephoning over the telegraph wires of the railroad, would have made this painful four-mile walk unnecessary; and besides would have enabled the relief to reach the injured passengers an hour sooner. You have printed various reports about the use of telephones on wrecking trains, and on passenger trains and cabooses, as well as the placing of 'phones in boxes on posts along the track; but the use of this valuable aid to railroading seems to spread very slowly. Why does it not find favor on every railroad? To let a score or a half score passengers and trainmen—or a single one—suffer cold and pain while the messenger for relief goes a long distance on foot, and on a road traversed by a dozen electric wires—is a thing which should be very much out of date in the year 1905. T. G. F.

Ten-Wheeled (4-6-0) Locomotive for the New York Central & Hudson River.

Fifteen locomotives of the 4-6-0 type have recently been built by the American Locomotive Co. for the New York Central, intended for both fast freight and heavy passenger service. In a way this is a reversion to the old practice of the road 25 years ago, when one type of engine was used in front of everything. The resemblance ends there, however, for nothing like these new engines was in existence at that time. Cylinders 22 in. in diameter with a piston stroke of 26 in. and a weight on drivers of 148,000 lbs., are features that did not belong to locomotives of the old regime. The illustration from a photograph and the side elevation show the size and power of the machine. Though the top of the stack is nearly 14 ft. 7½ in. above the rail it is but 23 in. above the smoke-box, while the top of the boiler barrel is 13 ft. 1¾ in. above the rail. This necessitates the use of a very low dome, though the height of the steam intake above the water line is helped by the wagon-top. The firebox is 106 in. long inside, with a sloping grate. It is fitted with water tubes for carrying a brick arch. The throat sheet has the forward slope with the widening leg that is current practice and by which the water has free access to the lower end of the arch tubes.

Heavy Ten-Wheel (4-6-0) Type Locomotive for Freight and Passenger Service—New York Central & Hudson River.

In cross-section the side water-legs of the firebox show but a slight increase in width from the bottom to the top. They are only 3½ in. at the bottom and 4 in. at the top, with sheets that are nearly vertical. The reason for this was probably a desire to widen the nest of tubes as much as possible and so increase their number, which is 400, to give a heating surface of more than 3,100 sq. ft.

Owing to the height of the top of the boiler above the rails, the whistle and safety valves are set directly on the sheet of the

wagon-top, which is reinforced underneath with a ⅝-in. liner. The boiler extends back for about one-half the length of the cab, so that the latter is roomy and convenient.

The frame has a width of 5 in. with a depth of 6 in. at the pedestals and 5 in. between the two front pairs of drivers and 5½ in. between the second and third pairs, where the firebox rests. The latter is carried by an expansion block at the front and the usual buckle plates at the back, while three supports of the same character are placed beneath the shell. The pedestal braces are unusually heavy; and, besides being fitted over ample lugs, are held in place by three 1¼-in. bolts.

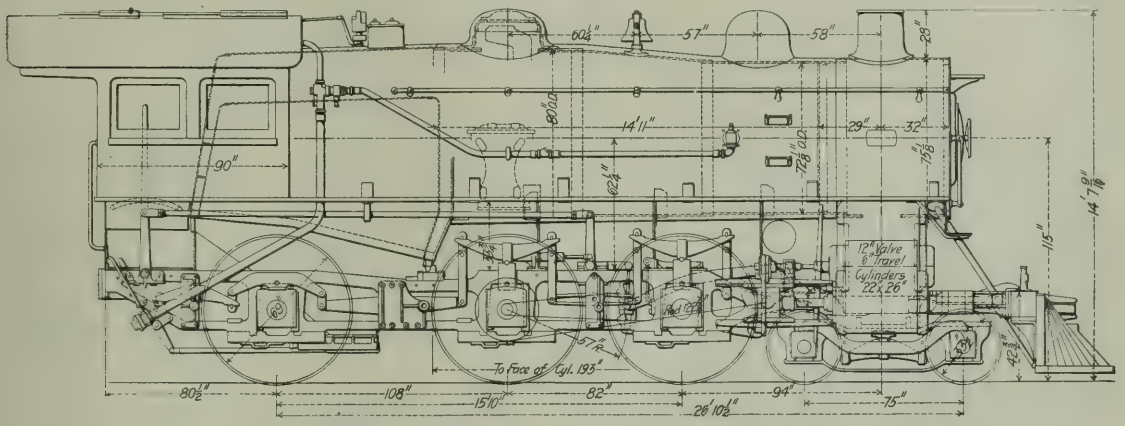
An interesting feature is the valve motion. The link is located just back of the forward driving axle, while the rocker, instead of being in line with it, is set ahead to a point only 43½ in. back of the cylinder center. The motion is carried forward from the

are all-around machines, available for both passenger and freight work and adapted for almost any emergency condition. The fact that the New York Central has selected the 4-6-0 type in this case is interesting as demonstrating its wide range of serviceability, especially in view of the fact that the road has a number of the 4-6-2 type engines which have given excellent results.

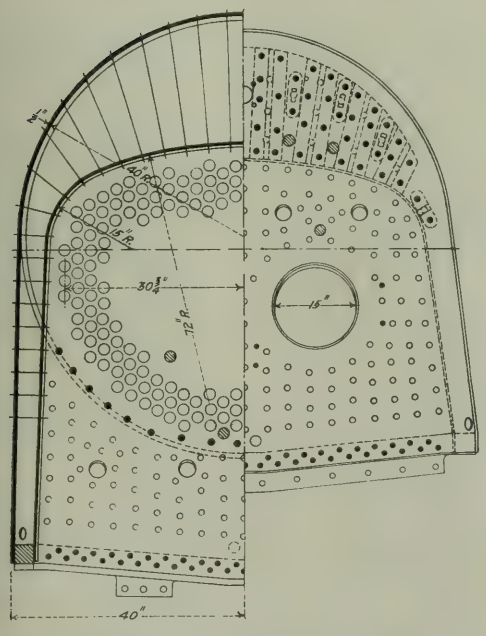
The following table presents some comparisons between the 4-6-2 and the 4-6-0 types of this road:

	4-6-2.	4-6-0.	Increase, pr ct. 4-6-2.	Increase, pr ct. 4-6-0.
Weight, total engine	222,000 lbs.	194,500 lbs.	14.2	...
Weight, total, eng. & tender	355,000 "	338,400 "	5.0	...
Tractive power	28,500 "	31,000 "	....	8.8
Grate area	50.2 sq. ft.	54.93 sq. ft.	....	9.4
Total heating surface	3,633 sq. ft.	3,306 sq. ft.	9.9	...

While the 4-6-0 locomotive has 27,500 lbs. less weight than the 4-6-2 type, the tractive power is 8.8 per cent. greater, and the grate



Side Elevation of Ten-Wheel (4-6-0) Type Locomotive for the New York Central & Hudson River.



Cross-Section Through Boiler and Firebox.

area 9 per cent. greater, but the heating surface is less. The smaller heating surface will probably affect the staying qualities, and the 4-6-2 class should have a larger reserve capacity for long runs without stops and for heavy trains at high speeds, but for all trains in which high speed long sustained is not required, the 4-6-0 type should be eminently satisfactory.

This design, which was worked out under the direction of Mr. J. F. Deems, General Superintendent of Motive Power of the New York Central, may be taken to indicate that the possibilities of the 4-6-0 and the 4-6-2 types have not yet been exhausted.

The principal dimensions of these engines are as follows:

Cylinder, diameter	22 in.
Piston, stroke	26 in.
Tractive power	31,000 lbs.
Wheel base, driving	15 ft. 10 in.
" " total	26 " 10⅛ "
" " engine and tender	59 " 2 "
Weight in working order	194,500 lbs.
" on drivers	148,000 "
" engine and tender	338,400 "
Heating surface, tubes	3,104.5 sq. ft.
" " firebox	174.6 "
" " arch tubes	26.4 "
" " total	3,305.5 "
Grate area	54.93 "
Axles, driving journals, diameter	9½ in.
" driving journals, length	12 "
" truck " diameter	6¼ "
" truck " length	10 "
" tender " diameter	5½ "
" tender " length	10 "
Boiler, outside diameter of first ring	72⅛ "
" working pressure	200 lbs.
" fuel	Bituminous coal
Firebox, type....Wide; length....105⅛ in.; width	75¾ in.
" thickness, crown and side sheets	⅝ "
" thickness tube sheet	½ "
" width front water leg	4 "
" width side and back water leg	3½ "
" type of crown staying	Radial
Tubes, length	14 ft. 11 in.
" diameter	2 "
" number	400
" material	Charcoal iron
Piston rod, diameter	4 in.
Piston packing	Cast-iron rings
Smokestack above rail	14 ft. 7 7-16 in.
Smokestack, diameter	20 "
Tank, capacity, water	7,000 gals.
Tank, capacity, fuel	12 tons
Valves, type	Piston
" travel	6 in.
" diameter	12 "
" steam lap	1 "
" exhaust clearance	¼ "
" lead	0 "
Wheels, driver, diameter	69 "
" truck diameter	33 "
" tender, diameter	36 "

one to the other by a connection bar, suspended on a swinging link at the back and attached to the inner rocker arm at the front. This makes a very short and compact valve stem with its connections, but requires considerable stiffness in the rod itself to avoid buckling.

The guide yoke is set well forward on the guides and serves, with the buckle plates already mentioned, to give the requisite stiffness to the frames. The engines have been termed "combination" locomotives by the railroad in the sense that they

The engines are equipped with the New York automatic and straight air for both driver and tender wheels with the New York

air signal. Compressed air is supplied by a No. 5 duplex pump delivering into one main reservoir 20½ in. in diameter and 130 in. long.

Single exhaust nozzles are used and these have been applied of 5¾, 5⅝ and 5⅞ in. in diameter. The tender frame is formed of 13-in. channels and plates, and the tank is made with a water bottom and gravity slides so as to deliver the coal as far as practicable at the gates.

Centenary of the Lancashire Railroads.

BY W. B. PALEY.

There are probably not many political divisions in Great Britain or elsewhere which contain a greater mileage of railroads in proportion to their area than Lancashire does. The origin of the vast network which now covers the country had its rise just one hundred years ago. As in several other cases, this came about through the instrumentality of canals. One of the most important of the many canals projected about 1792, the period when a distinct "canal mania" took possession of the moneyed class in Great Britain, was intended to connect the Leeds & Liverpool Canal, near Wigan, in Lancashire, with the town of Kendal, in the adjoining county of Westmoreland. This was to be termed the Lancaster Canal. The company obtained its Act of Parliament on June 11, 1792, the line being about 76 miles long, and passing through Preston and Lancaster in its roundabout course. It was soon found, however, that to carry it across the wide valley of the Ribble, just south of Preston, would be extremely costly, in consequence of which it was determined to insert a short length of railroad or tram road to connect the canals on either side.

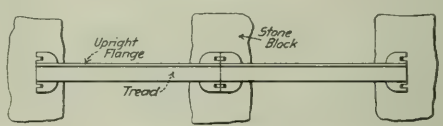
The southern portion of the canal, now entirely disused, terminates at Walton summit, or Thorpe Green, a desolate and lonely place between Preston and Chorley. Here is a basin with two arms, between them being a short dock, which evidently had a stone-built shed over it at one time. Five or six boats lie rotting and full of water, and the whole place is a melancholy example of skill and energy now utterly useless. From each side a line of railroad, still quite traceable, ran down the hill-side till the two met on level ground in less than half a mile. There were evidently interlacing or cross-tracks close to the top, whereby either wharf could send or receive cars, and between them must have been winding machinery, as the gradient is too steep for horses. Possibly this was of the self-acting kind, but no remains of it exist. Further down, between the two lines, is what looks at first sight like a bit of canal, but is really an excavation where the material forming the inclines was obtained. Another peculiarity which strikes an observant visitor is that the stone blocks of the western arm are unusually close together, yet the plug-holes for holding down the cast-iron ⌋⌊ plates are not in line with each other. On examination it will be found that there are no blocks at all on the other line, and that they have been taken up and inserted between those of the western branch, thus practically converting it into a stone tramway and enabling the farmer to get his hay carts up and down the boggy slope. From the point where the two single lines come alongside each other, near a small farm, the course of the old tram road lies in a grassy lane about 16 to 18 ft. wide, till it reaches the village of Bamber Bridge, a mile further. Two by-roads are crossed on the way, at each of which are formidable barriers of wood to prevent trespassing. At the main street of Bamber Bridge, which the line crossed somewhat on the skew, is a notice:

ANY PERSON FOUND TRESSPASSING
Upon This Site of Tramway
the Property of
The London & North Western
and
Lancashire & Yorkshire
Railway Companies,
or Damaging the Fences Thereto
Will Be Prosecuted According to Law.
By Order.

On the other side of the street, however, the line goes on as a public footpath, forming an important short cut for nearly half a mile. It is then lost for a short distance, but is found again as a barred-up lane further on. Except that the cast-iron plates, 3 ft. long, have all disappeared, nothing has been altered. The blocks which carried them are of hard sandstone, not square, as usual, but 2 ft. by 1 ft., placed transversely. Each has two plug-holes 4 in. apart at the centres and ¾ in. in diameter. In some cases the spike and wooden plug or treenail remain. The holes are about 5 in. deep, equal to half the thickness of the block. From the marks left the plates evidently widened out to 8 in. at the ends, to secure a steady base. Another object was to provide places for the spikes clear of the wheels, the holes being half-notches in the outer ends of the base. These corresponded with the notches of the next plate, both having sloping sides, a spike with shoulders to fit them held down two plates at once. The improvement of two spikes clear of the tread, instead of only one, and that in the middle of it, was due to Benjamin Outram, whose firm, Outram & Jessop, of Butterley Ironworks, Derbyshire, laid the tram road. The tread of the plates would have been only 3 in. wide, on which wheels about 1 in. thick were used. The gage from centre to centre of the treads was 5 ft.

Some portion of the line, in this second enclosed section, was neatly paved with small stones, probably where the ground was wet. The section in question extends about ¾ mile, in which are 3 or 4 most unpleasant obstacles of barbed wire fixed to stout fencing adorned with hook-headed nails. At last these end at a road running north and south, after which the rest of the way into Preston is a public footpath, perfectly open and free to all men. The lane continues, with the blocks showing on the surface, in a very level course till it nears the Lancashire & Yorkshire Railway, where a perceptible fall occurs at the edge of the Ribble valley. It is doubtful whether mechanical power, or extra horses, were used here. The line now runs out upon an embankment, about 12 or 15 ft. high and 20 ft. wide, for another three-quarter mile, till the river Ribble is reached. The edges of the embankment have been planted with lime trees by the Corporation of Preston, to whom it belongs, the result being a beautiful shady avenue. There are no bridges over roads, but in two places footpaths run to the bottom, passengers climb up to the top, cross and go down again. The Ribble is crossed by a modern bridge of wood, succeeding the original one of the same material. Directly the river is passed an extremely steep, though short, incline, of about 1 in 6, is faced. This is now a footpath in the public gardens, but at the top, where a stone pavilion stands, used to be a stationary engine, which worked the wagons up and down by means of a continuous chain. In the Free Library at Preston two illustrations are preserved, showing the bridge, engine house and the wheel or dam round which the chain passed at the bottom of the incline.

The remainder of the tram road site, the short distance from the top of the incline to the basin forming the south end of the northern section of the canal, is now built over, but it passed under Fishergate, the main street of Preston, by means of a short tunnel.



Lancaster Canal Tram-road—Putnam's Improved Plate, 1803.

In 1831 a serious accident occurred by the chain breaking, the wagons dashing down instantly and killing a man who was riding with them.

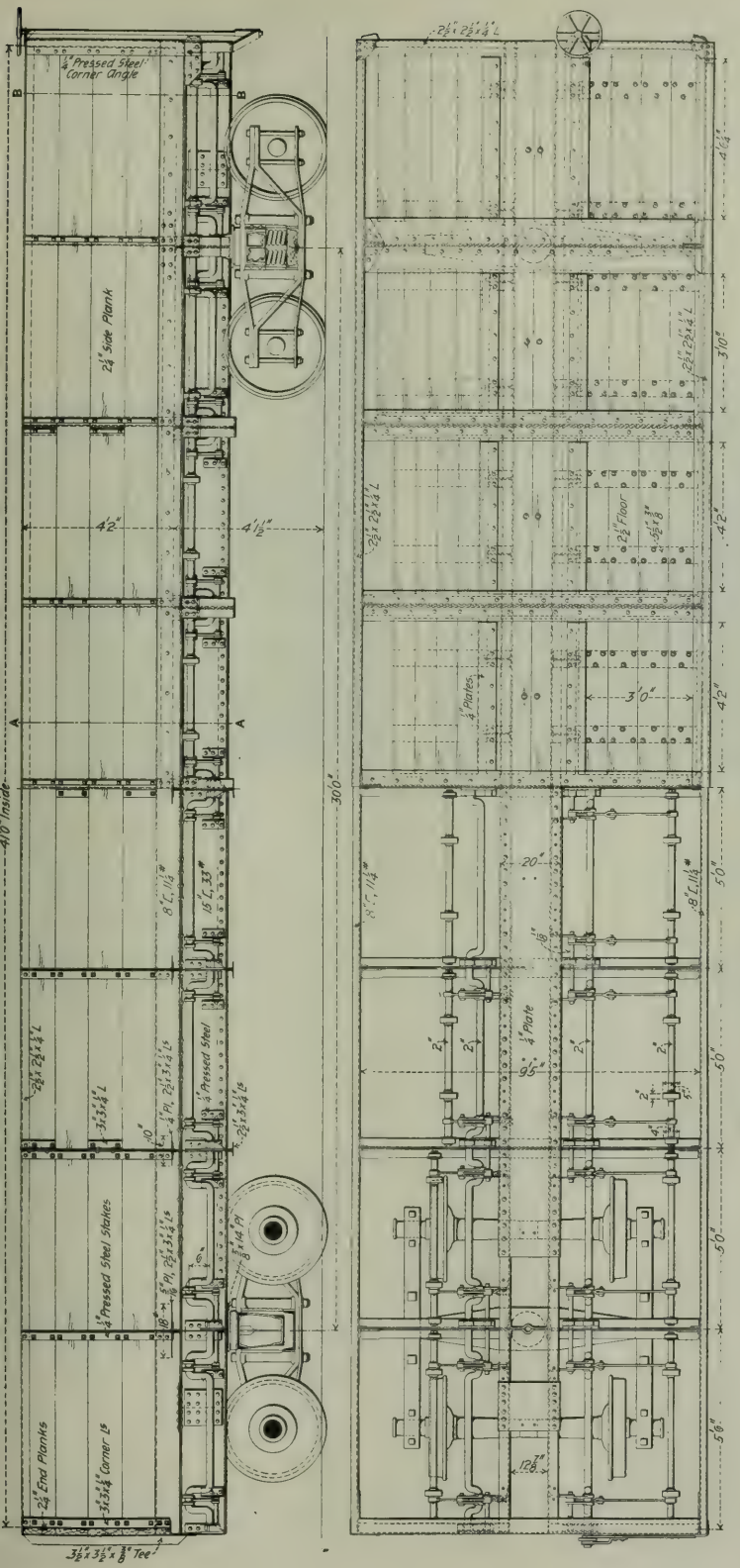
The portion of the railroad extending from Walton Summit to Bamber Bridge was opened for traffic on June 1, 1803, when a procession of 27 wagons carrying each about one ton of coal, was taken down by one horse; no very wonderful feat. The remainder of the line was completed in 1805, so that the centenary of Lancashire railroads may be said to have occurred this year. The canal was severely injured, as a commercial undertaking, by the interruption to through traffic caused by the severance of its northern and southern portions. It paid a fair dividend at one time, nevertheless, but the introduction of steam railways ruined it all the more quickly because of the break. In 1837 the tramway was acquired by the Bolton & Preston Railway Company, which did nothing with it, and in 1844 passed, with its belongings, into the hands of the North Union Railway, who worked it till 1859. After 9 years of disuse the plates and the winding machinery were taken up, and the embankment sold to the Preston Corporation. The North Union Company, extinct since 1888, long ago became absorbed jointly by the London & North Western and Lancashire & Yorkshire Railways, the former of which now owns and works the northern part of the canal, from Preston to Kendal.

The total length of the old tram road, basin to basin, was about 4¾ miles, the rise from the lowest point of the embankment to the disused wharf at Walton Summit is said to be 222 ft., equal to an average gradient of 1 in 77, but most of this is concentrated at the two points mentioned.

The Campbell Drop-Bottom Gondola Car.

A new design of drop-bottom gondola car, devised by Mr. Argyle Campbell, Chicago, is illustrated herewith. Its capacity is 100,000 lbs., the inside dimensions being 41 ft. long by 9 ft. 5 in. wide by 4 ft. 2 in. height of side. There are eight doors on each side, or 16 in all, operated in sets of four, which it is claimed will discharge 95 per cent. of the load.

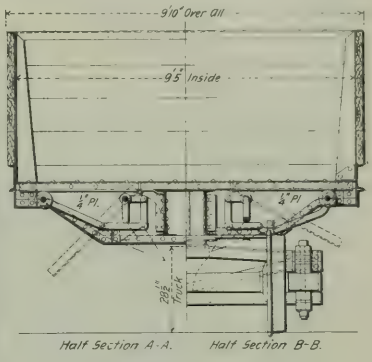
The center sills are 15-in. channels with a ¼-in. top cover plate and 3½-in. x 3½-in. x ⅜-in. bottom reinforcing angles. The side sills are 8-in. channels, and the transverse framing is composed of five continuous diaphragms between bolsters. These diaphragms are made of ¼-in. plate with 2½-in. x 3-in. x ¼-in. angles



Plan, Side Elevation and Longitudinal Section of Campbell Drop Bottom Gondola.

top and bottom, and are secured to the center sills by angles. On the top of each diaphragm, riveted to the angles, is a ¼-in. x 10-in. plate extending the width of the car, while 5/16-in. x 18-in. plates are used over the body bolsters. The end sills are made from ¼-in. plates flanged at top and bottom, with a reinforcing casting around the coupler.

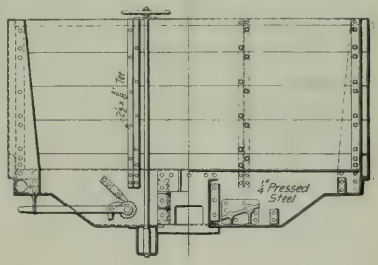
The side stakes are placed inside. They are made of ¼-in. steel, bent to angle section, and increase from a top width of 2½ in. to a bottom width of 7 in. where they are riveted to the diaphragms. The



Half Cross-Sections.

top plate of the body bolsters is secured to the side stakes by special bent plates, as shown by the drawings. The end stakes are 3½-in. x 3½-in. x ⅜-in. T-beams for greater strength, which are riveted to the end sills. Running around the tops of the side and end boards and forming a protection therefor is a 2½-in. x 2½-in. x ¼-in. angle, which is riveted to the side and end stakes. At the corners an additional angle is used on the inside, with the usual outside corner band.

Each set of four doors is operated by a 2-in. longtitudinal shaft, bent at several points, as shown by the drawings, to form



Half End Elevations.

cranks and also to clear the bell-cranks, the upper ends of which are joined to the shaft by short pieces about 6 in. long, rigidly secured to the shaft. The lower end of the bell-crank is connected to a push arm, the opposite end of which is joined to a short shaft near the outer edge of the door. This shaft has a small wheel on each end which runs on the bottom angle of the adjacent diaphragm, and also two small wheels at intermediate points on which the door bears. Adjacent bell-cranks on opposite sides of a diaphragm are mounted on a short shaft extending

through the diaphragm and having its bearing in a small malleable casting secured to the diaphragm and also furnishing the bearing for the main shaft. The outer ends of the bell-crank shaft are steadied by short pieces riveted to the adjacent center sill.

Each set of doors is operated by a ratchet lever at the end of the car. The ratchet wheel has a compound pawl and an additional pawl above. When it is desired to open the doors the top pawl is thrown up out of position. The top portion of the compound pawl being heavier than the bottom, throws the latter into service, and a slight pressure downward on the ratchet lever starts the doors, which drop open. The cranked portion of the shaft rotates to the left through about 200 deg., its position and those of the bell-crank and connected parts being indicated by the broken lines in the cross-sectional views. To close the doors the top pawl and the upper part of the compound pawl are dropped into position, throwing the lower pawl out of service. The doors can then be closed with comparatively little effort. It will be noted that the relation of the cranks and levers is such that the push on the doors is always approximately normal thereto. This, with the extra leverage secured by the bell-crank, makes the doors close easily. All of the doors open to 45 deg. except over the trucks, where the opening is about 30 deg. The design is controlled by the Enterprise Railway Equipment Company, Chicago.

Portable Air Compressor for Panama.

End View.

Portable Air Compressors for the Panama Canal.

The Panama Canal Commission recently placed an order with the Rand Drill Company, of New York, for two portable air compressors, which embody some features of distinct novelty. These machines are intended to operate pneumatic tools in general repair work in the Canal service. It is also expected that they will be found of great assistance in erecting the heavy machinery which of necessity will be delivered in sections along the line of work.

The illustrations give a very good idea of the arrangement of these compact little plants. The prime mover is a 16-h.p. gasoline engine. It is mounted on two steel channels, which constitute the frame of the truck. The engine shaft has at one end a heavy flywheel 4 ft. 8 in. in diameter; at the other end is a driving gear fitted with a friction clutch. Below and at one side of the engine a small Rand single stage air compressor is mounted, fitted with the usual mechanical intake and automatic discharge air valves. The crank gear of the compressor meshes directly with the driving gear of the engine and a valve rod operates the air valve gear by means of a back crank. The engine is started unloaded, with the friction clutch free. When full speed is attained, the clutch is thrown in and the load on the air compressor assumed. Gearing is such as to give the compressor a speed of 150 r. p. m., at which the displacement of the compressing cylinder is 60 cu. ft. of free air per min., which is delivered at a pressure of 100 lbs.

A novel feature of this equipment is the method of cooling circulating water for the engine and compressor cylinders. While provision is made for connection with an outside source of water wherever available, it has also been arranged for the machine to carry its own water supply. A rectangular open tank holding about 100 gallons of water is mounted on the truck in front of the engine. A small pump driven from the engine shaft draws water from this tank and circulates it through the cylinders of the engine and compressor. This water, heated by contact with the cylinder walls, flows upward to a perforated pipe elevated above the supply tank. It is here discharged through a series of fine holes and flows downward over a sheet of burlap to the tank below, being cooled by evaporation by exposure on a thin sheet to the open air. An air receiver 18 in. by 4 ft. 6 in. is suspended beneath the truck and between the axles. A gasoline tank with a capacity of about 30 gallons is hung from the truck in the rear. The entire machine runs on steel wheels. The total weight of this compressor outfit is 8,500 lbs. It has a wheel base 7 ft. long, with a tread of 5 ft.

Researches on the Purdue Locomotive.

Porf. Goss has ready for publication the manuscript of a book which is a compilation of the results of the researches conducted by the engineering laboratory of Purdue University relative to locomotive performance. Much of the contained matter has already been published in the form of papers read before engineering societies and railroad clubs or contributed to the technical press. In his book Prof. Goss has correlated this matter in its proper sequence under the various principal headings into which it should be subdivided. The table of contents is given below, from which it will be seen that in collecting these data into book form Prof. Goss has prepared a volume which will be a valuable reference work on this important subject.

1. *Locomotive Testing.*

I.—The Development of the Purdue Testing Plant.
II. Growth of Interest in Locomotive Testing.
III.—The Laboratory Locomotives, Schenectady No. 1.
IV.—Methods of Testing and Exhibit of Data.

2. *Locomotive Performance, a Typical Exhibit.*

V.—Locomotive Performance at Different Speeds and Cut-offs.

3. *The Boiler.*

VI.—Boiler Performance.
VII.—High Rates of Combustion.
VIII.—Thick Firing.
IX.—Spark Losses.
X.—Radiation Losses.
XI.—The Front End.
XII.—Superheating in the Smokebox.

4. *The Engines.*

XIII.—Lead and Its Effect upon Performance.
XIV.—Outside Lap.
XV.—Inside Clearance.
XVI.—Performance as Affected by the Valve Gear.
XVII.—Action of the Counterbalance.
XVIII.—Machine Friction.

5. *Locomotive Performance.*

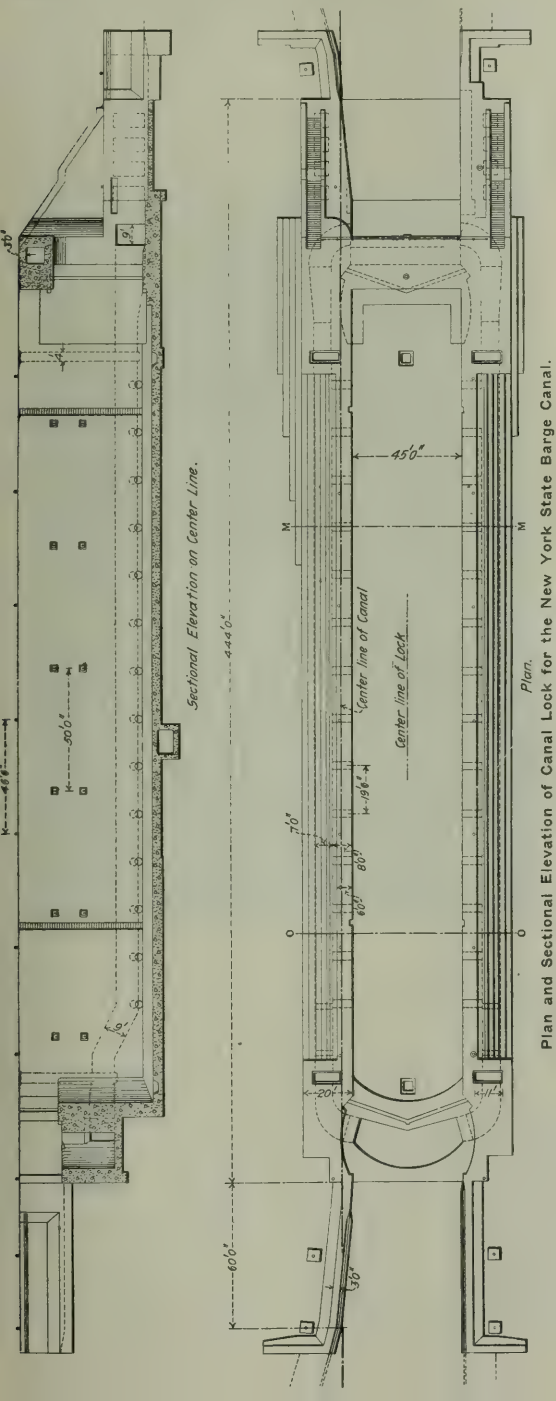
XIX.—Performance as Affected by Throttling.
XX.—High Steam Pressures.
XXI.—Performance as Affected by Diameter of Drivers.
XXII.—Atmospheric Resistance to the Motion of a Railway Train.
XXIII.—A Generalization Concerning Locomotive Performance.

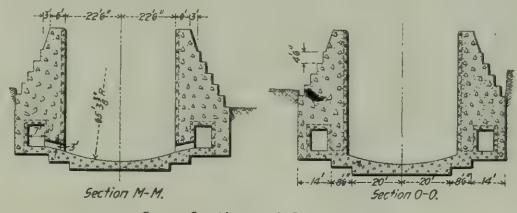
The New York State Barge Canal.

A general description of the proposed barge canal across the State of New York was printed in the *Railroad Gazette* of April 8, 1904. Since this description was printed a few changes have been made in the plans, such as widening the locks and altering locations in order to eliminate as many railroad crossings as possible. An important change in location which eliminates two grade crossings on the New York Central & Hudson River Railroad was made at Rome. Here, instead of taking the course originally proposed, the canal passes through Utica toward Rome on the north

of the New York Central. It leaves the river flats east of the Rome Locomotive Works and passes to the north, where it enters the Mohawk river. The route then passes along the Mohawk river to a junction with the present Black river canal and down that canal to the present Erie canal through Rome. As already stated in the *Railroad Gazette*, work on the canal is done under the direction of State Engineer Henry A. Van Alstyne and Superintendent of Public Works N. V. V. Franchot. The work in the State Engineering department is under the direction of Henry C. Allen, Special Deputy State Engineer, and W. B. Landreth, Special Resident Engineer. All engineering questions are passed upon by an advisory board of consulting engineers, composed as follows: Edward A. Bond, Chairman; W. A. Brackenridge, E. L. Corthell, Colonel Thomas W. Symonds, U. S. A., and Chief Engineer A. B. Fry. Work is under construction on six contracts, as follows: Contract No. 1, Hudson river work at Fort Miller, contractor Lindon W. Bates, contract price $605,000; contract No. 2, two locks 34 ft. lift each, with the connecting canals at Waterford, N. Y., contractor the Ferguson Contracting Company, contractor's bid $852,300; contract No. 3 land line and one lock at Fort Miller, contractor Sundstrom & Stratton, contractor's bid $670,500; contract No. 4, five miles of canal at the east end of Oneida Lake, contractor Lindon W. Bates, contractor's bid $727,000; contract No. 5, river work on the Seneca river near the Montezuma Marshes, contractor Lindon W. Bates, contractor's bid $382,000; contract No. 6, five miles of heavy rock work in the western city limits of Rochester, contractor F. A. Maselli & Company, contractor's bid $1,006,000. Work is progressing under these contracts and surveys have been completed for detail plans on about 300 miles of canal. Contract plans will soon be submitted for bids for three additional locks in the vicinity of Waterford and two dams and two locks on the Oswego river at Fulton. It is expected that plans will be completed by April 1st for at least 40 million dollars' worth of work. The legislature has already appropriated $10,000,000. This will pay for the contracts let, with something to spare. The state will be asked for another appropriation of from 30 to 40 millions very shortly. At the present time, there are about 350 engineers of various grades at work on the canal.

Thus far, the work contracted for has been let at about 17 per cent. under the engineers' estimates. Recently the canal authorities have decided to make all locks 45 ft. wide in the clear instead of 28 ft. wide as called for in the original plans. Because of the changes in location and plans, it is found that the extra expense incurred by larger locks will not increase the estimated final cost. The accompanying illustration shows the general design of the locks, of which about 52 in all will be used. It is estimated they will cost about $200,000 apiece. The total length of the canal is 440 miles, and it is expected that it will be completed in about seven years.





Cross-Sections of Canal Lock.

The following table comparing the principal quantities used in the estimates for the state barge canal and those for the Panama canal, is of interest at this time. The quantities used on the Panama canal are those given in Professor Burr's "Ancient and Modern Engineering and Isthmian Canal," page 458.

Principal Quantities of the Estimates for the New York State Barge Canal and the Panama Canal.

Items.	Quantities. Barge canal.	Panama Canal.
Dredging	57,676,756 cu. yds.	27,659,540 cu. yds.
Dry earth	54,286,888 "	14,386,954 "
Soft rock	7,655,974 "	39,893,235 "
Hard rock	387,820 "	8,806,340 "
Rock under water	2,762,963 "	4,891,667 "
Embankment and backfilling	9,455,408 "	1,802,753 "
Totals	132,225,809 cu. yds.*	97,440,489 cu. yds.
Concrete	3,243,105 cu. yds.	3,762,175 cu. yds.
Granite	9,778 "	13,820 "
Iron and steel	164,962,620 lbs.†	65,248,900 lbs.
Excavation in cofferdam	428,666 cu. yds.*	7,260 cu. yds.
Pneumatic work	.....	108,410 "
Other items.		
Excavation of structures	274,912 cu. yds.	.....
Puddle	2,243,933 "	.....
Sawn timber	93,756,000 ft., B.M.*	.....
Round spruce timber	4,176,000 lin. ft.	.....
Oak piling	53,600 "	.....
Riprap	1,628,967 cu. yds.	.....

*Does not include work for dams, bridges, highway, railway, and stream changes and some other small items.
†In bridges only.

Disastrous Collision at Rock Springs, Wyoming.

On the morning of December 7 a butting collision between Union Pacific eastbound passenger train No. 2 and a westbound freight train, five miles west of Rock Springs, Wyo., wrecked both engines and destroyed a mail car, a dining car and one other car of the passenger train, and the wreck took fire and was mostly burnt up. The freight train had received an order to wait at Ahsay for four eastbound passenger trains but waited for only three. Nine trainmen were killed and eight passengers and 11 employees were injured. The killed included the engineman of the freight, one brakeman, three cooks, the electrician, his assistant and two mail clerks.

Plans for the United Engineering Building.

The committee of the United Engineering Society, appointed to supervise the preparation of plans for the new Engineering Building in New York to be built by Mr. Andrew Carnegie for the joint use of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers and the Engineers Club, has prepared a report outlining the accepted plans. In the public competition instituted by this committee 26 sets of plans for the building were submitted. From among the competitors the committee selected Hale & Rogers and Henry G. Morse as Associate Architects for the three engineering societies, and Whitfield & King as architects for the Engineers Club.

The frontage of the Engineering Building on 39th street between Fifth and Sixth avenues is 125 ft. and the lot is 100 ft. deep. The building law of the city of New York requires that a building shall occupy only 85 per cent. of the lot area. Advantage was taken of this requirement to have space on all sides of the building, thus giving the building a monumental appearance. The building utilizes 115 ft. of the 125-ft. front, and 90 ft. of the 100-ft. depth.

The Engineering Building must meet requirements in five directions:

1. It must serve the convenience of each of the three individual societies. This has been secured by the proposed arrangement of society office floors, each society having one whole floor for its use. The working offices of the representatives of the society, the reception room, board and committee rooms, important elements of the life of the society, are on the desirable south front and have windows which look to the eastward.

2. The building must supply to the three National Societies and also to such other organizations as may be invited to participate in its benefits as associates, such meeting rooms and auditoriums as will be required for the annual meetings, the public reading and discussion of papers, and for scientific lectures and demonstrations. In view of the number of participant societies for which provision has been made, the committee has arranged for a number of assembly rooms suitable for various uses. One of these, primarily designed for the National Societies' meetings and for those of other large bodies, has been made to accommodate 1,000 persons. This limit is set as being as large a number as can be expected to hear clearly the voice of a speaker. The location of this large auditorium is on the first floor above the street, so as to make elevator service for it unnecessary. A large foyer and generous corridors give ample space for withdrawal from the large assembly hall. Ample provision for exit also at the four corners of this floor is a desirable provision for safety. To enable auditors in the back of the auditorium to see clearly such diagrams and illustrations as may be on the stage the seats are arranged on a grade conforming to best modern practice in theatres. This parterre arrangement enables coat-rooms to be provided, opening from the outer corridors, and special consideration has been given to secure rapid service with large numbers in attendance. The large auditorium floor is reached from the great central rotunda on the street floor by generous stairways, and it can also be reached from carriages entering the driveway and moving continuously as they receive or discharge their passengers. The room for preparing apparatus and exhibits for the stage is conveniently served by a large freight elevator, so that heavy machinery and apparatus can be easily handled. On the floor above the large auditorium are two assembly rooms occupying the principal portion of the area. These assembly rooms may be used independently for lecture purposes, or one may be made auxiliary to the other, and used as a foyer or conversation room. The two small rooms adjoining may be used in common when desired, as, for instance, for purposes of general reception or conversazione. Auxiliary smaller rooms on this floor are provided, and provision is made for the service necessary for light refreshments or luncheon. On the floor above a number of small lecture halls are provided suitable for ordinary meetings of scientific and engineering societies, and for meeting of sections at the time of general conventions of national organizations. It is expected that there will be a great demand, especially for the small meeting rooms, for scientific purposes. They will be supplied with electric current, with compressed air and with gas and water. The meeting rooms of all sizes will be fitted for the use of the projection lantern, and will be unique in their completeness for the purposes for which they are intended. The board rooms of the society floors will be large enough for holding small professional meetings when occasion may require.

3. In the planning of the building provision has been made on the two upper floors for the libraries of the various societies. The entire top floor is to be devoted to reading and reference rooms, to working alcoves, to rooms for photographic reproduction, and for drawing and similar library work. The roof will be specially constructed to secure the best illumination. The location of the reading rooms at the top of the building will be quiet, cool, airy, and free from dust. The floor below the library reading rooms will be devoted to the book stacks.

4. The building is also to furnish office accommodation for a large and continually increasing number of societies which have engineering or some other department of science as their principal object; such are, for example, the New York Electrical Society, Society of Naval Architects and Marine Engineers, Heating and Ventilating Engineers, American Gas Light Association, National Electric Light Association, Society of Chemical Engineers, Association of Edison Illuminating Companies, and many others. For these organizations the building will offer office areas of varying sizes, whose arrangements will be adjusted to the requirements of such participants. Such participants will have use of the auditoriums of the desired size.

5. By means of the driveway extending completely around the building access is had on the street level and under cover to the freight elevator, both for boxes of books and for other merchandise moving inward and for mail-sacks moving outward. This driveway also serves for carriage access to the auditorium and passenger elevators. It gives facility for unloading by gravity to the coal pockets of the heating plant without handling. The general convenience of the building is also served by the receiving and shipping

The New United Engineering Buidling.

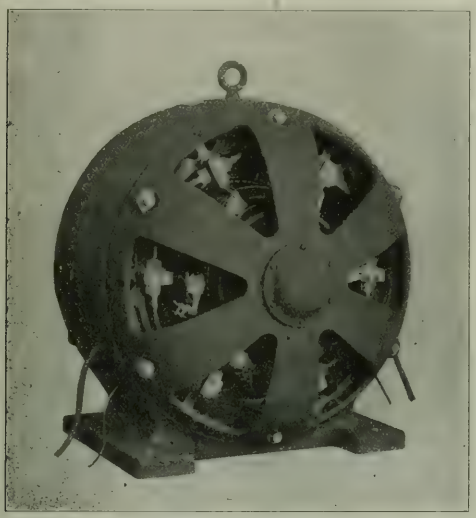
office at the rear, through which all goods in and out will be handled. There is also the bureau of information, at the right of the main entrance, where general questions can be answered, visitors directed, and some routine business transacted. This office will also be a suitable location for the telephone exchange, the telegraph and the sub-postoffice.

By a business arrangement formed under legal advice and forming part of the deed to the property to the east of the building, a restriction has been placed which prevents the erection on that lot of a building more than 60 ft. high. This restriction runs with the land and secures light and air for the building on its eastern front above the third floor. The west wall is built 10 ft. within the property line, so that openings for light and air should always be left on that side and on the rear, even if high buildings should be hereafter built on adjoining property to the west and the north. The committee contemplates finishing the building on all four sides and not merely on the south facade, in order that its monumental character may be seen and recognized from every point of view.

The contract for construction was signed in July, the excavation for the foundations was started at once, and the work of construction has now commenced. The contract limit is 15 months to date of expected completion.

Some New Inter-Pole Variable Speed Motors.

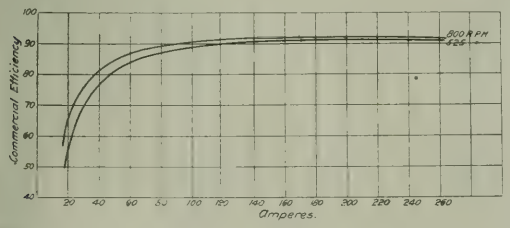
The Electro Dynamic Company, Bayonne, N. J., has recently delivered to the Philadelphia Rapid Transit Company a number of large inter-pole variable speed motors. They are for a 575-volt circuit and have each a capacity of 120 h.p. at 525 to 800 r.p.m. They are six-pole machines, fitted with a small inter-pole between each of the main poles, as shown in the accompanying illustration. The general design is similar to the four-pole machines which were described and illustrated in detail in the *Railroad Gazette* of March 3, 1905. The variation in speed in this type of motor is produced by changing the strength of the shunt field. They operate at all loads and speeds within the range given absolutely without sparking. The small inter-poles always give the proper fringe for commutation, as it increases with the load. In this respect the inter-pole motor is quite different from the motor of usual design, where the fringe



A 120-h.p. Inter-Pole, Variable Speed Motor for the Philadelphia Rapid Transit Company.

of the main poles for a given setting of the brushes is correct for one load only, and also in one direction of rotation only. With the inter-pole construction no change is required for the different loads, or for change of direction of rotation.

In the efficiency curves shown it will be noticed that at the high speed the efficiency is higher than it is at low speed. This is due to the fact that at high speed the shunt field loss is materially reduced, and also the losses due to hysterisis, eddy currents and friction. In general the losses due to hysterisis, eddy currents and friction are measured together, and although the friction loss is higher at the high speed, the total of the three losses is considerably



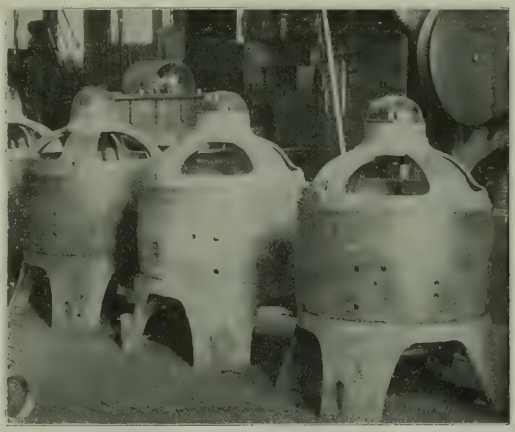
Efficiency Curves of 120 h. p. Inter-Pole Variable Speed Motor.

less at the high speed than at the low speed. If the machines had been fitted with ring oil bearings instead of ball bearings, the increased friction loss at high speeds would have considerably lowered the efficiency curve. It will be noticed also that the efficiency for light load is very high, showing over 80 per cent. for quarter load. In consequence the motors show unusually high efficiency for the average loads required in actual service.

The Electro Dynamic Company also has under construction a number of vertical motors, a few of which are illustrated herewith. The smaller size now under construction is for 50 h.p. at 400 to 750 r.p.m., and the larger size is for 100 h.p. at 400 to 750 r.p.m., all for 220-volt circuits. The motors are similar to the horizontal motors except that in addition to the ball-bearings for the radial thrust there is a ball-bearing for taking the vertical load.

Consolidation Locomotive for the Baltimore & Ohio Railroad.

In the issue of Dec. 1 a brief description with an illustration was published of the heavy consolidation locomotives that the American Locomotive Co. has delivered to the Baltimore & Ohio. Since the above date further particulars of considerable interest have been received regarding these engines. The tractive power, as already stated, is 41,100 lbs., and as they are intended for heavy service great pains were taken in the working up of the design. The fundamentals that were laid down at the start were that the first cost should be as reasonable as possible and not be enhanced by extra or unnecessary work, while the efficiency for the service to be performed should be kept at a maximum. Then, that the adhesive weight should be all that the strength of the track and the clearances would allow. With these points carried into effect it is expected that the machines will handle the heaviest gross tonnage that it is practicable to haul, at the highest speeds. Of course, in all this, the economy of fuel and maintenance was kept in mind, the latter involving the use of the fewest number of parts. In short, the design had to be that of a freight locomotive, adapted



Inter-Pole, Variable Speed, Vertical Motors Made by the Electro-Dynamic Co.

to hauling a heavy tonnage over a road both level and mountainous and of varying degrees of curvature.

The boiler is of simple design, and arranged for a very free circulation of the water. For this purpose the throat sheet has a rapid slope to the front, widening from 4½ in. at the mudring to 7 in. at the bottom of the shell. In the same way, the water legs widen from 4½ in. to 6 in. The inward slope of both sheets gives the steam an opportunity to free itself from the surface on which it is formed. The door opening is made by flanging the two sheets and using a supplementary sheet ring in addition to the heavy stiffening ring to which the door and its fastenings are attached.

The grate is made in one plane, dropping 10 in. from the back to the front in its length of 9 ft. 1 in. The fuel used will be either gas or soft, run-of-mine, bituminous coal. The rigid wheel base was made as short as would be consistent with the number and diameter of wheels used. It is 16 ft. 8 in., and the wheels are 60 in. outside the tread.

Bushings have been applied to the new cylinders in order to secure a good wearing metal for the pistons. This makes it possible to insure strong walls for the shell of the cylinder itself as well as for the saddle. The castings of the half saddle extend down to a level with the center of the cylinder and are provided with front and back flanges to which staggered bolts are fitted.

The frames have a strong section due to the ample dimensions of width and depth; these measurements at the pedestals being 5 in. and 6 in. respectively. The driver brake is arranged with the shoes applied to the front of the wheels in the usual manner, and with the push-down type of driver brake cylinder, having the cranks and connections so placed as to be readily accessible for repairs, cleaning and adjustment.

There are two air storage reservoirs suspended from the running board on either side and having a combined capacity of 60,000 cu. in. It is expected that this in connection with an 11-in. air pump should be able to give ample means for properly handling the longest trains down the grades of the mountains. The main and side rods have been made of a heavy section around the brasses, knuckle joint pin and other openings.

The crosshead is designed so that the vertical wear may be taken up without disturbing the alinement of the guides. In this

connection, attention is called to the fact that the piston rods and guides are so disposed that the metallic packing can be applied when the crank-pins are on the front dead center, and the piston packing rings can be applied without disconnecting the piston from the crosshead.

Brass is used for the eccentric straps and for the shoes and wedges in connection with the cast-steel driving boxes. The Walschaert valve gear having proved so satisfactory in the case of the heavy Mallet compound No. 2,400, it has been applied to five of these engines for the purpose of making a comparison and securing data upon which to base a decision as to the advisability of using it instead of the Stephenson gear on future equipment. The cab is large, roomy and convenient, special attention having been paid to the matter of ventilation for tunnel service.

The tender underframe is of deep channels, with the cistern equipped with collision angles and iron coal gates, so as to reduce the liability of the tank or coal being forced ahead over the tender-frame in the case of an accident. The cistern is formed with a deep water bottom extending to the front end of the frame in order that an ample proportion of weight may be maintained over the front tender trucks at all times. The floor has also been so arranged that all coal will be brought down by gravity to a point as near the coal gates as possible.

A first sample locomotive was built in advance of the regular order and was put into service in August last. This gave an opportunity for examination and discussion by the three committees mentioned in the previous article, as well as to make a practical demonstration of the machine in service so that any minor changes that might be suggested could be made.

The reports made by these committees contained many valuable suggestions, which, coming from the people who will be in direct charge of the maintenance and operation of the locomotives over level and mountainous divisions, have been of considerable benefit in producing a design that the motive power people feel will give the most satisfactory general results.

It is felt that this method of producing locomotive equipment by a combination of drawing office and practical shop and operating knowledge of locomotive design and construction will result to the best advantage.

In deciding upon types of new locomotives to be built and in designing, only those of maximum power have been considered, and the fewest number of standard types adapted to the present and future needs of the different service and to meet the contemplated physical improvements of the property decided upon. With the above in mind, it was decided to classify the 250 locomotives that have been placed in this order into three groups, five being a switching type for special service, 35 a Pacific type for passenger and fast freight service, and 210 of the consolidation type for slow and fast freight service.

As the principal work to be accomplished by a railroad is the movement of its trains from one terminal to another on time, it is thought that the monthly mileage that can be derived from any class of properly designed, constructed and maintained motive power is limited only by terminal delay and the despatch with which it can be handled over a division, even though the speed, grade and curvature are factors that may largely control the loading of the locomotives, as well as the cost for their operation.

With the demand for faster schedules, the general tendency and more desirable practice has been followed of increasing the diameter of the driver wheels and the length of the stroke, which, combined with a proportionately reduced diameter of cylinder, results in less liability for wear and tear on the track and locomotives, and decreased operating expense due to less revolutions per coupled wheel per mile, and a material gain in reduced boiler and machinery stresses.

The demand for great locomotive tractive power in one unit has frequently resulted in the use of extreme diameters of cylinders, reduced spread of frames, increased distance between centers of cylinders and greater length of rigid wheel base, which proportions have transmitted stresses to the cylinders and connecting frames, that have resulted in a large number of breakages of these parts.

Furthermore, the failure of the higher steam pressures to produce efficient and economical results, in many modern locomotives, has frequently been due to defective boiler, cylinder, frame and motion gear design and construction; excess weight and inferior quality of material applied to frictional parts; neglect in the details of design; inadequate provision for drifting and condensation; priming, method for lubrication, etc.

It was, therefore, kept well in mind that when the steam pressure is not maintained, a locomotive cannot develop its working power, and that the modern type is under the further disadvantage of having to haul an increased dead weight, especially on mountain grades. Therefore, by combining in the new construction features that have been found in practical experience to have met local conditions, and by the elimination of personal preferences, it is believed that a plain, simple, practical design and construction, and one that will give satisfactory results, has been obtained.

The following are a few of the principal dimensions of these engines:

Cylinder, diameter	22 in.
Piston, stroke	30 "
Tractive power	41,100 lbs
Weight in working order	208,500 "
" on driving wheels	185,900 "
" of engine and tender in working order	345,900 "
Wheel base, total of engine	25 ft. 7 in
" driving wheel	16 " 8 "
" engine and tender	59 " 8½ "
Heating surface, tubes	2,612.80 sq. ft.
" " firebox	162.26 "
" " total	2,775.06 "
Grate area	56.5 "
Axles, main journals, length	13 in
" " " diameter	10 "
" truck " length	10 "
" " " diameter	6 "
" tender " length	10 "
" " " diameter	5½ "
Boiler, type	Straight top
" outside diameter of first ring	74 7-16 in.
" working pressure	200 lbs
" fuel	Bituminous coal
Firebox, type	Wide, radial stay
" length	108⅛ in
" width	75¼ "
" thickness of crown, side and back sheets	⅜ "
" thickness of tube sheet	½ "
" thickness of water space	4½ "
Tubes, material	Charcoal iron
" diameter	2¼ in
" length	15 ft. 10 "
Exhaust pipe diameter	5½, and 5¾ "
Exhaust pipe, type of nozzle	Single
Piston rod, diameter	4 in
Stack, diameter	18 "
Stack, height above rail	14 ft. 7¾ "
Tank, capacity, water	7,000 gals.
Tank, capacity, coal	12 tons
Valves, type	Richardson balance
" travel	6 in.
" steam lap	1¼ "
" exhaust lap	⅜ "
" lead in full gear	1-16 "
Wheels, diameter of drivers	60 "
Wheels, diameter of truck	33 "

The engines are equipped with the Westinghouse-American driver brake and an 11-in. air pump, with straight air. Cast-steel is used for the driving boxes, driving wheel centers and some other of the working parts.

1906 M. C. B. and M. M. Convention.

At a meeting of the joint executive committees of the Master Car Builders' and American Railway Master Mechanics' Associations at the Hotel Manhattan, New York City, Dec. 11, it was decided to hold the next annual conventions of these Associations at Atlantic City, N. J. The Master Car Builders' Association will meet June 13 to 15 inclusive, and the American Railway Master Mechanics' Association June 18 to 20 inclusive. No hotel will be headquarters. The following hotels, members of an association of hotels in Atlantic City, agreed to reserve in all 2,040 rooms, with 825 private bath rooms. The rates for those who will attend the conventions are also listed:

Hotels.	Distance*	Total promised Rooms.	Total promised Baths.	Rate of rooms by the day (American) One person—Single.	One person—Double.	Two persons—Double.	Two persons—Ex.lrge Baths.	
Royal Palace	13 min.	125	60	$3.50	$4.00	$7.00	$8.00	Without
Royal Palace	..	....	..	5.00	$6-$7	10.00	12.00	With
Rudolf	4	310	110	3.50	4.50	6.00	8.00	Without
Rudolf	..	....	..	5.00	6.00	10.00	12.00	With
St. Charles	3½	145	45	3.50	4.50	$6-$9	9.00	Without
St. Charles	..	....	..	6.00	$7-10	$10-14	14.00	With
Seaside	1	90	25	3.50	4.50	7.00	None.	Without
Seaside	..	....	..	5.00	6.00	10.00	12.00	With
Strand	1	135	40	3.50	5.00	7.00	8.00	Without
Strand	..	....	..	5.00	7.00	10.00	12.00	With
Haddon Hall	3	75	20	3.50	4.50	6.00	None.	Without
Haddon Hall	..	....	..	5.00	6.00	10.00	12.00	With
Chalfonte	3	100	30	3.50	4.50	6.00	8.00	Without
Chalfonte	..	....	..	None.	6.00	10.00	12.00	With
Young's	5	150	100	1.50	....	3.00	....	Without
(European)	..	....	..	2.50	....	3.50	4.00	With
Windsor	9	110	30	4.00	5.00	8.00	10.00	Without
Windsor	..	....	..	None.	8.00	11.00	12.00	With
Traymore	9	105	35	3.50	7.00	7.00	8.00	Without
Traymore	..	....	..	5.00	10.00	10.00	12.00	With
Brighton	11	25	..	$4-$6	None.	$8-12	None.	Without
Brighton	..	....	..	$6.50-9	None.	$11-18	None.	With
Marlborough	12	345	225	4.00	5.00	8.00	None.	Without
Blenheim	..	....	..	6.00	7.00	10.00	$14-20	With
Dennis	13	150	50	$3.50-4	4.50	$6-$7	8.00	Without
Dennis	..	....	..	5.00	7.00	10.00	12.00	With
Shelburne	13	175	45	3.50	4.50	6.00	8.00	Without
Shelburne	..	....	..	5.00	6.00	8.00	12.00	With

*Distance from pier.

The exhibits will be placed on the east side of the big pier. Applications for space should be made to L. B. Sherman, Secretary of the Supplymen's Association, Old Colony Building, Chicago, Ill.

Washington Correspondence.

WASHINGTON, Dec. 12.—Little progress has been made during the past week in the direction of preparing a railroad rate bill. The Senate Committee is waiting for the publication of the digest of the testimony that was taken during the hearings of last spring, and has not had a meeting since last week. The House Committee on Interstate and Foreign Commerce was appointed on Monday and met on

Tuesday, but did not take up the rate question, nor did it adopt any programme for its consideration. The question of whether or not the House Committee shall have hearings before undertaking to report a bill has not been decided. There are three new members on the committee: Messrs. Gaines, of West Virginia, Republican; and Bartlett, of Georgia, and Russell, of Texas, Democrats. It may be that hearings will be considered necessary for the benefit of these men, who are not as familiar with the subject as are the men who have served on this committee in former Congresses.

Republican leaders in both houses are working with the idea of lining up the members of their party in support of a bill and putting it through Congress as a party measure. This will be a difficult task on account of the wide differences of opinion at present existing in the party, and one of the reasons for going slow at the beginning of the session is that the leaders desire to have their men lined up as well as possible before too many of them have committed themselves positively for any particular measure. It now seems probable that if the House Committee shall decide to give hearings it may be late in January before a bill has been reported to either House.

It is impossible to keep the subject entirely in the background, however, and on Monday of this week the Senate gave the greater part of the session to a railroad debate. The discussion was precipitated by the introduction of a bill by Senator Tillman, of South Carolina, one of the Democratic members of the Committee on Interstate Commerce, which he was allowed to explain before its reference to the Committee. The object of the Tillman bill is to confer the power to make maximum reasonable rates on the Interstate Commerce Commission in the shortest form possible. It contains no provisions for the judicial review of the acts of the Commission, allowing the courts the full power in this respect that they now exercise. This measure served to bring up and concentrate the attention of the Senate on the one fundamental question of whether giving the Commission power to fix a rate for the future would be such a delegation of legislative power as Congress could not constitutionally make.

It is manifest that if Congress cannot delegate this power to an executive body, all of the bills that have been proposed conferring the rate-making power on the Commission must be abandoned and some measure framed on the lines of the Foraker bill must be adopted. It is claimed, however, that the plan proposed by Senator Elkins avoids this constitutional difficulty by making the fine distinction between an order of the Commission directing the carrier to substitute a new rate and an order directing it to modify the existing rate. Senator Foraker took the leading part in Monday's debate, contending that giving the Commission power to fix a rate for the future would constitute an unconstitutional delegation of legislative power unless Congress should more accurately define the standard by which rates were to be made than by simply providing that they should be reasonable. He contended that under such a definition of the legal standard the Commission would exercise discretionary legislative powers, and that if it was to make rates constitutionally Congress would have to set up some exact standard, such as a provision that rates should be so much per ton mile, or that a railroad earning a certain per cent. on its capital should not be permitted to charge above so much, leaving the Commission the simple administrative task of making the necessary calculations and applying the standard.

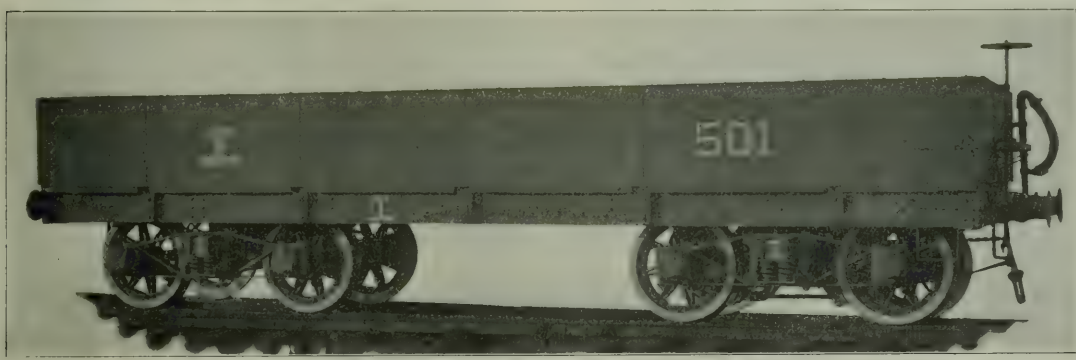
Such debates may be expected from time to time in the Senate until some bill has been formally reported from the Committee, and it is probable that by that time the constitutional questions involved in the various pending propositions will be thoroughly threshed over. It is apparent that there are at present wide differences of opinion among the lawyers of Congress on these questions, and these differences will probably continue until the end of the debate. The attack on the constitutionality of the measures proposing to give the Commission rate-making power was helped along during the week by the filing with the Senate Committee of an exhaustive argument against the constitutionality of the Interstate Commerce Commission bill by Mr. Walker D. Hines, formerly Vice-President of the Louisville & Nashville.

J. C. W.

Narrow Gage Coal Cars for Japan.

The Middletown Car Works has recently completed 500 gondola cars for the Imperial Government Railways of Japan. These are part of an order for 1,900 cars placed in this country by the Japanese Government last June. The Western Car & Foundry Co. built 900 box cars, and the remaining 1,000 gondolas were divided between the American Car & Foundry Co. and the Middletown Car Works. The entire equipment is narrow gage, 3 ft. 6 in.

The car illustrated has a steel underframe and is designed for a capacity of 18 tons. The frames are built up from 10-in. and 6-in. channels, and the end sills are pressed from ¼-in. steel plates. The truck bolster consists of two 7-in. I beams joined by steel cover plates and supported by eight coil springs, which rest on a 12-in. channel spring plank. The brakes are operated by hand and are applied to one truck on each car. The draft gear is made up of a drop-forged draw hook, which pulls against a cast-steel draft lug riveted to the two center sills. The cars also have standard English buffers for compression. The spoke wheels and axles were made in England and shipped to this country, but the remaining parts are American design and construction. The steel and malleable castings were by Benjamin Atha & Co., and the National Malleable Castings Co., while the truck and draft springs were furnished by the Railway Steel-Spring Co. The general dimensions of the car are as follows: Length, 28 ft. 9¼ in.; height, 5 ft. 11¾ in.; diam. of wheels, 34 in.; weight, 18,500 lbs.; depth of inside, 2 ft. 6 in.; width of inside, 7 ft. 2 in.; total wheel base, 21 ft. 4 in.



Steel Underframe Gondola, Narrow Gage, for the Imperial Government Railways of Japan.

Fast Runs of 1905.

At least nine new high speed records have been made on the railroads of the United States during the present year and, if our readers are willing to accept our guess that no more "record breaking" will be done before the first of January, they will doubtless be interested at this time in reading a list of these runs. As in the case of most other performances of the kind, it is impossible to give all the particulars that would be desirable, and entirely out of the question to make discriminating comparisons between different runs, except in a rough way. Considering only distance and time, the times here shown are "world records" in each case.

In the accompanying table these runs are shown in the order of their length, the longest first; and the rates of speed vary from 44.3 miles an hour to 79 miles.

The first run in the list, that which was made to carry Mr. E. H. Harriman and party from San Francisco to New York, was not undertaken with a view to breaking records, and, as will be seen by details given at the end of this article, sent to us by an officer of the Union Pacific, the rates of speed have probably been exceeded on every one of the divisions which the train traversed. Nevertheless, the time through for the whole distance across the Continent was much better than has ever before been made. Though each of the roads interested disclaimed any intention of beating former records, it is clear that the special train was favored, especially on single track lines, in a way to enable it to make much better time than is made by regular trains. The Jarrett & Palmer

special of 1876, from Jersey City to Oakland, ran 3,311 miles at 39.53 miles an hour.

The next in order of length was the run made over the Atchison road to carry a Death Valley miner of Southern California, who took this way to get rid of some of his money. The best previous run from Los Angeles, Cal., to Chicago was on March 27, 1900, 38.55 miles an hour. This also was done for an individual, or small party.

The third item, that of the regular 18-hour trains of the New York Central, is introduced for the sake of completeness, although we have no precise record of the very best speed made by this train through between termini. In several instances the train has lost time and has subsequently made up the loss, but this did not, of course, affect the rate of speed through, because the trains have never yet been compelled to begin their trip behind time. The New York Central is to be credited with higher speed than its competitor on these regular runs, because its line is longer than that of the Pennsylvania. These 18-hour trains have on many occasions hauled more than their regular number of cars for a part of the distance, and the use of dining cars for a part of each trip makes it impossible to definitely state any weight which can be used in a comparison of speeds.

The next item in the table, the fourth, shows what the 18-hour trains can do when they are behind time. On this run the speed from Harrisburg to Altoona (132 miles, over a line largely up grade and none of it down grade) was 58.7 miles an hour. The figures for this run, which are official, are somewhat different from those originally reported. The run is by far the best on record for so great a distance as 700 miles.

The fifth item, the Lake Shore special run, is already well known to our readers.

The sixth and the seventh also refer to a special run, and it will be observed that there was one more car than in item five. In item six there was no stop at Clarke Junction.

The eighth run, that on the Atlantic City road, is remarkable not so much for the few seconds saved over previous records, as for the weight of the train. The Atlantic City engines now do as well with five or six or more cars as in the early days was done with four cars. The engine in this case carried 225 lbs. steam pressure.

Item No. 9 records a run in which there was a flying start; and there was no stop at Donaldson.

It is about as difficult to make comparisons of the locomotives used to haul these trains as to compare the roads over which they travel; and, indeed, for the longer runs no accurate data are at hand. On the Atchison run the engines were, of course, changed many times, and in some of the mountain districts helping engines had to be used for considerable distances. We give the principal dimensions of the engines used on the runs of October 24 on the Pennsylvania Lines West of Pittsburg, and it may be said in a general way that nearly or quite all of the engines used, for all of the runs shown in the table, are of large modern types; for all of the roads named own considerable numbers of these engines, and would naturally use their best for these notable performances. Most of the engines used had cylinders of from 20½ in. to 22 in. in diameter and from 24 in. to 28 in. stroke. The driving wheels of most of the Atlantic type and Pacific type engines were of 79 in. or 80 in. diameter, but the Atlantic City engine had 84-in. wheels. The weight on the drivers of the Atlantic type engines was from 109,000 lbs. to 130,000 lbs., except on the Atlantic City road. On the Lake Shore (items 3 and 7) Pacific and Prairie type engines were used on some of the divisions. On the Atchison 10-wheel engines were used in New Mexico and west of there, and four-cylinder balanced compounds in Kansas and east thereof. The Atlantic City engine, as before stated, was worked at a higher steam pressure than any of the others, so far as reported.

A condensed schedule of run No. 1 is given below. There were, of course, many stops besides those here shown. In connection with this run it is of interest to note that Mr. Harriman and his party made a fast trip across the Pacific Ocean in the steamship "Siberia" of the Pacific Mail Steamship Company, so that they traversed the 7,775 miles between Yokohama and New York in 13 days, 16 hours and 43 minutes. Yokohama time is about 6 hours 40 minutes slower than San Francisco. San Francisco uses Pacific time, one hour slower than Mountain time, two hours slower than Central time, and three hours slower than Eastern time. The "Siberia" cleared Yokohama lightship at 5.29 p.m., October 13, and arrived off San Francisco lightship at 10.28 a.m. October 23. The train started from Oakland, east side of San Francisco bay, 5 hours and 2 minutes later. In passing the 180th meridian east of Greenwich the "Siberia" added a day to the calendar.

Special Train, Oakland to Jersey City, Oct. 23-26, 1905.

	Miles.	Time elapsed hrs.	min.	Miles per hr.
Southern Pacific:				
Oakland, Cal. ..Dep. Mon., 3:30 p.m. P. T.	....	..	..	....
Sparks, Nev. ...Arr. Mon., 10:51 p.m. P. T.	243	7	21	33.1
Sparks, Nev. ...Dep. Mon., 11:58 p.m. M.T.				
Ogden, Utah....Arr. Tues., 11:24 a.m. M.T.	539	11	26	46.9
Union Pacific:				
Ogden, Utah....Dep. Tues., 11:34 a.m. M.T.				
Green Rvr,Wyo.Arr. Tues., 3:30 p.m. M.T.	176	3	56	44.7
Green Rvr,Wyo.Dep. Tues., 3:37 p.m. M.T.				
Omaha, Neb. ...Arr. Wed., 9:26 a.m. C. T.	824	16	49	49.0
Chicago & North Western:				
Omaha, Neb. ...Dep. Wed., 9:44 a.m. C. T.				
Chicago, Ill. ...Arr. Wed., 8:00 p.m. C. T.	492	10	16	47.9
Transfer to L. S. & M. S. Ry.*	8	1	5	....
Lake Shore & Mich. So.:				
Chicago, Ill. ...Dep. Wed., 9:05 p.m. C. T.				
Buffalo .....Arr. Thurs., 7:55 a.m. C. T.	532	10	50	49.1
Erie: Buffalo.....Dep. Thurs., 9:08 a.m. E. T.				
Jersey City....Arr. Thurs., 7:42 p.m. E.T.	425	10	34	39.4
Add time consumed in stops at places shown above: 7 + 10 + 7 + 18 + 13 = 55 minutes..	.....	..	55	....
	3.329	73	12	44.3

*Including all stops in Chicago.

Baker Bridge and East Everett.

The Grand Jury of Middlesex County, Massachusetts, on December 7, made a report on the Baker Bridge collision, but found no bill against Engineman Lyons, following the finding of the coroner. Lyons had been arrested on a charge of manslaughter, and had been in jail for about one week, but on the announcement of the report of the Grand Jury he was set free. The Grand Jury finds the railroad company at fault in not requiring trains to come to a full stop at signals indicating that the time interval is too short between trains following one another; in having a rule which does not clearly make it the duty of the rear brakeman to flag a following train, in a situation like that at Baker Bridge; in depending on the time interval, lanterns, flags, fuses and torpedoes, which constitute an inadequate system; and in assigning inexperienced engineers to fast passenger trains. In this connection, the report says:

> If there is an agreement with the engineers whereby the first spare man on the list is to be assigned to the first vacant job, no matter what the character of the service required or the experience of the engineer, such an agreement is in violation of public policy and endangers the safety of the traveling public. The jurors find that no engineer should be permitted to work from 16 to 18 hours or more a day five days in succession.

The Grand Jury declares the men in charge of the accommodation train at fault in not stopping at Baker Bridge. It appears that in making the station stop the engineman ran some distance past the platform, and the stop was in such a position, around a curve, that the tail lights were not so clearly visible as they would have been at the proper stopping place. This train crew is also blamed for not sending a flagman back when the train was within two or three minutes of the time of the following express train. Lyons is found "greatly at fault" but, as before stated, he was not found guilty of manslaughter.

A lawyer, said to be counsel for Engineman Lyons, says that this was the first trip on which Lyons had ever run an express train.

At a hearing before the state railroad commissioners, an officer of the road testified that on Sunday about three-fourths of the men for the trains are usually taken from the spare list. The telegraph operator at Lincoln, less than two miles east of Baker Bridge, testified that the local passenger train passed him at 8:14 and the express at 8:15.

On Wednesday evening, about 6:30 o'clock, three days after the Baker Bridge collision, there was a rear collision on the Eastern division of the Boston & Maine at East Everett, Mass., about five miles from Boston. A suburban passenger train of six cars, bound north, was run into at the rear by a following freight train drawn by two engines. Three of the passenger cars were considerably damaged, and all of the 200 passengers were shaken up; but only 10 or 15 were injured, and these only slightly. The freight train

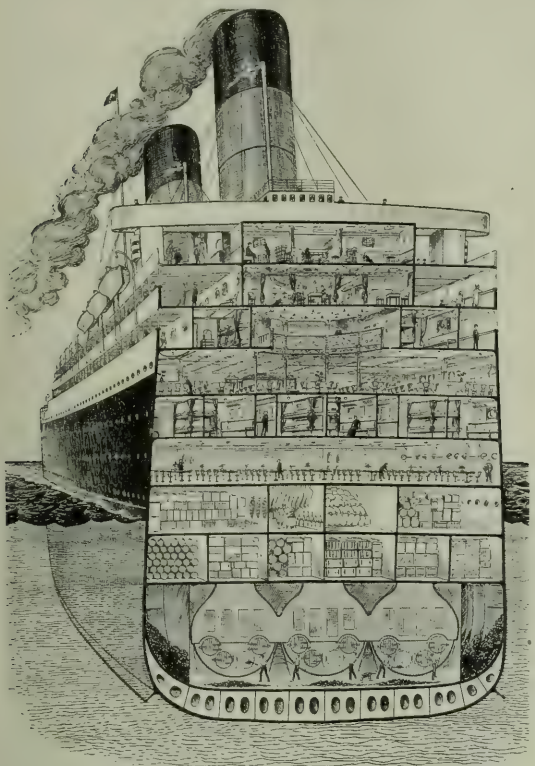
Fast Runs on American Railroads in 1905.

Date of starting.	Railroad.	From	To.	Distance, miles.	Time h. m. s.	Speed, miles per hour.	Cars No.	Cars Weight, lbs.	Locomotives Type.	Locomotives Size of cylndrs. ins.	Locomotives Weight on drvrs. lbs.	Reported in *Railroad Gazette*, date and page.
1. Oct. 23.	S. Pac., Un. Pac., C. & N. W., L.S. & M.S., Erie.	Oakland	to Jersey City	3,239.0	73:12:00	44.30	..	.....	.....	.....	.....	Nov. 3; 137, G.N.S.
2. July 9.	Atch., T. & Santa Fe.	Los Angeles	to Chicago	2,246.0	44:54:00	50.00	3	338,000	.....	.....	.....	Sept. 8; 234.
3. Daily.	N.Y. Cent., L. S. & M.S.	New York	to Chicago..	964.0	18:00:00	53.55	3 to 5	.....	Atlantic.	.....	.....	.....
4. Nov. 3.	Pennsylvania	Harrisburg	to Chicago.	717.0	12:49:00	56.00	3 to 4	.....	Atlantic.	.....	.....	Nov. 10; 146, G.N.S.
5. Jun. 13.	Lake Sh. & Mich. So.	Chicago	to Buffalo....	525.0	7:33:00	69.53	3	350,000	.....	.....	.....	June 30; 751.
6. Oct. 24.	Pennsylvania	Crestline	to Clark Junc	257.4	3:27:20	74.55	4	520,000	Atlantic.	20½x26	109,000	Nov. 17; 456.
7. Oct. 24.	Pennsylvania	Crestline	to Ft. Wayne	131.4	1:41:20	77.81	4	520,000	Atlantic.	20½x26	109,000	Nov. 17; 456.
8. May 14.	Atlantic City	Atlantic C.	to Camden.	55.5	0:42:33	78.26	5	460,000	Atlantic.	21x24	99,000	June 2; 597.
9. Jun. 8.	Pennsylvania	E. Tolleston	to Dunlson	50.0	0:38:00	79.00	3	.....	Atlantic.	20½x26	109,000	Aug. 11; 123.

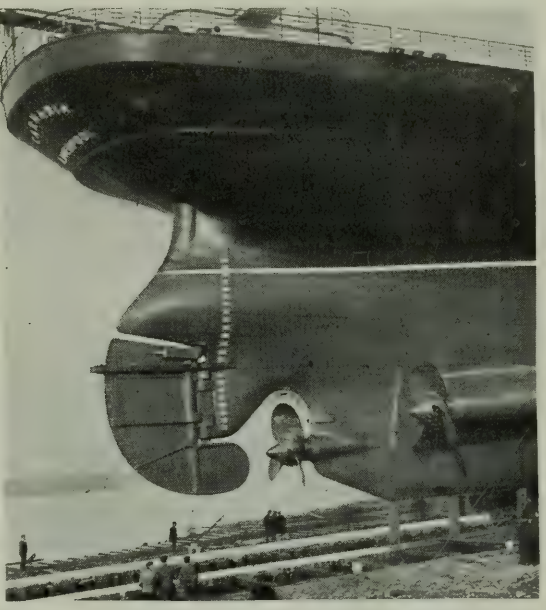
in this case had started from East Somerville, about one minute behind the passenger train, and it had run past three automatic block signals set against it. The engineman of the leading engine, which engine was to accompany this train only to Revere, about six miles, admitted on cross examination that he had disregarded a plain rule in running past these signals without being sure that he saw and knew their indications, and without getting his train under control. The situation of the block signals, measuring back from the point of collision, was as follows: The first one, 2,000 feet back; the next, 8,350 feet back, and the next, 11,980 feet. This engineman had been cautioned by the Master Mechanic that it was a bad night (rainy) and "to be very careful, so that no accident should happen."

The New Cunard Steamship "Carmania."

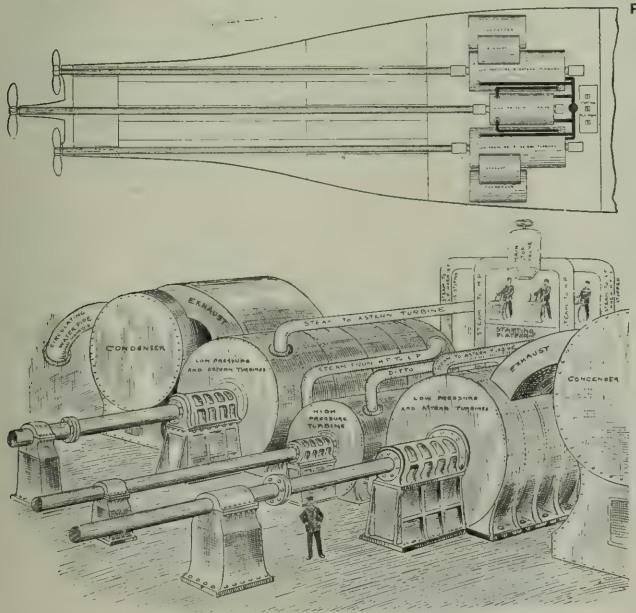
The accompanying illustrations show the general arrangements of the engines and propellers of the new Cunard triple screw turbine steamship "Carmania," built by Messrs. John Brown & Company, Ltd., Clydebank. Aside from her engines the "Carmania" is similar to her sister ship the "Caronia," which was illustrated and described in the *Railroad Gazette*, March 10, 1905.



Cross-Section of the New Cunard Steamship "Carmania."



Stern of the New Cunard Steamship "Carmania," Showing the Powerful Rudder and Two of Her Three Propellers.



General Arrangement of Turbines and Propellers on the New Cunard Triple-Screw Steamship "Carmania."

She is the third merchant ship in the transatlantic trade driven by triple screws, the Allan liners "Virginian" and "Victorian" having preceded her, and is the largest turbine steamship in the world and the first turbine merchant steamer to enter a port in the United States. She left Liverpool on her maiden voyage December 2, and arrived in New York after a passage of 7 days, 9 hrs. and 30 min.; thus making an average speed of about 16 knots. There are eight continuous decks on the "Carmania," and the distance from the upper boat deck to the keel is 84 ft. Her principle dimensions are: Length over all, 676 ft.; beam, 72 ft. 6 in.; moulded depth, 43 ft. 9 in. When fully loaded the "Carmania" draws 33 ft. of water. Her gross tonnage is 21,000, and her total displacement is 30,000 tons. She carries a crew of 450 officers and men. She is fitted with three independent Parsons turbine engines, which, it is estimated, develop a total of 21,000 h.p. There are 16 steam winches for handling the cargo, and in addition to these there are two electrically operated winches on the boat for handling the life boats. The rudder is amply protected below the water line, as shown in the illustration, and the propellers are arranged as shown—one on each side and one in the middle.

There are 14 principal water-tight compartments separated by heavy bulkheads or partitions of steel running from the keel to the upper deck. Any one or all of the doors in these bulkheads can be automatically and instantly closed in case of accident by turning a lever located on the bridge. During her trial trip the "Carmania" attained a speed of 20¼ knots in four runs over the measured mile and maintained an average speed of 19½ knots on a continuous run of six hours. She was not designed for an ocean greyhound. She is essentially a passenger steamer, although her cargo capacity, like that of the "Caronia," is considerably larger than that of the other Cunarders.

Telephones on the Illinois Central.

This company is making important improvements in its telephone facilities, concerning which an officer writes as follows:

The I. C. has about 2,000 miles of metallic long distance telephone circuit on the telegraph poles along its road between Omaha and Chicago; Chicago and New Orleans (via Memphis, Tenn.; Grenada and Jackson, Miss.); Sioux City and Ft. Dodge; Carbondale and St. Louis, and Grenada and Water Valley, Miss. Copper wire weighing 166 lbs.* to the mile was used in building these circuits, and while it gives good service in zones of from 350 to 400 miles, the copper is too small to provide talking service for greater distances than 400 miles. The railroad company is itself replacing this small wire between Chicago and Fulton, Ky., with copper weighing 435 lbs.† to the mile, and it has contracted with the Cumberland T. & T. Co. for an exclusive metallic circuit consisting of copper, 435 lbs. to the mile, from Fulton, Ky., to New Orleans, via Memphis, Vicksburg and Baton Rouge, the line following the Yazoo & Mississippi Valley road south of Memphis. The railroad company also secures for its own service a metallic circuit of the C., T. & T. Co. of copper weighing 190 lbs. to the mile between Fulton, Ky., and Louisville, Ky.

All of these circuits are to be worked together exclusively for the railroad company, thus providing interchangeable talking facilities between the cities of Chicago, St. Louis, Louisville, Memphis, Jackson, Miss.; Vicksburg, Miss., and New Orleans.

A considerable part of the existing telephone wires owned by the road is used for telegraph service, in addition to the telephone service, by the composite system; but it is not the intention to so use the new large-wire circuits. This combined service is possible, but it is attained by introducing into the line certain features that are objectionable, and which are liable, at times, to interfere slightly with the telephone circuit for very long distance service.

The use of single ordinary telegraph wires for telephone communication in addition to the telegraph service has had considerable trial on the Illinois Central, and in some cases it has proved very satisfactory. Such service is limited to distances of 125 miles for successful work, but hitherto the cost of the apparatus has been such that as a general rule it is more economical to provide separate wires. Some improvement in the compositing apparatus may be made so that the composite scheme on single grounded lines can be worked satisfactorily and economically, and we expect to make a trial of some late improvements which may bring about the desired results.

The Illinois Central has for a year and a half used a large number of telephones between block signal cabins with highly satisfactory results. About 700 miles of the company's most important single track lines are now worked by the block system, between the stations of which the communication is done by telephone.

I need not tell you that the telephone answers important requirements of modern railroading; and it has not been the experience of the Illinois Central that the telephone service has diminished the amount of telegraph business. It is not expected that it will do so. The telephone is an added facility that is found very useful, and the expenditures for it are deemed wise.

*Diameter of wire weighing 166 lbs. per mile.

†Diameter of wire weighing 435 lbs. per mile.

November Decisions in Railroad Law.

The following abstracts cover decisions in railroad law cases made during November by the United States courts:

Methods of train despatcher approved.—The movement of extra freight trains by telegraphic orders based on information relative to the location of trains furnished by local operators or station agents to the train despatcher is a rational, careful and approved method of operating a railroad. The train despatcher is justified in relying on such information and a railroad company will not be liable for injuries to a member of a train crew for a collision occasioned by reason of orders to meeting trains issued on false information furnished by the local operator. In such a case the proximate or immediate cause of the collision will be held that of the recreant local operator who is a fellow servant of the train crew. Northern Pacific Railway Co. v. Dixon, 139 Fed. Rep. 737.

Injury to passenger alighting from moving train.—The fact that the porter of a train announces a station as "the last stop—all out" and opens the vestibule door of the car does not amount to an assurance that the train had stopped or an invitation to the passengers to alight before the car had stopped so as to support an action for injuries received in alighting from the train before coming to a stop. The words were at most an announcement that the train was near the station and would presently stop and the act of opening the door was to facilitate egress when the train had stopped. Mearns v. Central Railroad of New Jersey, 139 Fed. Rep. 543.

Removal of causes to the Federal Court.—A personal injury action has had a novel termination in Alabama. Three railroads were sued for injuries caused by the explosion of dynamite claimed to have been negligently stored in the warehouse belonging to such companies. The plaintiff commenced his action in a court previously created by a state statute. The railroad companies took the proper steps and had the case removed to the Federal Court, where it remained until the statute of limitations ran against the action. Afterwards the Supreme Court of the state held the law creating the new court invalid. The Federal Court, through Judge Jones, has now decided that the action, because instituted in a court having no existence, was never legally commenced and hence there was no "suit pending" in the state court within the Federal statute authorizing removal of causes to the Federal Court and dismissed the proceeding. The statute of limitations of Alabama having run against the action the injured person is left without a remedy. Crowly v. Southern Railway Co., 139 Fed. Rep. 851.

Presumption of care by person killed at a crossing.—In the case of persons killed at crossings the courts generally indulge a presumption of due care by the deceased to avoid the accident. This presumption is by no means conclusive and will not avail the representatives of the deceased in an action for his death when it is clear that the exercise of due care by such person would have prevented the catastrophe. There was such a case where the person killed at the crossing lived in the vicinity and was acquainted with the surroundings and notwithstanding this fact and the further fact that the train was visible for a long distance from the crossing and was approaching with headlight lighted, yet he drove onto the crossing with side curtains of his buggy down and met his death. The physical facts clearly rebutted any presumption that he exercised due care and were of such a character as to preclude any recovery against the railroad company for his death. Rollins v. Chicago, Milwaukee & St. Paul Ry. Co., 139 Fed. Rep. 639.

Assumption of risk.—Although it is the duty of a railroad company to use reasonable care to provide reasonably safe appliances for their servants to work with and keep them free from defects, yet an employee accepting employment with appliances known by him to be unsafe will be held to have assumed the risk of injury therefrom. Where he makes known the dangerous condition and repairs are promised he may then continue his employment for a reasonable time without assuming the risk. Cincinnati, New Orleans & Texas Pacific Ry. Co. v. Robinson, 139 Fed. Rep. 519.

State interference with Federal Receivers.—Judge Grosscup in a case in which a Federal receiver who had been ordered to tear up a non-productive railroad, was interfered with by officers of a state court acting under an injunction writ which forbade the tearing up of the tracks, has held the officers in contempt and punished them. He decides that the institution of the proceedings in the state court was not open to objection but that the Federal Court having possession of the road through its receiver had a right to enter such orders as it deemed within its power and to execute such orders without physical interference by others, including the officers of the state court. Under this decision the state court had a right to determine to what extent it had jurisdiction and the power to relieve parties seeking the injunctions short of physical interference with the possession of Federal Court. Royal Trust Company v. Washburn, Bayfield & Iron River Railroad Co., 139 Fed. Rep. 865.

Injuries to Passengers.*

Injuries to passengers for which employees are at fault, and which could and should be avoided, result from collisions, derailments, improper handling and management of trains and stations, and I will, by way of illustration, cite to you a few cases which have occurred and tell you how, in my opinion, they might have been avoided.

We will first take those caused by collisions:

At Forest Station, April 2, in which 3 passengers were killed and 26 were injured, caused by train No. 112, upon which they were riding, being run into by engine No. 405, hauling train No. 2, Engineman Jackson, at 4 p. m.

In a dense fog and on a part of the division and at a time when trains were thick, with a knowledge that he had followed No. 112 all the way from Thornton, the engineman was so careless as to run by two automatic signals set at danger, a flagman, and into No. 112, and three lives go out and 20 odd are injured. Could anything be more reckless? Do any of you want to ride behind that kind of runner or be on a train in front of him, even if you have your life insured and your home paid for? Will we not all agree that such a man is unsafe and unfit for the service? And in view of the dense fog and the number of trains moving,

*From a paper prepared by the Claim Department of the A., B. & C Railroad, to call attention of the officers and employees of the operating department to the causes of many accidents, and show how they could be prevented.

should not trains have been blocked a station apart? It is an absolute protection against accident, which the time interval is not. And when you enginemen see a signal against you, think of the wrecks you have known of since you entered the service, and stop; take no chances. If you can't see the signal, slow down to such a speed that you can stop within the range of your vision. In case of doubt always take the safe course. If you know of any man with defective vision and so little regard for the lives of others as to try to remain in the service with that defect you owe it as a duty to yourself, to your family, the passengers, and other employees, as well as to the company, to report him to the proper officer before and not after an accident occurs. Some day there will be a law requiring the frequent examination of the vision of trainmen, but until that time comes we should all do the best we can to guard against such men.

Next we come to accidents caused by making a switch of cars containing passengers without the engine being attached to the car:

Thomas H. Norton, injured Oct. 20, 1904, in State St. yards; caused by the Pullman car Winona, in which he was traveling, being kicked down against a coach standing at the other end of track, by switch engine 731; the drawbar was gone from the north end of this car and when switch crew tried to stop the car they claim they could not do so with hand brakes, although in good condition.

Everyone knows that it is unsafe to handle a car containing passengers without the engine being coupled to it and air-brake in use, and that rule 181 expressly requires it, and yet in this case it was not done by men long in the service, who probably had done the same thing before without accident and without being caught, and chanced it once too often, and the cost in this case would pay many times over for the time they had saved before. And it is just as unsafe to switch caboose cars in which train crews are resting and cars loaded with horses and cattle or emigrant movables in that way, and it ought to be stopped. If it is, there won't be the injuries to trainmen or damages to live stock that we have now.

We have no end of trouble with circuses and theatrical troupes traveling in their own cars, many of which ought to be in the scrap heap. These cars should never be accepted by us, no matter who is in them or what notice you may have received about the runs to be made with them, unless the brakes, running gear, and everything connected with them are in good repair, but when we do take them, handle them as carefully as if they contained dynamite, and get them off the line without accident. And when you find such a car on a track which you are obliged to use—they should when possible be set on a track not used for switching—either to move it or some other car, handle it with the greatest care; don't do as was done at Harrison just a short time ago when

Laura Jameson, with a theatrical troupe, was in car "Pomfret," Nov. 9th, which was coupled onto by engine No. 402 with such force that she was thrown from the chair in which she was sitting, bruising and injuring her.

Neither would any of the following cases, caused by careless handling, have happened:

Mrs. R. A. Storrs, passenger injured at Whiteford, Aug. 8th, at 7:20 a. m. Engine was pulling train back in the yard and ran in on track that had some cars on it and collided with them, the switch having been left open.

W. R. Thomas, Winton, Iowa, injured at Winton, at 2:50 p. m., Dec. 10, 1903, by reason of standing up near stove in way car and when two cars were coupled on train he was thrown against stove and onto floor.

John A. Klohs, stockman, was riding in the caboose of extra stock train east, conductor, G. H. Tanner, at Yale, June 4th; got up to take off his coat; the train was coupled up with so much force that he was thrown over the stove and his ankle injured.

Now we will take up cases caused by careless loading and unloading of freight from mixed trains:

It would not seem necessary to have to tell anyone that timbers or telegraph poles ought not to be unloaded from moving trains carrying passengers, or from any moving train, and yet that is exactly what was done, when

John A. Owen, W. A. Stead, Martin Kjoelseth, Andrew Thorsen, and C. G. Strombeck, passengers on train No. 82, were injured at Wallace, Aug. 2, by reason of the caboose in which they were riding colliding with some cars on the side track, caused by Anderson, a telegraph lineman, unloading some poles from a car in the train upon which they were riding while it was moving, one of which struck a switch target, opened switch, and caboose ran in on side track and collided with cars.

And when you have a car loaded with logs in your train see that they are secure. If you do, we won't have another accident like the one near Hamlin, January 8th, when

Julius Lewinsky, traveling salesman, passenger on train No. 641, was injured while riding in coach; chain on one of the cars gave away, and logs fell off and were forced through bottom of the coach, striking his left leg.

It would seem to be a simple matter to see that logs, water pipes, machinery, or other property liable to fall from cars are properly secured before car is taken in the train, and so avoid such accidents. Why not do it?

When in a terrible rain-storm you are running over a track which is being repaired, with a slow order, don't do it at a speed of 50 or 60 miles an hour, if you value your life and the lives of those in the cars behind you. If you don't value them, don't do it because it is dangerous and your orders tell you not to, and because your family will suffer if you get killed in the attempt and the company's property will be damaged, and don't, under such, or any other, circumstances, run by a station five minutes ahead of time contrary to Rule 84; and yet that is just what was done on the night of July 2, 1904, when

James Williams, engineman; Charles Jones, fireman; and two tramps were killed; and F. C. Stodmeister, brakeman; W. W. McAllister, baggageman; C. W. H. Brown, Charles Brown, and A. Parsons, porters; W. J. Smith, telegraph operator; Mrs. Miller, Alice Eager, and Mrs. David, passengers, and Thomas King, a tramp, were injured, 1½ miles west of Janeway by train No. 8 running off derail and knocking down the tower.

When you get a bulletin prohibiting running down certain hills or around curves faster than 30 miles an hour, don't do it at 40 or 50 miles an hour, as it is unsafe, and yet that is exactly what was done May 12 near Wilkes, and resulted in the derailment of freight train No. 18, and

William Little, brakeman, was killed, M. J. McWheeney, Geo. Ornesson, Jr., O. A. Dalseth, C. F. Shoelkopf, Geo. V. Hickock, and C. W. Doner, passengers, injured.

A bulletin was issued by Superintendent Davis Nov. 29, 1903, prohibiting trains going down this hill faster than 30 miles an hour. From the statements of the train crew it would appear that no attention had been paid to this bulletin, and, from what the passengers say, it has been customary for a long time for trains coming into Wilkes from Notman and Guilford, if in sight of each other, to make a race to see which train could get there first, so as to get out of Wilkes for Joppa without delay.

Now, there was no excuse for the engineman and conductor not complying with the order. They both got off without injury, as the parties to blame for such accidents generally do. Neither was there any excuse for the train despatcher not knowing that the order was being disregarded daily, as the train sheets would tell him that, and he should have stopped it. To my mind, he was just as guilty as the engineman and conductor, and should have received the same punishment. And when disregard of such orders and bulletins are not winked at, until an accident happens, there will be fewer cases of failure to observe them.

Don't try to run around curves 50 or 60 miles an hour, as a train I was riding on a few weeks ago did and went in the ditch; neither should freight or passenger trains run over interlocking switches faster than 15 and 20 miles an hour, respectively, because it is not safe to do so, and Rule 104 says you must not. Conductors, who are in supreme command on the train, should pull the air on any engineman who is running too fast around curves, over bad places, or through stations, and when you get in, report the matter to your Superintendent, as reckless running should not and will not be tolerated.

Next we have the accidents resulting from occasional derailments, which were not serious, but might have been, and it is the cause, as well as the result, we want to eliminate, such as:

Mrs. K. Smith and four other passengers, train No. 6, which was derailed at Heilprin, Sept. 3. The train was very crowded and these women were standing up at the time of the accident and were injured.

Mrs. Jessie Doan and five other passengers, injured Oct. 11, caused by train No. 15 being derailed one-half mile east of Morse station. From report made by Mr. Reynolds it would seem that this derailment was probably caused by reason of a brakeshoe on the tank of the engine coming off; this brakeshoe had an old defect.

J. E. Fitzsimmons, passenger, injured near Hedley, by derailment of train No. 316, on which he was riding.

None of which would have happened if some one had not failed to perform his duty, and when every accident, no matter how slight, is investigated by an expert—who reports not to the officer who may be primarily at fault, but to the General Manager—to ascertain the actual cause and find a remedy, our troubles will be largely eliminated.

The same is true of injuries like the following, resulting from trains breaking in two:

R. B. Janeway, passenger, and J. P. Mitchell, baggageman, injured Jan. 9th near Gray. Train No. 280 broke in two and rear end ran into head end, and these men were injured.

George Burgan and W. L. Smith and two other stockmen, passengers on train No. 83, injured at Newport, Neb., Nov. 21st; train broke in two, and when the two parts came together these men, who were sitting on the locker in way car, were knocked down.

Another class of accidents which are of altogether too frequent occurrence are injuries caused by trains not stopping long enough for passengers to alight.

Frequently the persons injured are old people not accustomed to traveling, who are necessarily slow in their movements, and

of whom we should take greater care. Think how you or I would feel if our mother or grandmother, if we were fortunate enough to have them with us still, were injured on the Lehigh or Pennsylvania just because the conductor or brakeman didn't have forethought or decency enough to give them time to get off. If you will do that, I won't have a procession of such cases as the following coming into my office, and the company will be so much ahead, as I never could resist the appeal of an old lady, or a young one either:

Mrs. A. J. Denman, passenger from Norwood to Avon, injured at Garwin, Sept. 7th; caused by the train not stopping long enough for her to alight at station platform.

Mrs. C. E. Collinwood and C. Collinwood, passengers on train No. 32, from Omaha, injured at Hamburg, Oct. 17th; caused by train starting before they had an opportunity to get off. They were alighting on the side away from the station; claimed that station was not properly announced. A number of people were compelled to get off this train after it had started.

P. J. Wilkins, passenger, injured at Johnsport, at 1:10 a. m., Oct. 31, getting off train No. 35, while in an intoxicated condition; brakeman gave signal for train to start as the man was coming down the steps, thinking as he claims, that the man would have gotten off before train started; both the brakeman and the conductor of train knew that the man was intoxicated.

Sarapino Guiseppi, injured at Engletown, Sept. 26, at 6:15 p.m. When train stopped at Engletown a number of passengers crowded onto it and, before this man had an opportunity to get off, the train started, and, while alighting, he fell and was run over and lost his left arm. The conductor was in the combination car, one of the brakemen had gone to the station with way-bills, and the other brakeman was at the end of the car from that at which this man got off.

It seems to me that if the instructions contained in Rule No. 38, requiring the announcing of stations by brakemen, were complied with and thereby passengers given ample notice of the approach of the train to their destination, they would be prepared to get off, instead of in the present method, or, rather, lack of method, as the rule is so seldom observed as to cause comment when it is complied with, and if, before giving the signal to start the train, trainmen would get upon the car platform and look into the cars to see that there was no one else to get off, especially should this be done at night when passengers are tired and sleepy, when platform lights are not any too numerous, and with excursionists, and picnickers who are often none too sober and who are not accustomed to moving quickly, and if at division terminals trainmen would pay more attention to assisting passengers off instead of being in such a hurry to cut off a car, getting their markers, or getting away from the train, not only would such accidents as those last enumerated be avoided, but the journey would be made much more comfortable, as well as safe to passengers; and that the road doing this would increase its traffic. We deadheads, who mostly ride in Pullmans or private cars, do not realize how annoying and exasperating to paying passengers is the present method of trainmen, going into the cars and pretending to call stations in some dead language, or by talking to themselves. In transferring passengers from express to local trains you must bear in mind that the passenger is frequently unaccustomed to the surroundings, is generally over-anxious about getting off so as not to miss connections, and coming from a lighted car out into the darkness, in his hurry and excitement may not notice that the train is running; in these cases the train is always moving so smoothly the passenger thinks (or says he does) that it has stopped, and off he goes, and it is necessary, to prevent such accidents occurring, to exercise the greatest care, and by proper announcement make it plain to all such passengers that ample time will be given them to alight, and that their train cannot pull out until after your train does.

And when you are receiving passengers, especially on mixed or freight trains, don't start until they have a chance to get seated, and then such cases as the following won't occur:

Mrs. A. L. Bishop, passenger on freight train 91 from Milton to Jessop, had gotten into caboose, but had not time to get seated before train started with a jerk; she was thrown down and injured.

Mrs. Mary Hanson, passenger from Grant to Portsmouth, on train 15, June 4th, 1:15 p. m. Before she had time to get to her seat, train started, and she was thrown down and injured.

When you are making your station stop, don't jerk your train, after it has stopped, or is about to stop, and while the passengers are getting off, as they surely will commence to do so as soon as (if not before) the train is stopped. Don't pull up or back up a few feet to get to the standpipe or coal chute, because if you do, some one is liable to get hurt, as the following did:

Dr. H. Q. Johnson, passenger, injured at Dale, Sept. 6; train No. 603, engine 421, Engineman Wm. White, stopped at station platform and then started to move ahead again. Dr. Johnson stepped from platform onto steps of coach and, as he did so, brakes were set to emergency and train stopped suddenly; he was thrown against the edge of vestibule.

Helen Kennedy, a child 2½ years old, with its parents, was on train No. 73, bound for Stratford; had gotten up for the purpose of getting off at Henderson, March 26. Train stopped and as passengers were on the platform it was backed up without notice, and this child was thrown, and her arm went between the two car platforms, badly bruising and cutting it, just missed taking it off.

And when you are pulling into a station and intend to take water and are going to run by the pipe a few feet, don't use the emergency brake to stop with, because, if you do, some one is liable to get hurt. Nearly every one has been on a train when this has been done contrary to Rules 436 and 438, and if you enginemen could hear some of the complimentary remarks that are made about you and the company on such occasions, you would want to resign. And when it is raining to beat the band, stop your trains so that the passengers can get off opposite the station building and avoid getting wet, do not pull them by a couple of hundred feet just because the locomotive is thirsty. Pull up to the tank after the passengers get on and off, so says Rule 341, and the women, and men, too, for that matter, will think you are a dandy and vote for you the next time you run for school trustee; and perhaps, by so doing, you may prevent your best girl spoiling her dress.

And when you are running an engine you want to know that its grease cups are screwed on tight and that its brake-shoes are not cracked, if you do not want to have cases like the following:

Fred. C. Mitchell, while waiting for a train on station platform at Lucian, Feb. 1st, was struck and fatally injured by a grease-cup plug from engine No. 206, passing the station, hauling train No. 82. Feb. 2d this same engine, on its way to Louisville, lost a similar plug, but fortunately, it did not hit anyone when it came off.

Chas. C. Wilson, standing on the platform at Newton, June 30th, to take passage on a train; brakeshoe on engine No. 716, hauling train No. 32, running through the station at 60 or 65 miles an hour, broke, and part of it struck Mr. Wilcox on the foot, injuring him.

One of the rules most frequently disregarded is No. 232, prohibiting a train on the double track pulling through a station while another one is standing there unloading passengers.

About nine times out of ten you can do it without an accident, but the tenth time some one will get hurt and you will get a vacation of from 30 days to life. I know it is tantalizing, when you are pulling a fast train and are, perhaps, a little late, to be compelled to stop and wait until the other train has pulled out, and its last car passed the end of the platform nearest you, when you could sneak through the station and save a little time, and perhaps no harm be done and no one be the wiser; but don't do it, because the rule says you must not.

If that part of the rule which says, "When two trains are nearing a station from opposite directions at the same time, and only one of them is scheduled to stop, the train making the stop must reduce speed and let the other through the station before it arrives" was complied with, the trouble would be largely overcome.

You men who are running stations should see that your platform lamps are not only kept clean and properly filled, but that after dark they are burning so that passengers won't get hurt falling off platforms in the dark, and that the platforms are kept clear of freight as per Rule 645; that baggage and express trucks are placed where patrons won't fall over them, and, if there is a fast train coming, especially a mail or newspaper train, notify the passengers and get them inside the depot, the only safe place at such times. Especially is this necessary on the double track. If there is a broken plank or a hole in the station platform, nail a board over it until the carpenters can get around to fix it. See that the platforms are kept clear of snow and ice; but when there is ice on the platform, throw ashes or sand over the ice so that people won't slip on it. And if you have people waiting for trains at your station, especially in the night time, see that the fire in the stove in the waiting room is kept going so that they will be comfortable and not catch cold. It will take you less time to do these things than it will to make a report of an injury, and then cases like these won't be put up to me to guess at:

Mrs. J. P. Gedney, injured at Ontario, June 24, 10:27 p. m., was at station to take passage on train No. 17, went out of a lighted waiting-room onto a dark platform and fell and was injured.

Mrs. Mollis Schmella and Dr. Cleveland, injured, passengers on train 31, arrived at Altruria 8:30 p. m., Saturday, Aug. 21st; raining; got off train, no lights on platform; doors of depot locked, and fell from platform to track.

M. O. Hudson, passenger from Elton to Woodbridge, on train No. 47, arriving at latter place Aug. 28th, at 12:30 a. m., got off coach and ran up to baggage car to get baggage; in doing so ran against train signal on platform, was thrown down and injured; no lights on platform or in signal.

S. W. Thomas, passenger on train No. 48, injured at Harkrader, Oct. 21st, at 11:20 p. m., was getting off chair car, which stood 150 ft. south of the platform; there were no lights, and the porter had no lantern, and when he stepped from the car step to the porter's box he slipped and fell.

And sweep the car platforms, so passengers won't slip on banana peels, and then such cases as the following won't happen:

H. T. Witheridge, injured at Wingate, Aug. 4, 1903; caused by his slipping on a banana peeling left on the platform of a coach in train No. 176 by the car cleaners.

When passengers are carried on freight trains Rule 241 says the car in which they are riding must stop at the platform to unload them. Don't do it out in the yard, and, if you have to do

switching after unloading the passengers, stop at the station platform as you are pulling out and give the passengers a chance to get on and not compel them to go into the yard in order to do so. If at night, they might fall into a culvert or over some obstruction alongside the track and get hurt, and, if the platform at the station is short, arrange your work so as to make one stop where the passengers can get off safely, and notify them, so they will know when they can do so; and be sure to assist them in getting on and off, especially the old men and women, the children, and the cripples (that is what Rule 801 says, and you always do it for the young and pretty girls) and then I won't be trying to conjure up excuses for cases like the following, or pay for them either:

Miss Belle Saunders, injured at Milwood, Dec. 14, 1903, was a passenger on train No. 16 from Homer to Milwood. This is a mixed train. It was stopped some distance from the passenger station; the passengers were allowed to alight, and in getting from the track to the street going down the embankment she fell and sprained her left ankle. It has been the custom to stop this train at this point for some time and allow the passengers to get off there, the busses coming up as near as they could to take them to the hotel.

Mrs. A. Zuehlke, injured at Granby, Oct. 10th, at 6:10 p. m., in getting off a train on which she had been riding as a passenger; the station platform is so short that only the platform of one car in trains can be stopped at it, and when the car happens to stand in a special position, owing to the manner in which the platform is constructed, the space between the car and the station platform is about 3½ ft.

Mrs. Mary H. Crawford, passenger, injured at Beulah, Oct. 13th, getting off train No. 35; porter allowed her to fall, and she stepped between platform and car steps, injuring her left thigh.

Another cause of injury to passengers, especially children, who always want the windows open, is by the windows falling and injuring them. Nearly always their little hands or fingers get hurt; or by ventilators falling on their heads. When you have an accident caused by a window falling examine it immediately and, if the catches are all right, show the injured person or, if a child, the man or woman in whose charge it is traveling that it was not the fault of the window catch, and at the same time call the attention of some intelligent passenger and of your brakeman to the matter and have them try the window catch, and send in their names and addresses with your report. If, however, the catch is defective report the fact, but don't advertise it, and whenever you find any defective catches or anything else wrong about a car in your train call the attention of the first car repairer you meet to the matter and have it repaired, and, at the same time, report it to your Assistant Superintendent. If the car repairers would make an examination of the windows, their catches, and of the ventilators, for the purpose of finding out their actual condition, we would get rid of many such cases. Do the same thing with the matting in the aisles, and when there is a hole in it get it fixed, or get a new one. If you can't do that, take the matting up and so prevent anyone falling on it.

And, speaking of aisles, so far as possible get passengers to keep their valises, suit cases, and bundles out of the aisles so that other passengers won't fall over them. If the glass in a door gets broken, when the train is running, be sure that all the glass is taken out of the frame, so that passengers won't catch their hands on it. Take pains to see that your passengers, especially the old and infirm, the woman, and children, are provided with seats, and when some passenger, whether man or woman, who has paid for only one seat or is riding on a pass, is occupying three or four seats have them make room for those standing. Pay some attention to ventilation—in cold weather open the ventilators on the side the smoke trails on, and then there won't be any draught. In other words comply with Rule 573 and then cases like the following, which seem to be on the increase, won't happen:

Nora Holm, 3 years of age, injured near Henshaw, July 24th; caused by a window in coach 338, train 9, falling on her arm, on account of a defective spring.

Charles A. Paner, passenger, injured July 17th, between Henley and Chester, window catch in coach 4378 was broken off; he raised the window and put a comb under it to hold it up, and window came down on his arm.

H. Wicker, boy, passenger, injured at Butterfield, Aug. 25th, on train No. 19, at 3:55 p. m., had his head out of window in coach No. 818; screws were out of clasp and the window fell on his head.

The Allis-Chalmers Steam Turbine.

The first turbine to be put in operation by the Allis-Chalmers Company, Milwaukee, Wis., which lately entered the steam turbine field, was recently started up at the Washington street power house of the Utica Gas & Electric Company, Utica, N. Y. The unit is shown in Fig. 1. The turbine is rated at 1,500 k. w., normal load, running 1,800 r. p. m. It is direct coupled to an Allis-Chalmers two-phase, 60-cycle, revolving field alternator, operating at 2,500 volts. The unit has a continuous overload capacity of 25 per cent., with a three-hour 50 per cent. overload capacity without exceeding a safe generator temperature, and capable of 100 per cent. safe momentary overload. Artificial ventilation by means of an electrically-driven fan blower will, however, enable the unit to be run safely beyond its rated overload capacity.

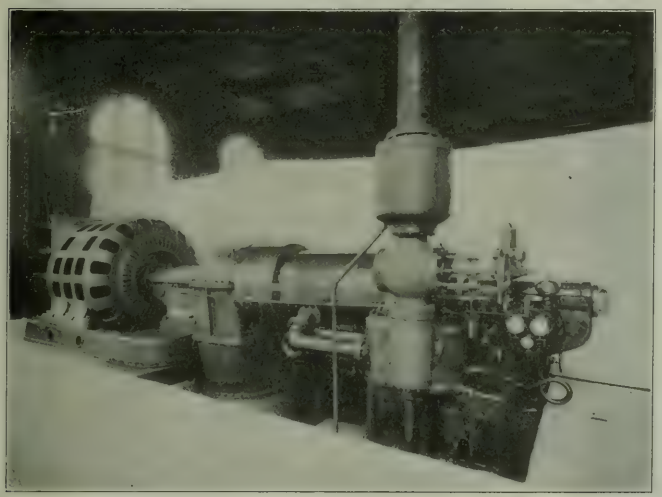


Fig. 1—The Allis-Chalmers 1,500 Kw. Turbine Unit.

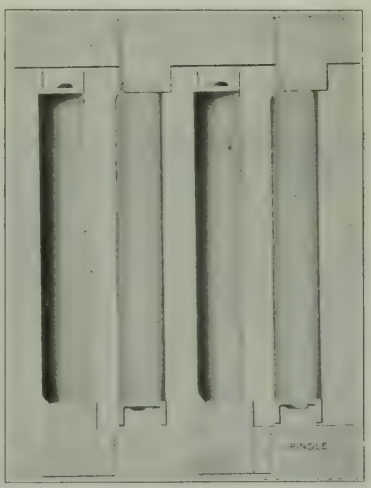


Fig. 2—Blading Scheme.

The turbine follows the well-known Parsons type, which has proven itself eminently successful in numerous installations both here and abroad. The Allis-Chalmers construction, however, embodies a number of features which are new in this country, and which are claimed by the builders to be distinct improvements. The chief distinguishing feature of this construction is the blading, which, while it is of the Parsons reaction type as regards the principle of operation, differs in mechanical construction in a number of essential details. The roots of the blades are formed in dovetail shape by special machinery, and are inserted in slots cut in foundation or base rings; these slots being formed by special machine tools in such a way as to conform exactly to the shapes of the blade roots. The foundation rings are of dovetail shape in cross section and are inserted in dovetailed grooves cut in the turbine cylinder and spindle respectively, in which they are firmly held by key pieces, much in the same way that the well known "Lewis bolt" is fastened. In order further to insure the integrity of the construction, the key pieces or rings after being driven into place are upset into undercut grooves.

Another noticeable feature of the blading is the method of reinforcing and protecting the tips of the blades. This point in steam turbine design is one upon which much thought has been expended by inventors; it is claimed that the design under consideration successfully solves all difficulties. In forming the blades a shouldered projection is left at the tip. This is inserted in a slot punched in a shroud ring; the slots being punched by special

machinery in such a way as to produce accurate spacing and at the same time form the slots so that they will give the proper angles to the blades independent of the slots in the base ring. After the blade tips are inserted in the slots in the shroud rings they are riveted over by specially arranged pneumatic machinery. The shroud rings are made in channel shape, with outwardly projecting flanges which, after assembly in the turbine, are turned and bored to give the necessary working clearance. The flanges of the channels are made so thin that, although amply sufficient for stiffness, the shroud ring does not have the disadvantage of a solid shroud which acquires a dangerous temperature by friction in case of an accidental contact of the rotating and stationary parts. It is claimed for this construction that the blades are stiffened against the effect of vibration in a much more substantial manner than by any other means thus far employed, while the use of a protecting shroud ring enables the working clearance to be made smaller than in the case of naked blade tips, without danger in case of accidental contact, thus reducing the leakage loss to a minimum; the leakage past the blade tips being the principal source of loss in the steam turbine. As to the safety from damage in case of accidental contact, it is claimed that this has been proven by experiment with actual blading, by throwing the bearings out of center so as to produce contact, without detrimental results. An incidental advantage claimed for this construction is that if by chance a blade should prove defective, it is so held in place by the shroud ring that it cannot possibly work loose and produce damage.

By the method of construction described, the entire blading is produced by machinery, thus eliminating the personal equation which enters into blading done by hand work, which depends upon the skill of the individual workmen. Besides insuring that every blade is securely fastened, all blades are necessarily set at exactly

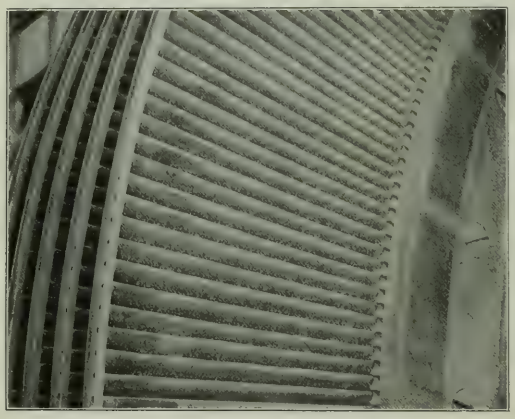


Fig. 3—Detail View of Blading.

the designed angle and pitch; the openings between blades, upon which in great part the economical performance depends, being absolutely uniform. The blading is made up in half rings in the blading shop and is carefully inspected before being inserted in the turbine.

Fig. 2 shows the general scheme of the blading, illustrating the method of fastening the blades as well as the channel-shaped shroud ring. Fig. 3 illustrates the blading, and shows its substantial construction as well as the uniformity of the work. Fig. 4 shows a turbine spindle of the same size as that of the Utica turbine. A feature noticeable in Fig. 4 is the absence of the usual low-pressure "balance piston;" the photograph showing only two balance pistons instead of the three pistons formerly used in this type of turbine, where it is said to have been found difficult to produce a balance piston of the size required for balancing the low-pressure stage of the turbine and at the same time make it sufficiently rigid to run with the necessary small working clearance. In the Allis-Chalmers construction there is, however, a third balance piston, but instead of being at the high-pressure end of the turbine, as formerly arranged, it is at the low-pressure end, and as it is smaller than the large end of the spindle it is hidden from sight in the photograph. By making this piston in such a way that its circular area is equal to the annular area of the pistons used in the older construction, the low-pressure balance piston is made much smaller Instead of reducing the leakage past this piston by means of "dummy packing," as in the high-pressure and intermediate pistons, and as used in the low-pressure pistons of the older construction, a labyrinth packing of radial baffling type has been adopted, thus eliminating small axial clearance in this turbine. A considerable advantage is claimed for this construction in permitting the use of smaller working clearances in the high-pressure and intermediate balance pistons. Other points of improvement claimed for this construction include details of spindle construction, governing mechanism, lubrication, and other minor features.

The alternating current generator of the Utica outfit deserves notice. Perhaps the most noticeable feature of this generator is the substantial design of the revolving field, providing great strength and at the same time giving the thorough ventilation which is essential. Particular attention has been paid to the insulation, evidenced by the fact that the armature (Fig. 5) was subjected to an alternating current insulation test of 10,000 volts for a period of 15 minutes. This generator was built at the Bullock works of the Allis-Chalmers Company, at Cincinnati, Ohio, where the generators for all of their other turbine outfits are being built.

The Allis-Chalmers Company, in entering the steam turbine field, effected an alliance with the Turbine Advisory Syndicate of England, thereby securing the co-operation of the firms therein interested, including Messrs. Millans & Robinson, the high-speed engine builders, of Rugby; Yarrow & Company, the well-known torpedo boat builders, Isle of Dogs, London; and the Neptune Shipbuilding Works, Walker-on-Tyne. The Utica turbine was built for

Fig. 4—Turbine Spindle.

the Allis-Chalmers Company by Messrs. Williams & Robinson, to whom a number of turbine contracts were sub-let by the Allis-Chalmers Company before the latter had perfected the installation of their special machinery for turbine manufacture. An agreement has more recently been effected with Hon. Charles A. Parsons, C. B., for interchange of data, thereby giving to the Allis-Chalmers Company the benefit of the vast experience of Mr. Parsons, the original inventor of this type of turbine, and to whose engineering ability and indomitable energy the evolution and present state of perfection of the successful steam turbine are principally due. The Allis-Chalmers Company has also secured rights under Mr. Parsons' patents for marine turbines and turbo-compressors and blowers, for which there is a growing demand.

The Allis-Chalmers Company is now building steam turbines in its engine works at West Allis (Milwaukee). The growth of the business has led to a large extension of the works, amounting to a practical doubling of the present plant. A considerable part of the extension will be devoted to the manufacture of steam turbines and the accompanying electric generators; one of the three new manufacturing buildings being given up to the exclusive manufacture of the turbines themselves. The first steam turbine of

Fig. 5—Armature of 1,500 Kw. Utica Generators.

the Allis-Chalmers Company's own make, of 5,500 k. w. capacity, has recently been shipped, and others are following as fast as the present crowded condition of the shops will permit.

Bavaria takes the prize for the most conscientious passenger if we may trust a correspondent of an Augsburg newspaper who relates the following as an actual occurrence. On entering a second-class compartment of a train going to Munich, the correspondent found there an elderly gentleman and his son. He entered into conversation with the father, who listened attentively but soon seemed much distracted and consulted his watch frequently. Finally, when within a few miles of Munich, he jumped up and pulled the cord which sets the emergency brake in German cars. As the train came to a sudden stand the trainmen ran to the compartment and asked anxiously what was the matter. "Nothing is the matter with the train," said the old man, blandly; "but this boy of mine became 10 years of age just now, at half-past nine. As he was not 10 when we started, I got a half-fare ticket for him. For the rest of the way to Munich full fare is due. What's to pay?" The language of the trainmen is not reported, but the paper seems a little scorched just there.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns our own opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XXXIX., No. 25. FRIDAY, DECEMBER 22, 1905.

The official report of the October meeting of the American Railway Association, which has just appeared, shows that the important vote to lengthen the time that a borrowed car may be kept without paying penalty was carried with very little discussion, as was the vote to raise the ordinary per diem rate from 20 cents to 25. This five-cent increase was approved by a vote of 109 to 4, the only strenuous objector being the New Haven road, which was represented by both its general manager and its counsel. The lawyer argued that the main object of per diem—to make cars move better—had been accomplished, and therefore the further oppression of the terminal roads was unnecessary. Chairman Hale replied to this that car movement had, indeed, been improved, but by no means enough. Moreover, he claimed that the New Haven road's purchases of new cars had not been large enough to materially increase its facilities, for the volume of business had also increased. The only real issue that the discussion settled, as between the New Haven road and its western connections, was that of the supply of cars for joint business. Mr. Higgins, of the New Haven, said that for half the year—the dull half—he could not get his connections to use his cars, each connection having enough of its own. To this Mr. Hale in reply pledged the connections—particularly the coal roads—to an equitable arrangement for the future, to be kept in effect all the year round. Mr. Hale said, in regard to the New England 96-hour rule, that 96 hours' free time had to be allowed on the great bulk of the cars in Ohio, so many exceptions being made in that state to the 48-hour rule. If Ohio roads can stand this burden, New England ought to be able to stand it. One member argued for 40 cents a day and a penalty rate of $1.25, but the promptness with which he was voted down showed that the meeting was "solid" for the committee's figures. Mr. Hale estimates the average cost of a freight car per day at about 27 cents; and there was evidently a strong aversion to adopting any rate above cost.

The proposal to let long roads keep cars 40 days at the ordinary rate, instead of 30 days, as at present, is an important change, and it would not be surprising if the letter ballot should show a considerable vote against it. It looks like weakening the effect of the penalty principle on thousands of miles of road where it is greatly needed, for the sake of appeasing the grief of a very few roads. There are thirty railroads, operating about three-fourths of the railroad mileage of the country, which have over 2,000 miles each, and which will thus have the benefit of the 10 days' additional use without penalty; while a number of long roads, such as the Lake Shore & Michigan Southern, the Chicago Great Western, the Kansas City Southern, the Chesapeake & Ohio, and the Texas & Pacific, will not enjoy the proposed benefit because, having few branches, their total falls below 2,000 miles. And the funny thing about it is that the New Haven road, which complains so loudly about the misfortunes due to its shortness, is one of those which will benefit by this relief which has been devised to help the long roads, for the aggregate length of its multitude of short roads is 2,088 miles. The only rational way to introduce the 40-day arrangement would be for the committee to specify the routes—such as that of the Atchison from Chicago to Los Angeles—on which the relief should apply. A long road does not need this relief on its short lines any more than does a short road. The action of the committee is to be explained presumably on the theory that in such a large and unwieldy body as this Association it is best to get what you can even at the frequent sacrifice of reason—as has been the case, indeed, in other features of the car-service reform. A number of ideals may have to remain in the background for some time to come; such, for example, as that which requires all foreign cars to be promptly returned home. Diversion of cars to get some profitable local business, and ordering illegitimate movements of cars to break penalties continue to be common, and their viciousness is recognized; but the committee has been unable to even suggest any effective rule to put a stop to the evil.

Besides the car service matter and the rules for transportation of explosives, which have already been reported in the *Railroad Gazette* (October 27 and November 3), the official *Proceedings* contains the Secretary's official report of the International Railway Congress. The expenses of the 7th Session, including the special trains for carrying the visitors to St. Louis, Chicago, Montreal, etc., were $48,871. The report says that the reason why the time signal of May 3 was not sent around the world was the unwillingness of the Eastern and Great Northern telegraph companies to co-operate. These companies own the lines in Asia, and the signal would have passed through that part of the world in the busiest part of the day. The report pays a high compliment to the managers of the exhibition of railway appliances which was held at Washington in connection with the Congress. The report of the Committee on Safety Appplianes which was presented at the Chicago meeting, says that the committee is preparing a code of air-brake rules. The Association instructed this committee to arrange for uniform tests in connection with the rules governing the determination of physical and educational qualifications of employees. The Committee on Statistical Inquiry presented a report at the meeting containing definitions of units and an elaborate blank form for reporting railroad transportation statistics. While the matters presented by the committee were

approved, the committee's explanation of its work is yet to come. This will probably be submitted at the next meeting. The Committee on Standard Cipher Code expects to have the code ready for delivery soon.

CAR AND LOCOMOTIVE OUTPUT IN 1905.

Official returns from all of the car building plants in the United States and Canada, with the exception of one of the smaller builders, whose output we have estimated from our current records, show that 168,006 cars were built during the year 1905, including cars for use on subway and elevated railroads, but exclusive of street and interurban electric cars. These figures do not include cars built by railroads in their own shops, of which an exceptionally large number have been built this year. Of the above total, 165,455 are for freight service, and 2,551 are for passenger service, 162,701 are for domestic use, and 5,305 are for export. This is the largest car output in any one year that we have yet reported, and is considerably more than double the total output for last year, which was 62,950. The next largest output for any one year was in 1902, when a total of 162,547 cars were built. During the past three months the car companies have booked some record breaking orders. The majority of these are for 1907 delivery, and among them are orders from two of the leading railroads which alone amount to almost as many cars as the total car output in 1904. During the year 2,164 cars were built by firms in Canada, an increase of 222 cars over the number built in 1904. The following table shows the *Railroad Gazette's* estimate of cars built during the last seven years:

	Cars—		
	Freight.	Passenger.	Total.
1899	119,886	1,305	121,191
1900	115,631	1,636	117,267
1901	136,950	2,055	139,005
1902	162,599	1,948	164,547
1903	153,195	2,007	154,808
1904	60,806	2,144	62,950
1905	165,455	2,551	168,006

Official returns from all of the locomotive builders in the United States and Canada show that there were 5,491 new locomotives built in 1905, as against 3,441 built in 1904. Like the car total, this total does not include locomotives built by railroads in their own shops, nor does it include orders given for repairs or rebuilding. Of the total number of locomotives reported built, 140 were electric locomotives as against 95 electric locomotives for last year. Of the total number, 583 were for export and 4,896 for domestic use, including 177 compound locomotives. The total number of locomotives built this year exceeds the total number for any previous year that we have yet reported. The nearest number to it was in 1903, when there were 5,152 locomotives built. The following table shows our figures for the number of locomotives built during the past 14 years:

1892	2,012	1899	2,473
1893	2,011	1900	3,153
1894	695	1901	3,384
1895	1,101	1902	4,070
1896	1,175	1903	5,152
1897	1,251	1904	3,441
1898	1,875	1905	5,491

In analyzing the above reports, it is interesting to note what the totals really mean by calculating the expenditure involved. At an average cost per freight car of $1,000, the total spent for freight cars would be $165,455,000; at an average cost per passenger car of $7,000, the total spent for passenger cars would be $17,857,000, and at an average cost per locomotive of $14,000, the total spent for locomotives would be $76,874,000. Adding these totals shows that the total amount spent by the railroads in 1905 for motive power and rolling stock approximates the enormous sum of $260,186,000.

MR WESTINGHOUSE AGAIN LOOKS AHEAD.

In the few letters which Mr. George Westinghouse has addressed to the public, he has divorced himself from his commercial interests and told what he believed to be true and in each case it has proved to be true. Nearly four years ago he braved hysteric public opinion by pointing out that the New York Central tunnel disaster would have involved a still greater loss of life if electric traction in the then state of the art had been in use. For this he was, as he says in his letter in another column, "harshly" criticized; he was injuring his own business, making pointless the demand for immediate change of power and curbing an irascible district attorney, who was busy and indiscriminate in attacking the hard-earned reputations of railroad officers. In his present letter he is alike high-minded. At first sight one may say that having perfected an alternating current series motor, he is a biased scientific man when he says that this system is capable of higher speed than the direct current system, more economical, and does less injury by electrolytic action to underground metallic work. But he is not necessarily so biased, for his great rival has an equal right with his own company to use all patents owned by either company. This wise arrangement between the two companies was made in the interest of the advancement of the science of electric working. His statement of his part in making practicable the generation of the alternating current, twenty years ago, is too modest. In the scientific part of that invention which has made high-speed electric traction possible he ranks with other great workers in the electrical field; the practical part he accomplished almost alone.

The importance of the prevention of electrolytic action cannot be overestimated. Outside of the cities electrolysis does little damage; but the greatest current consumption on a railroad would take place in the yards and terminals in the cities and the extent of electrolytic action is proportional to the strength of the current flowing between electrodes. The enormous amount of power flowing in the ground return circuit has caused and will cause damage to adjacent parallel underground metallic structures where direct current is used, even if the most effective preventative measures are taken in the way of metallic return circuits and frequent grounding of the rails to pipes in the danger zone. With alternating current, electrolytic action is not present in destructive amounts. The fluctuating polarity of the current prevents decomposition of the metallic surfaces.

It is clear that Mr. Westinghouse does not criticise the New York Central or its electric commission for their recommendation to use the continuous current system, for he says in his letter to Mr. Newman that "there had been no such development of the single-phase system now actively under discussion as could warrant its adoption, and therefore the selection of the continuous current system by your commission of engineers was an obvious outcome of the situation as it then existed." During the period of the New York Central investigations, Mr. Westinghouse arrived at the same conclusion that its commission did, and upon his advice his company equipped the Long Island terminal with direct-current motors, taking their power from a conductor rail. In this progressive science it is of the highest importance that commercial rivalry shall not be an obstacle to the development of the safest and most economical system of heavy, high-speed electric traction.

THE WORK OF THE INDUSTRIAL COMMISSIONER.

Perhaps no modern development of railroad organization is more significant of foresight and enterprise than the creation of the industrial department and the work of the commissioner who stands at its head. For railroads to desire new industries and the development of their territory is as old as railroads; for them to set a highly trained officer to giving all his time to carry out this desire, is the modern development. The review in another column of the history and workings of the industrial department comes from information furnished in letters and personal interviews by a number of industrial commissioners. It suggests the breadth of wisdom which a successful railroad industrial officer must have about the business conditions of his territory, its resources and its industrial possibilities. It also shows the varying character of his duties in different parts of the country.

His object in every case is the same—the industrial development of his railroad's territory—but his methods vary with the natural circumstances of his territory. In the east, his particular efforts are directed to the establishment of manufactures; in the west and south, to agriculture, mining and the development of natural resources. His work, east or west, may be summed up in the phrase, "An endeavor to create conditions favorable to industrial development." The first step in bringing about this result is the collection of information. This comes from many different sources. Directly, technical and trade papers and particularly government bulletins such as those of the geological survey, furnish much material; indirectly every business enterprise within his observation adds to the industrial commissioner's knowledge. He becomes a specialist in a score of different industries. Are there towns on his line where iron ore, coal, coke and limestone are readily available? The industrial commissioner learns about the steel business more than enough to enable him to talk intelligently on the subject. Do undeveloped water powers and spruce timber exist near together on the line? The commissioner spends months in learning the pulp and paper mill business. Thus his endeavor to create conditions favorable to the location of industries results in his acquiring for him-

self and for the records of his department, complete and accurate information about all those manufacturing and agricultural enterprises in which, within his particular territory, his department is likely ever to be interested.

Through his assistance in the organization of, and his co-operation with, boards of trade and other commercial bodies and especially through his personal acquaintance with the officers of such organizations, the industrial commissioner puts himself in another way directly in touch with local conditions all along his line. According to his point of view the industrial department is to the railroad what the board of trade is to the community and for this reason close co-operation is most desirable for both. His effort is to organize the entire territory—not part here and part there—in order that if a manufacturer fails to find the exact location wanted in one town he can be directed at once to some other nearby town along the line which will meet his requirements. This close association with business organizations results in the acquaintance of the commissioner with the leading business men in his territory, through whom he keeps in touch with all sorts of business developments. Through this acquaintance and the detailed information with respect to raw materials, cheap fuels, conditions of labor, availability of manufacturing locations and adaptability of various soils which he possesses, the industrial commissioner comes to be at the head of a sort of business publicity bureau engaged in a persistent and continuous campaign for manufacturing development.

After the necessary information is collected and the territory well organized commercially, the commissioner takes active steps to get his road known as a field for business opportunities. Even if they do not produce immediate results, the distribution of industrial circulars and advertising in trade papers are found to be, in general, exceedingly profitable railroad advertising. Although the iron and steel firms among whom the St. Paul's iron ore map was so popular, and the concerns who make use of the Erie's coal, oil and gas map in their daily business, may not directly contribute any additional traffic to the road on this account, the indirect effect is to create in their mind the impression that these are roads worth doing business with when opportunity offers. In his campaign the industrial commissioner is engaged in two sorts of activities—establishment of new industries, and changing the location of established industrial enterprises. In each case the first success is the hardest. The example of one successful new industry of its kind or of one prominent firm going to a new and better location, once it is obtained, will almost surely soon be followed by others. By a thorough knowledge of the business and the situation in his territory the commissioner can often make clear to capital the possibilities of profitable development. An example of this, in a small way, is a profitable kindling wood business which was built up by the industrial department of a western road by working out a plan to use the pieces of wood previously burnt to get rid of them by saw mill companies in the lumber country as kindling wood in the Chicago market. The success of this enterprise would not have been possible if it had not been for a favorable rate given, at the suggestion of the industrial department, on these shipments. Similarly, before hemlock timber was generally known to be available for newspaper pulp, a manufacturer in touch with the department discovered that it could be successfully used, and, in connection with a large tannery which had just been established some 75 miles away, secured, through the industrial department, a rate on the hemlock lumber, after the bark was taken off, low enough to make it possible for it to be used with profit. The low rate on the kindling wood and on the hemlock logs was not a loss but a gain to the railroad company, for in both cases it created entirely new traffic and in the latter case the finished product was again shipped over its rails. These cases illustrate the close co-operation of the industrial commissioner with the traffic department. Aside from the immediate interests of his own department, the benefit of his specialized knowledge is also often called on to determine the rate to be given on a special class of goods. He must, of course, in deciding on the desirability of a certain industry, take into account the traffic interests of the railroad company, so as to locate the industry where it will be, at the same time, best situated for its own success and for its contribution to the traffic of the railroad. He must try to get traffic which will move in the opposite direction from that of the greatest loaded car movement rather than in the same direction, and must, in all the complicated rate situations which come up, consider the interests of the road along with the successful establishment of the shipper.

One of the most valuable characteristics of the industrial commissioner to the railroad is that he can take time. No freight traffic manager or general freight agent, with his rush of other duties, usually occupying every minute and more of his available time, can find a chance to think up schemes for attracting manufacturers or spare time to devote to projects which may amount to nothing at all. What traffic official would have a chance to work up a soil map of his railroad's territory compiled from government reports and distribute it with a list of farm lands for sale; or publish a monthly newspaper devoted to the industrial building up of his territory; or work out from the best available scientific sources the cost per ton of producing pig iron at different towns on his line? Activities like these, of great importance in building up a railroad's permanent prosperity, are out of the traffic officer's reach. What's everybody's business is nobody's business, and this sort of farsighted building for the future is left undone unless there is an officer who can devote to it his whole time. No less important may be the ability to spend time on a doubtful chance. A real estate agent comes to a traffic manager of a road which has no industrial department, saying that he has in tow a large manufacturing concern whose name he cannot mention but which might be induced to locate. He wants to get the railroad's engineers to make a survey and determine the practicability of the proposed location. The traffic manager probably does not know the man and in any case knows that real estate agents' plans often go astray. He also happens to know that at the moment the engineering department needs every possible man for a certain piece of reconstruction work. To grant the request for engineers will, for this reason, mean on a blind chance a direct loss to the company of several hundred dollars. This does not seem worth while on the call of a man with plans undisclosed. He therefore does not take enthusiastically to the idea and the real estate agent may be thrown entirely on his own resources. On the other hand, if there is an industrial department, the traffic manager at once sends the inquirer to the industrial commissioner, whom he tells him is *the* man to be seen. The commissioner meets him, is not unlikely to have met him somewhere before, and listens to his case. After a talk, the commissioner may himself come to the decision that there is not enough in the scheme to make it worth considering. On the other hand, he may know that this particular man has a habit of landing his big fish; or from information which has come to him in the course of other dealings he may, by putting two and two together, be able to have in his own mind more than a suspicion of the very company which is considering a change of location. He knows that the location which the real estate man proposes would be exceedingly well suited to the requirements of that particular industry and also to the traffic prosperity of his company. He, too, knows the situation in the engineering department but, nevertheless, the chance is, in his judgment, well worth taking. As it is on his judgment in such matters that the other officers of the road depend, his telephoned request to the engineering department is at once honored and he can assure his visitor before he leaves the office that the examination will promptly be made. This is only the first step in negotiations which may or may not secure a large amount of steady and dependable traffic for the road; but it illustrates how effectively the industrial commissioner can treat with interested persons as the responsible head of the railroad's side of the negotiation. From the moment the project is broached, to the final closing of contracts for side-track facilities, the officers, from the president down, back up his judgment with their knowledge and authority. At the same time he consults them —the traffic manager, in regard to possibilities for reductions in a particular rate; the chief engineer, for his judgment on a side-track connection; the division superintendent, for his approval of a plan as fitting in with local conditions; and the president, in regard to plans for the future, not yet announced, which will affect the particular situation. Within his field the industrial commissioner has a very large share of centralized authority; outside it, the other officers hold their expert services at his disposal.

From this description it is not hard to see that a successful industrial commissioner must have a wide knowledge of all sorts of industrial conditions. Not only must he be familiar with businesses likely to locate in his territory but with all competing businesses as well, the source and supplies of raw material, the most available markets, changes in the trade or conditions affecting the industry, grouping within rate-making territory, the effect of the establishment of an industry on his own and other roads and almost innumerable other questions bearing on business from his railroad standpoint. He must be something of an engineer, enough of an operating man to make clear the advantages of his railroad in freight schedules and service, a good deal of a traffic man, and, most of all, a skilful dealer with other men; for it is above all by personal contact that the industrial commissioner accomplishes his work. There is nothing which impresses a business man, in

an inquiring mood, more favorably than an intelligent understanding by a railroad officer of the particular business with which he himself is so thoroughly familiar. By the commissioner's ability, through this knowledge, to put his finger on particular opportunities in his territory or by his frankness in telling a prospective manufacturer that he has come to the wrong place for what he wants, he most of all serves his railroad by making the manufacturer feel that here is a railroad in the best sense of the word and a railroad with which it is a pleasure to do business. Once this state of mind is established the rest is easy. The man may not at the time decide to locate, but his good impression of the railroad remains and is likely at some time in the future to be a distinct asset to the company. The services which an industrial commissioner can give to his railroad are in these many ways so great that the wide extension of the railroad industrial department in the fifteen years since its first establishment is easily accounted for. Acquaintance with actual results accomplished makes it surprising that all the larger systems have not yet appreciated the economy of having such an officer.

Finally it must be remembered that the activities of the industrial commissioner do not represent a survival of the old-fashioned cut-throat railroad competition; his object is not to draw away manufacturers from equally favorable locations on other lines. In accord with the modern type of competition combined with common-sense, he aims to make the largest use possible of the particular resources of his particular line of railroad and to bring about in his territory the proper economic location of enterprises poorly situated elsewhere. In a word, the industrial commissioner aims, not to upbuild his own at the expense of other railroads, but, through the development of the natural resources and opportunities of his own road, to aid in the industrial development of the whole country.

November Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of November, printed in another column, contains accounts of 26 collisions, 19 derailments, and three other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

Nov.	Place.	Killed.	Injured.
7th	Liverpool, N. Y.	4	0
8th	Hunlock's Creek, Pa.	6	3
20th	Falconer, N. Y.	2	0
23d	Albion, Ind.	7	3
24th	Wayland, Mass.	1	2
24th	Thompsontown, Pa.	1	8
26th	Baker Bridge, Mass.	17	30
26th	South Waterboro, Me.	3	0
29th	East Everett, Mass.	0	20
30th	Penn Haven Junction, Pa.	2	12

The most notable accident in this list, that at Baker Bridge, Mass., has been reported already, so far as the facts are available. The investigation of the Massachusetts State Railroad Commission has not yet been completed. The question of discipline as here illustrated has been dealt with in the two articles which we have given in the editorial columns. To a considerable extent the different points which this case brings up in connection with discipline are applicable to the conduct of trainmen under either the time interval or the space interval method of managing trains; but, in view of the peculiar circumstances of the collision, a comparison of the relative virtues of these two systems will be found prominent in many of the discussions. We may note the main features of this comparison.

(1) The rules of the time interval system were grievously disregarded. As we have many times said, the time interval system has already been so widely discredited—has been shown to be so honeycombed with radical faults—that time employed in defending it is poorly spent; but it must be admitted that in this case the disregard of the rules was flagrant. It is not fair to throw all the blame on the system. The report of the Grand Jury says, in substance, that Rule 99, the flagging rule, as prescribed on the Boston & Maine, was not fitted to this case; and the superintendent of the division is reported to have said that he was not at all sure that he would censure the rear trainman of the local train for not going back with a red signal and torpedoes.

To hear that the Boston & Maine, or any other road, has not prescribed a suitable rule—a rule which will appeal to a grand jury as adequate and reasonable—is not surprising, for it is only by introducing a most elaborate combination of precautions, covering a page or two of the Rule Book, that a workable general rule can be formulated. The flounderings of the American Railway Association Committee on this subject afford sufficient evidence of this. After trying various forms, the Committee has practically rejected all forms, and now gives to the roads of the Association simply a "principle" in one short paragraph. If the B. & M. rule concerning rear protection was defective it may be that the trainman was justified in depending exclusively on fusees. If the grand jury is wrong; if the rule required the trainman to go back when a following passenger train was due, the fault was the trainman's. In either case one of the simplest principles of the time interval was violated.

But it cannot be that the whole fault was with Rule 99. In the first place, there was Lincoln station, less than two miles from the point of collision, with an operator on duty, and yet the second train was allowed to follow the first within one minute, or at most two or three minutes. This is an entire abolition of the time interval principle, which is universally understood to mean an absolute interval between passenger trains of at least five minutes; and on most roads 10 minutes. Caution signals, in the hands of crossing gatemen, had taken the place of the true time interval.

If we allow the rear brakeman of a train to substitute fusees for the time-honored red flag and torpedo, a new danger is introduced; we no longer have any audible signal. The fusee was originally adopted on most roads as an "additional" signal. This phrase means that the flag and torpedo are to be continued in full force. On many roads—not the Boston & Maine alone—it seems that the flag and torpedo have not been continued in full force; that is to say, not so rigidly in force as if no fusees were used. To use torpedoes the brakeman must get off and go back; but he can use the fusee without leaving his car. The radical element of superiority in the old practice—that the torpedo gives an audible signal—is then lost. In this case a torpedo probably would have aroused Engineman Lyons to his duty. It is unnecessary to repeat in this place that even where the rules are adequate, the difficulty of training brakemen to faithfully follow the flagging rule, and, where trains are frequent, the difficulty of formulating the rule itself, are so great that the time interval system breaks down.

(2) In considering the adequateness of the block system to prevent a collision like this, the points to be emphasized are, first, the necessity of "surprise checking," and, in the case of automatic signals, the enforcement of a stop at all signals. The stop may perhaps be omitted, under suitable restrictions, in the case of heavy trains going up grade at low speed. No one disputes the superiority of the space interval, either in this case or in any other; but there has been some disposition to argue that in this case it might not have been so very much better. But it is always better, under any circumstances, because of the better discipline. Good discipline is easy; with the time interval it is difficult. While there has not yet been gathered a sufficient body of statistics of cases where block signals are disregarded to admit of precise conclusions from actual experience, no reasonable person, who has been familiar with the operation of the block system, will deny that where the rules require trains to be stopped at fixed points, the habits of the enginemen are far better than where, because of the uncertainties of flagging, the question as to where a train should be stopped or slackened is often left to the judgment of the runner. Under the block system a runner, for most of the time, has in his mind the definite idea that he has a clear track to a certain definite point ahead—the next home signal. Under the time interval he must expect a red flag anywhere. There is all the difference between certainty and uncertainty. Where the manual block system is used, the necessary check upon enginemen who may be tempted to be careless is afforded by the presence of the signalmen at each block station; and with automatic signals a suitable system of surveillance, by competent inspectors, takes the place of the monitorship which in the manual system is exercised by the signalmen.

The common rule with automatic signals is to require a full stop at any home signal which stands against the train. The duration of the stop is in some cases specified and on some roads is, we believe, as much as three minutes. Unless the signal system is inadequate, a stop of 30 seconds would seem to be short enough anywhere; and so far as mere discipline is concerned, it is long enough. To provide for the easy enforcement of this rule and to guard against unnecessary permissive running, the rule should forbid the enginemen of passenger trains to pass two consecutive block signals with only the half minute stop at each. At the second signal the stop should be longer; say five minutes or 10 minutes. The fact that two successive signals are found against a train indicates that a preceding train probably is the cause of this signal being in the stop position; and a train following thus closely ought to lengthen the time interval so as to have the benefit of the distant signals. If in such a case a signal does not clear after a period of 10 minutes, there is a fair presumption that the train ahead has been seriously delayed; and in that case there would be no advantage in closing up on it.

Block signals, both automatic and manual, have been used in such a way that the full benefits derivable from them have not been secured; and such faulty use of them tends to aid those who would argue that the space interval is not much better than the time interval. But the rational use of block signals always demolishes such arguments.

The number of electric car accidents reported in the newspapers

of the United States in the month of November was 11, in which seven persons were killed and 89 injured. Four of the killed were in cars which were struck by trains at crossings of steam railroads.

The State Railroad Commission of Kentucky, after a hearing at which evidence was given by the principal roads of the state, has issued an opinion making sweeping reductions in the freight rates on certain kinds of lumber. Woods of value must be charged no higher than ordinary lumber; logs must be carried at 70 per cent. of the lumber rates; sleepers for railroad track must be charged no higher than lumber, and no charge shall be made on stakes and other things used to secure the load on a car. The Commission condemns the practice of giving a rebate on logs which are manufactured into lumber and afterwards shipped over the same road. "Woods of value" are declared to be now not much more valuable than other kinds, classed as lumber. In connection with the rate on sleepers, it appears that most of the roads, and particularly the Louisville & Nashville, have been charging on these a higher rate than for lumber, with a view to conserving the supply of ties for their own tracks. The counsel for the L. & N. argued that the price paid by his company for ties was a fair one, and that the only persons complaining at the policy of the road were jobbers in the city of Louisville who wished to buy the ties to ship into other states. The Commissioners' opinion says:

> No good reason has been shown why this practice should be permitted to prevail. It was clearly shown that crossties are less valuable than the low grades of lumber. In one instance the rate upon ties was at least two and one-half times that of the rate upon lumber. This extraordinary rate is now in effect upon the Louisville & Nashville, and it has been in force for a number of years. With such a rate in effect, the movement of this commodity from points upon the line of this railroad has been prohibited, and the producer has been forced from necessity to dispose of his crossties to the railroad companies charging this rate While a great deal of testimony has been offered, yet nowhere do we find any attempt at a justification of this rate; indeed, counsel for the Louisville & Nashville Railroad Company very frankly admitted that there was no real justification for it.
>
> It will not do to say that because these ties are a necessity to the railroads they should be permitted to charge a rate for their transportation in excess of what may be deemed just and reasonable for the service performed.

A railroad is a public institution enjoying the benefit of the right of eminent domain. It cannot perform its important function as a public servant without a good track, and the right referred to would doubtless be sufficient authority, in case of need, to empower it to cut trees on lands near the road, to keep up the track. But the railroad companies of Kentucky seem to have taken a short cut to improve the law. In seizing for locomotive fuel a car or a hundred cars of coal in transit, railroads have always found easy justification, in case of real necessity, provided they offered the fair market price of the coal. The tie case is not quite so simple. No public and impartial authority has been called in to decide on the fairness either of the transportation rates or the prices paid for ties. The L. & N. lawyer calls the compensation afforded by the lumber rate, as applied to sleepers, a mere bagatelle—but this suggests that the rates on lumber have perhaps been made too low by the railroads, voluntarily. It is imaginable that a railroad might make very low rates on lumber, for the purpose of developing the country along its lines, while still maintaining on "lumber" in the shape of logs suitable for ties, higher rates, yielding a fair profit, and this without injustice; but it would probably be futile, in any state, to try to convince objectors of the fairness of such an arrangement, except through a judicial decision.

The Executive Committee of the Italian State Railroads proposes the introduction of a zone tariff intended especially to encourage long-distance travel. The existing rates are substantially mileage rates, and these are to remain unchanged for distances of 150 kilometers (93 miles) or less. For that distance they are $1.68, $2.59 and $3.70 for the three classes respectively. For 250 kilometers, or 155 miles, there would be but a slight reduction (28 cents, 40 cents and 58 cents) from the present fares, but for 550 kilometers (332 miles) there would be a saving of nearly a third on the two lower classes and a fourth on the first class; while for 950 kilometers (590 miles) the comparison is as follows:

	Class		
	First.	Second.	Third.
Present fares	$23.40	$16.30	$10.63
Proposed fares	13.42	8.84	5.65

and for 1,500 kilometers (962 miles—New York to Chicago) it is:

	Class		
	First.	Second.	Third.
Present fares	$38.17	$27.72	$16.72
Proposed fares	16.89	11.15	7.10

These are certainly very material reductions; but it must be remembered that from the Mont Cenis Tunnel to Brindisi, almost the only long route in Italy over which continuous journeys are now made by considerable numbers of people, the distance is but 740 miles; from Mont Cenis to Naples, just 700; and while it is possible to extend the latter journey 294 miles further, to the Straits of Messina, and even across the straits 151 miles to Palermo, the number of passengers who will make such a journey without stopping by the way must be very small. The tourist travel, nearly all first or second class, is a very important source of earnings for the Italian railroads, and the proposed fares are quite likely to fail of adoption because of the popular idea that they would be for the benefit of the foreigners rather than for the Italians; but actually the tourists rarely make long journeys in Italy; the attractions which cannot be missed are too near together.

A plumb bob was thrown into President Roosevelt's special train as it was passing through the northern part of Philadelphia Dec. 2, and, says a press despatch, "the Pennsylvania Railroad officials and the Philadelphia police authorities have united in a determined effort to break up the practice of throwing missiles at trains. The road has been persistenly annoyed," said an officer of the company, "by the throwing of stones and bricks through car windows. This occurs usually in outlying parts of the city. The only thing that will break up the practice," said this officer, "is a heavy fine and imprisonment for the offenders when caught." And the only thing that will keep it broken up, he might have added, is to keep the police after hoodlums and mischievous boys constantly. Every large road is "persistenly annoyed"; and much of the stone throwing is by boys. Mischievous boys of 14 or 15 years who are not punished, are likely to become malicious at 17. To punish only the most flagrant offenders is to tolerate a constant danger. To punish spasmodically is to ignore the fact that a new mischief maker is born every minute. In most cities, the telephone wire from the railroad superintendent's office to police headquarters ought to be worked a good deal more actively than it is.

TRADE CATALOGUES.

Automatic Wrenches.—The superiority of the Bullard automatic wrench over the ordinary pipe or monkey wrench is explained and illustrated in a pamphlet published by the Bullard Automatic Wrench Co., of Providence, R. I. This wrench works on a new principle which is to apply a twisting instead of a crushing strain. This is accomplished by compounding three separate levers, the resulting grip being modeled on the principle of the human hand. It is an automatic wrench because it will fit itself to different sized nuts or pipe without the adjusting of any screws or nuts. It can therefore be entirely worked with one hand. More than this, it can, on account of its shape, be applied to a pipe laid close to a floor, wall or ceiling, and is a ratchet and monkey wrench combined.

Bulletin No. 125, the first of the "Sturtevant Engineering Series," has just been published by the B. F. Sturtevant Company, Boston, Mass. It describes in detail the line of automatic vertical engines made by this company. These range from 5 in. x 5 in. to 12 in. x 10 in., are entirely enclosed and all bearings are provided with positive forced lubrication under 15 lbs. pressure. This method, it is claimed, has proved greatly superior to older splashing devices. These engines which were primarily designed to meet the exacting requirements of dynamo driving, are capable of continuous operation without skilled attention, and represent the highest standard of material, workmanship and efficiency.

Car Heating Apparatus.—Special Circular No. 4 of the Chicago Car Heating Co., Chicago, Ill., describes the vapor system of car heating, which is controlled by this company. The distinguishing feature of this system is that the radiating pipes are filled with steam or vapor at atmospheric pressure and a constant temperature of about 208 deg. Fahr. This is accomplished by an automatic vapor regulator inserted between the main floor valve and the radiating pipes on each side of the car. Perfect regulation of temperature and economy of steam consumption are the two principal claims made for the system.

"The Arrowhead."—The passenger department of the San Pedro, Los Angeles & Salt Lake has begun the publication of a monthly magazine of western travel and development under the above name. The first number is a creditable piece of work and contains a number of articles of interest and value, among them "The Water Salvation of Los Angeles," "Wonders of Utah," "Nevada's Marvelous Mineral Zone," and "Landmarks of California." The magazine, which is 10½ x 13¾, makes a favorable appearance, being excellently illustrated and printed.

Electric Motors.—The Northern Electrical Manufacturing Co., Madison, Wis., has developed a line of box type motors, which are especially adapted for severe service such as crane and hoisting work. These equipments are completely enclosed and are thus dust proof. They are frequently built weather proof. They are equipped with extremely sturdy armature shafts and liberal bearings and a compact although accessible arrangement of the motor parts. Bulletin 32 is descriptive of these equipments.

CONTRIBUTIONS

The Single-Phase Alternating and the Direct Current Systems.

111 Broadway, New York, Dec. 19, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The railroad officials of the country are so deeply concerned in all that relates to the electrification of their lines that I deem it important to now take notice of an article which appeared in your issue of October 20, as well as of the article in the *Street Railway Journal* of October 21, written by Mr. Frank J. Sprague, one of the important engineers upon the Electrical Commission of the New York Central, which thereby precipitated a far-reaching controversy as to the relative advantages and disadvantages of the two systems of electric traction, namely, the alternating single-phase, which can be operated with overhead conductors, and the direct current system, which, for railroad purposes, requires a third-rail.

In dealing with this subject, it is well to recall that when the alternating current system was first introduced into this country by the Westinghouse Company in 1886, the advocates of the direct current system, feeling that their particular business and their efforts to secure a monopoly of the electric light and power industry of the country might, as they really have, become abortive, left no stone unturned to accomplish the suppression of this new and comprehensive electric system. Legislatures in several states were invoked to pass laws to prohibit any use whatever of the alternating electric system, and the present method of killing criminals in New York state was the direct outcome of the organized efforts of the business rivals of the Westinghouse Company, who were also enemies of the public, to use that company's make of alternating current generators for this base purpose in the hope that their legislative efforts referred to might be crowned with success.

The triumphant success of the alternating current system, without which none of our great railroads could have had the benefit of electric traction, needs no words of mine to emphasize it; but there are arrayed to-day against the alternating current single-phase system of electric traction many of the same men and the same interests, actuated by the same commercial spirit and using the same methods and tactics as were employed by them in the days referred to when they began their "peculiar" opposition to the alternating electric system.

Public discussion and the facts already demonstrated will bring discomfiture to that organization which has made a long and losing fight to acquire a monopoly of the electric light and power business of the country and will insure the acceptance in this country of the single-phase system as the only solution of the electric traction problem on main railroads, as has already been the general result of a most intelligent consideration of the subject in Europe.

In 1886 it was said by some influential people that I was making a mistake in attaching so much importance to the efforts being made at that time to discredit the alternating system. The beneficial results which have followed my efforts in that and other cases, in the true interests of users of electric apparatus, impel me to believe that I would be remiss at this moment to accede to like suggestions which have been recently made to me.

Mr. Sprague, while disclaiming that he was speaking officially for the New York Central Company, seems to have left no doubt in the minds of a large number of people that his views were those of the members of the New York Central Electrical Commission. In his haste to create for his clients a strong public opinion calculated to induce the officials of the New York & New Haven Railroad to give up their plan to use the single-phase alternating system and to take exactly the same kind of apparatus as the New York Central had already contracted for, namely, the third-rail direct current system, and in pleading the great need for uniformity, Mr. Sprague forgot to inform the public, probably as he would have done had he had more time, that he is receiving a very large retainer under a contract of years duration, whereby, though he may become Consulting Engineer for a railroad, yet he cannot do so if, in the opinion of the officials of the General Electric Company, such work or obligation may be in conflict with the interests of that company; and having a particular personal interest in his own form of control, which is suitable for direct currents only, he equally overlooked the fact that the electro-pneumatic multiple unit control made by the Westinghouse Company had been fully perfected for the operation of locomotives and multiple unit trains when operated by the alternating single-phase or the direct current.

Your article above referred to also tended to mislead its readers upon most important railroad questions, because it seems to have been written with a knowledge of only one side of a situation and thus under an impression that the action of the New York, New Haven & Hartford road might prove not helpful, as it will, but rather disadvantageous to electric traction in general.

Believing that a great effort had been inaugurated to fasten upon the railroads the direct current third-rail system as a standard, through a specious appeal in this particular case for uniformity, and knowing that nothing more harmful could happen to railroad interests than to extend that system, I wrote a letter, after a conference on the subject, to President Newman, of the New York Central, and inclosed therein a letter from Mr. B. F. Lamme, Chief Engineer of the Westinghouse Electric & Mfg. Co., in criticism of observations made respecting the action of the New York, New Haven & Hartford Railroad. Copies of these letters are inclosed herewith for your perusal and publication.

An intelligent public discussion of these important questions cannot fail to be of the utmost benefit, and in saying this I have in mind the rather harsh criticisms made of my letter published in the *Railroad Gazette* of Jan. 17, 1902, written in a spirit of friendliness and helpfulness to the New York Central officials, who were, in my opinion, being misjudged with reference to the accident which had shortly before occurred in the New York Central tunnel. The result of that discussion has, as all know, been the development of the steel car, so that there are now a number of firms ready to supply non-combustible cars which are superior to the old form; in fact, the Interborough, the Pennsylvania, and the New York Central have all ordered steel cars in large numbers and no one would now think of doing otherwise.

In conclusion; I wish to say that the single-phase alternating current system not only equals the direct current system in every particular, as fully set out in Mr. Lamme's letter, but in several respects has advantages of supreme importance, two of which I will particularly refer to.

No problem is of higher importance than that relating to the avoidance of the destruction by electrolytic action of all underground metallic work such as employed in the great improvements of the New York Central, the Interborough and other underground work yet to be undertaken, and the water and gas pipes of New York. These works have been created, not to last a decade, but are intended to, and should, endure for ages. It has been shown fully and completely that the direct current is working all of the time in the destruction of some of the metallic structures, especially water and gas pipes, adjacent to electric conductors, which metallic structures invariably act as conductors for some of the current escaping from the uninsulated rails forming part of the electric circuit in railroad operations.

In illustration of this electrolytic action of continuous currents, I enclose a photograph with memorandum of explanation showing the electrolytic action due to the leakage of electric current from a street railway line in East Pittsburg. I do not pretend that the rapidity of action in this case is likely to occur, except under extraordinary conditions. Had, however, the alternating current been used, there would have been no electrolytic effect whatever. This electrolytic difficulty is a well known one. It cannot be hid or covered up and must be surmounted, because the sum involved in this phase of the electric problem is so great as to justify every possible effort to avoid its rapid depreciation or loss.

In the matter of the regulation of the speed of trains upon standard railroads, the single-phase system will have it all its own way, because with the continuous current no speed can be attained greatly in excess of the predetermined one. In railroad practice it often happens that speeds of 70 and 80 miles per hour are necessary to make up for time lost. If the direct current motors are constructed for this speed, then at the ordinary speeds of 40 or 50 miles there would have to be introduced a dead resistance in the motor circuits to reduce the voltage, which condition can be maintained only for a short time, and is in effect not unlike applying a brake to hold the speed down. The only other way to maintain an average low speed would be to put the current on and off, an intolerable and uncomfortable practice one frequently observes when a motorman is obliged to move a street car at a slow speed. In the single-phase system, the auto-converters used in connection with the locomotive and car equipments provide for continuous running at any desired speed in a manner equivalent to the placing of the throttle and reverse lever in appropriate positions.

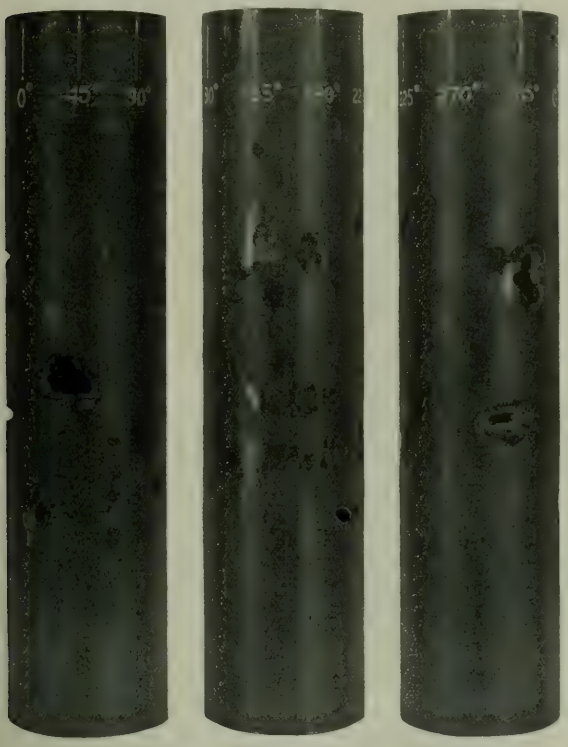
My references to Mr. Sprague and his article and his interests are reluctantly made and are not to do him an injustice but to prevent an injustice being done to vast interests by the forgetfulness referred to.

GEO. WESTINGHOUSE.

A Remarkable Case of Electrolysis.

The accompanying illustration shows the results of the electrolytic action referred to in the preceding communication of Mr. Westinghouse. This piece of pipe was recently removed in the condition shown from one of the natural gas wells on the property of the Westinghouse Electric & Manufacturing Co. in East Pittsburg, Pa., after having been installed just 30 days. The action was found to be due to electrolysis, caused by stray currents from the street railway system. This gas well was in operation for several years.

with 2-in. tubing, consisting of bare steel pipe with no preservative or other protection. The well suddenly gave out, and upon pulling the tubing it was found that for 30 or 40 ft. above the rubber packing (located about 1,800 ft. down for preventing access of water to the gas bearing strata), the pipe was greatly reduced in thickness, more or less uniformly, but broken entirely through in several places, thus causing the well to be "drowned out." As the well goes through salt water strata and there is some sulphur in the surface waters, this was believed to be the cause. As a supposed remedy new tubing was installed protected by a japanned coating inside and outside, known as "Loricated" tubing. The piece of pipe shown is a portion of this tubing and shows its condi-



Effect of Electrolysis on Iron Pipes.

tion after 30 days' use. The action was immediately diagnosed as electrolytic entirely, and was, of course, aggravated because a very slight defect in the coating concentrated electrolytic action at these spots, thus causing an aggravation instead of a remedy. To cure the trouble, careful observations were made as to the source of current, and a slight flow of current was found at all times with very heavy flows during the busy hours of the street car line. After installing the new tubing several insulating joints were inserted in the casing in the hope that these will prove a remedy.

Arguments for Single-Phase Traction on the New Haven.

At the time of the announcement of the awarding of the contract for equipping the New York, New Haven & Hartford with single-phase a. c. locomotives to run into the new Grand Central Station, there was a discussion as to the practicability of adopting this method of electric traction for use over the portion of the New York Central's lines to be equipped with d. c. apparatus. At that time, the Westinghouse Electric & Manufacturing Company, to which the New Haven contract for the single-phase equipment had been given, had not proved its ability to operate, without error, a. c. motors on d. c. current. We print below two letters from officers of this company which state the possibilities of the single-phase system:

New York, Oct. 27, 1905.

To W. H. Newman, Esq., President,
New York Central & Hudson River R. R. Co.,
Grand Central Station, New York.

Dear Sir.—There can be no more important questions before you and your officers than those involved in the present electrification plans for your New York terminal and adjacent suburban lines. When your company, under public pressure and legislative enactment, undertook the change in your terminal facilities involving the use of electric power for your cars and trains, there had been no such development of the single-phase system now actively under discussion as could warrant its adoption, and therefore the selection of the continuous current system by your commission of engineers was an obvious outcome of the situation as it then existed, notwithstanding there had been enough progress made with alternating current single-phase traction to warrant frequent references in my conferences with you and your officers to the possibility of that system being perfected in time for a change in your plans.

The business relations existing between your company and those I represent, and the consideration you and your officers have always given my personal views on the subject of the electrification of your railroad, seem to demand the prompt fulfillment of my recent promise to set out to you in a letter the reasons why, because of the possible much greater use of electricity upon many of your lines of railroad, your company could and should now change your plans providing for the use of the continuous current, third-rail equipment, to those employing the alternating current, single-phase, overhead system.

These are some of the controlling facts as they have been developed:

1. Motors can be as successfully and economically operated by single-phase, alternating currents as by continuous current, with the advantage in favor of the use of the alternating current that the great variations in speed requirements of a railroad can be more easily and economically met thereby than by continuous current.

2. Single-phase electric locomotives larger than you require have already been constructed and operated by current from overhead lines.

3. Electro-pneumatic, multiple-unit control has been perfected whereby trains fitted with alternating current motors can be better operated than those propelled by continuous current.

4. Both locomotive and car equipments with multiple-unit control have been evolved, whereby either the alternating or direct current systems of distribution can be used.

5. If there is any desire for the use of the storage battery system, such batteries can, with rotary transformers, be as well utilized in connection with the single-phase system as with the direct current system.

Comparative Costs.

Bearing upon these great questions are the comparative costs of the line equipment of the two systems.

As an example, the comparative costs of line and sub-station installation for alternating current, single-phase, and direct current to meet the conditions of traffic now existing on the section of the New York, New Haven & Hartford from Woodlawn to Stamford, are given below, based on the following:

(a) Single-phase, alternating current, high tension transmission, transformer sub-stations, 6,000 volt overhead line supported by catenary construction from bridges spanning four tracks.

(b) Direct current employing high-tension, alternating current transmission, rotary converter sub-stations and third-rail at 600 volts.

Comparative Cost Per Mile of Four-Track Line.

	System—	
	Single-phase alternating.	Direct-current.
Sub-stations	$1,714	$16,150
Contact line	12,436	18,872
Transmission line	1,815	2,181
Track bonding	308	308
	$16,273	$37,511

Difference per mile in favor of a. c., single-phase, $21,238.

Comparative Cost Per mile of Double-Track Line.

	System—	
	Single-phase alternating.	Direct-current.
Sub-stations	$1,542	$13,840
Contact line	6,750	9,436
Transmission line	1,815	2,181
Track bonding	154	154
	$10,261	$25,611

Difference per mile in favor of a. c. single-phase, $15,350.

These figures mean, assuming that your company may in the near future electrify its main lines from New York to Buffalo, that the extra cost of the line equipment with the continuous current system for 450 miles of four-track road of the New York Central main line would amount to $9,000,000, and for the double-track of the West Shore road, $6,750,000. From these figures you can easily compute what the additional cost would be upon the entire mileage of the New York Central's other lines east of Buffalo and those west of that point.

This great difference in the first cost of the continuous current system with the almost absolute certainty that traffic depending upon the third-rail will be subject to many interruptions during your severe winter months, coupled with the constant danger from live third-rails upon the surface, would seem to make most fortunate the advent at this moment of the complete system of overhead, single-phase apparatus, before any great quantity of car and locomotive apparatus has been constructed on your order, or the

line and overhead construction has been begun under your extensive plans.

Stated briefly, your situation seems to be this: Your power house and its equipment now under construction is suitable, without substantial change, as are also your sub-station rotaries and storage batteries, for the operation of single-phase equipment. Orders have been placed for 35 electric locomotives costing, say, $900,000, and 180 electric car equipments with multiple-unit control, involving an additional $775,000. Neither the locomotives nor the cars and equipments will be needed before September of next year, according to your present desires, but most probably not before April in the year following, because of the inevitable delays in the carrying out of so important a work as you now have in hand.

Had the order for the locomotives and equipment been placed with the Westinghouse Electric & Manufacturing Co., that company would have been very glad to have taken up with you a change in programme on a reasonable business basis, and I assume that your contract relations with the General Electric Co. are of such a character that you can also ask them to discuss the change in the character of equipment or arrange with them for a specific sum to cover the amount they have already expended, with such profit as they are likely to make from the completion of the work. Such sum ought to be an unimportant item as compared with the costs which may result from the completion of the work along the lines of your present plans. We are aware that the General Electric Co. has admitted its inability to produce locomotives of the character which the Westinghouse Company has contracted to supply the New York, New Haven & Hartford, but such admission on its part does not really affect the question of the Westinghouse Company's ability to produce such apparatus in the necessary quantity and in the time required.

You know of the diametrically opposed views and interests of the Westinghouse and General Electric companies and of the strife between them. You also know of my full recognition that the works of the former company being upon your line at Schenectady, it is natural that your company should give the General Electric Company at least a preference in the placing of contracts for electrical machinery.

The greatest difficulty in arriving at a conclusion is likely to be due to the commercial rivalry between the two electric companies, but there seems to be no good reason why your company should be a victim of such commercial strife. I feel confident that my recommendation that you now take steps to effect the change from your present plans will be found to be based upon the best of reasons and that that recommendation will in all probability prevail if the matter is most carefully investigated, as I am sure it will be.

I am sending Mr. Wilgus a letter with some technical correspondence, of which I have pleasure in enclosing you herewith a copy, with a hope that you may find time to read the same.

Inasmuch as many of your Directors know only the one side of this important situation, am I asking too much of you to have my letter placed before them? I ask this because of my very great desire to have my suggestion that your company now make a change fully understood and appreciated by your associates. Believe me,

Very truly yours,

GEORGE WESTINGHOUSE.

Pittsburg, Pa., Oct. 27, 1905.

To Mr. E. M. Herr, First Vice-President, Westinghouse Electric & Manufacturing Co.:

I have noted Mr. H. H. Westinghouse's letter addressed to you, in which he gives the result of a conversation with Mr. Wilgus, of the New York Central, in which Mr. Wilgus brought forth certain reasons which, in his opinion, militated against the use of single-phase apparatus in the New York Central terminal. While the comments in Mr. Westinghouse's letter are under certain more or less definite heads, for the purpose of clearer discussion, I will set forth my views under somewhat more general headings:

Locomotives.

It has been assumed in the communication referred to that owing to the apparent novelty of the design of the New Haven locomotives, insufficient time is available to produce a successful single-phase locomotive in order that it may be ready for the date set for the proposed operation by electricity of the New York Central terminals. Our opinion on this matter is that this single-phase locomotive operated as a direct current equipment comes much nearer to standard, well-accepted direct current practice than the locomotive adopted by the New York Central for its service.

The type of mechanical construction, using swivel trucks, is very similar to that universally used on heavy electric traction cars while the method of control, involving series-parallel operation of the motors, is common practice everywhere.

The type of motor used is not a radical departure from direct current practice, except in minor features of construction. The motors are extremely well protected from dirt and moisture, and they possess certain features which make them superior to any large direct-current motors yet built by any concern, more especially as regards entire freedom from "flashing," "bucking" and difficulties of commutation, not to speak of the great advance which has been made in the application of forced ventilation.

If the Westinghouse Company had been asked to build passenger coaches fitted with four motors of the capacity used on this locomotive, these motors to be operated with the usual electro-pneumatic, series-parallel control system, there would have been no hesitancy in undertaking the contract, and it would not have been considered necessary to have made a long test on a trial equipment. The problem would have been considered as merely a further development of the type of equipments now operated on the P., N. Y. & L. I. R. R.

On the other hand, the long time taken by the New York Central for testing and experimenting was but a natural precaution, in view of the many radical departures from standard practice which were incorporated in its locomotives. For instance, the type of motor used on the New York Central locomotive is entirely open and exposed to dirt and weather conditions. This construction is a radical and questionable departure from what experience in railroad work has taught us is good practice, and it would have been folly to have attempted to put such machines in operation without very long and extended tests. Aside from the mechanical features of this equipment, the motors electrically and magnetically are such as had never been tried out by the experience gained by long service.

The result of all previous experience in electric traction has apparently been abandoned in the New York Central type, and I consider that that locomotive is an infinitely greater experiment than any that the Westinghouse Company could be considered as offering in the New Haven type.

In the course of our consideration of this problem, nothing has developed which leads us to have any doubt as to our entire ability to meet the requirements of delivery with an entirely successful locomotive.

Operation.

It is interesting to note that these locomotives have been generally referred to as "single-phase" or "alternating." We, among ourselves, have used these terms and perhaps are responsible for the nomenclature. In reality, however, the equipment of these locomotives is simply a high-class, direct current arrangement adapted for operation on alternating current as well.

The motors are not primarily designed for alternating current and adapted for operation on direct current, but knowing the problem which we had to meet, they were in reality designed for the very highest class of direct current service, and they will operate successfully on alternating current. In accomplishing this result, the fundamental features which make for a good direct current railroad motor have not been slighted, but on the contrary they have been amplified in order that the motors may work successfully on alternating current. We may take it as a fundamental condition in this class of work that in order that a motor work successfully on alternating current, it must be an extremely good direct-current motor.

Method of Control.

It has apparently been assumed, although the example of many of our single-phase roads is to the contrary, that a multiple-unit system of control is not possible or feasible with the types of equipment which we are building for the New Haven road. This is, of course, an error, but it is probably brought about by the fact that only the electric system of multiple-unit control has been kept in mind, *whereas the system which we use is the electro-pneumatic.* It has further been assumed that, with any system of control, duplicate apparatus is necessary for d.c.-a.c. operation, which, of course, is another misconception, as the type of control which we are building for the new locomotives, and which is also in use on other of our installations, involves the employment of the *same controller for both alternating current and direct current service.*

This assumption has also called forth criticisms of the complications and difficulties in passing from direct current to alternating current, or the reverse, and much stress has been laid upon the awkwardness of having to employ two systems of control. As a matter of fact, roads now using this system pass from one current to the other at speeds as high as 50 miles an hour without the slightest delay or any indication to the passengers that such a change has been effected. The whole mechanism to accomplish this is of the utmost simplicity and reliability.

It should be borne in mind that when multiple-unit control is referred to, we do not mean that form which depends for its operation upon the use of the line current, but upon the form used successfully and exclusively by our company, namely, the *electro-pneumatic system*, which depends for its operation upon the use of compressed air.

The type first mentioned, that is, the straight electric control, is obviously but ill-suited to use on a.c. or a.c.-d.c. systems. Our company has from the first appreciated that the type of control which we have adopted is practically the only one which can be used either on d.c. or a.c. or d.c.-a.c. systems without additional prohibitive complications.

If the New Haven road should decide that it wishes to operate its

suburban or any other service by multiple-unit trains, there is no reason why we cannot furnish entirely suitable equipments for d.c.-a.c. operation.

Power Consumption.

In Mr. Westinghouse's letter it is stated that the single-phase locomotive when used on d.c. and running at low speed requires double the amount of energy compared with a locomotive designed for direct current only. This statement, when read by itself and without any other consideration of the conditions, is apt to lead to very erroneous conclusions. The statement is true only when the d.c.-a.c. locomotive, which we have sold to the New Haven is compared to the case of a d.c. locomotive equipped with four d.c. motors, where all four can be thrown in series on the low speeds. Where the ordinary series-parallel control is used, such as on the Interborough System and the New York & Long Island Road, and which also is proposed for the New York Central multiple-unit cars, there will be no essential difference in current consumption between the d.c.-a.c. and the straight d.c., provided the equipments are designed for the same normal car speed.

In criticising the apparent disadvantage in economy of the d.c.-a.c. locomotive at low speeds, it would be only fair at the same time to show its superiority on the higher speeds, which I will point out later more than offsets this apparent disadvantage in power under which it operates at the very low speeds.

It is true that the d.c.-a.c. locomotive, equipped with four motors, will at certain very low speeds consume what appears to be a large percentage excess of current over the straight d.c. locomotive equipped with four motors, but it should be remembered that this condition of lowest speed also means the point of least power consumption. This being kept in mind, it can readily be seen that a large percentage increase of current actually means only a small increase in power requirements.

At higher speeds, the conditions, when comparing the two types of locomotives, are exactly reversed, the locomotives which we are building being of greater economy at the various higher speeds than those with which they have been compared to their disadvantage.

At one-fourth speed the total power consumption of the d.c.-a.c. or the straight d.c. locomotive is in no sense a controlling feature. It is the power required to accelerate the locomotive up to its full speed that is of importance, and also the power consumption when running at high speeds.

The New Haven service up to Woodlawn may be considered as consisting of three sections: First, a short section where the speed may possibly be 6 miles an hour; a second section where the speed may possibly be 26 miles an hour, and a third section where the speed may possibly be 45 miles an hour. The total power consumption of a train on the first section, whether with d.c.-a.c. or straight d.c. equipments, will be small, due to the shortness of this section of the tracks, and to the fact that the input of the motor at these lower speeds is a minimum.

On the second section the d.c.-a.c. and straight d.c. will be very nearly at par.

On the third section, where a high-speed service is required, the d.c.-a.c. locomotive, as designed for the New Haven road, will present considerable economies over the straight d.c. locomotive as adopted by the New York Central.

It should be remembered that the higher economy gained with the utilization of larger amounts of power will offset a very large per cent. of loss in economy at the low speed when very small amounts of power are required.

The results of a comparison of a typical run on the New Haven service showing in the first case the d.c.-a.c. locomotive which we propose to furnish, and in the second case a straight d.c. four-motor locomotive adapted to handle the same train service are shown in the table below.

New Haven locomotive.				Four-motor direct-current locomotive equivalent to New Haven			
Speed. m. p. h.	Time. seconds.	Kw.	Dist., ft.	Speed. m. p. h.	Time. seconds.	Kw.	Dist., ft.
0 to 6	13	654	59	0 to 6	13	327	59
6	58	150	570	6	58	75	570
6 to 21.5	36	654	...	6 to 9.5	7	327	...
				9.5 to 21.5	29	654	...
21.5 to 25	12	654-420	1,715	21.5 to 25	12	654-420	1,517
25	52	240	3,632	25	52	240	3,632
25	Mom'tary.	720	3,632	25	Mom'tary.	420	3,632
25 to 45	240	720-324	17,470	25 to 36	209	420-210	...
45	88	303	...	36	182	210	...
45 to 25	14	0	23,749	36 to 25	8	0	23,749
25	240	24,649		25	240	24,649	
25	Mom'tary.	720	...	25	Mom'tary.	420	24,649
25 to 32	28	720-486	...	25 to 29	28	420-304	...
32 to 25	5	0	25,906	29 to 25	4	0	25,906
25	23	240	26,761	25	23	240	26,761
25	Mom'tary.	720	26,761	25 to 44.8	45	1,392	...
22 to 46.6	404	720-312	...	44.8 to 61.4	183	1,392-570	...
46.6 to 0	262	0	62,357	61.4 to 0	882	0	62,357
30 watt-hr. per ton-mile.				30.1 watt-hr. per ton-mile.			

From which it appears that the actual energy per ton mile required by the d.c.-a.c. locomotive is almost identical with that required by a straight d.c. locomotive under the same conditions of service.

Effect on Power House and Sub-stations.

If reference is made to the foregoing table, which shows the relative power requirements of the two types of locomotives at various speeds, it will be seen that as regards the fluctuation in the power supplied, the d.c.-a.c. will represent an easier condition than the straight d.c. locomotive, as the load will be very uniform. While the minimum load will be greater than the straight d.c., the maximum or peaks will represent less power. Such a condition is in reality more ideal and much easier on the power house or sub-station than one where the same total power represents greater maximum and minimum values. The ideal condition as regards efficiency at generating and sub-stations would be a constant power or a constant load, and we come nearer to this condition with our d.c.-a.c. locomotive than is obtained by the New York Central type on the basis of the same total power consumption in each case.

In conclusion, I believe that the statements made herein are a sufficient refutation of the views set forth in Mr. Westinghouse's letter. The New Haven road, however, in adopting apparatus for single-phase operation, is looking further than the limitations imposed by the terminal requirements. The engineers of the New Haven road recognize that the extension of electric operation was absolutely prohibited, both for physical reasons and reasons of economy, if direct current was adhered to.

The necessities of economical high-speed railroad service require that power shall be drawn by the system in proportion to the work it has to do. The trains must at times run at full speed, at intermediate speed and in emergencies at extremely high speeds to make up for loss of time. The single phase, a.c. locomotive or equipments are the only feasible type which draw power in exact proportion to the work to be done. Direct current equipments have but two or three points of maximum economy. They have no ability to go beyond a certain maximum speed, which is a frequent requirement of railroad service. At all other speeds, except these few economical points, power is wasted in regulating the speed. The single-phase, a.c. equipments utilize power at all speeds at maximum economy. I believe that this feature alone is sufficient justification, aside from the many other advantages of the system, for its adoption by the New Haven Railroad.

B. G. LAMME,
Chief Engineer Westinghouse Electric & Mfg. Co.

Fire Protection Precautions at the Stuyvesant Docks.

BY H. W. PARKHURST.

In the *Railroad Gazette* of March 31, 1905, there was an article by the author on the Stuyvesant docks fire of Feb. 26, 1905, giving some account of it, and particularly discussing in what respects provision had been made for preventing, and for handling, a conflagration. It was stated that many provisions had been made both for preventing and for fighting fire, but that the combustible nature of the construction made it practically impossible to stop the complete destruction of the whole plant when once it had been fully kindled; all mains, hydrants, sprinklers, fire-walls, fire-proofing and fire-resisting provisions not serving to stop the devouring element after its volume had grown to a certain size. In concluding the article, the suggestion was made "that the construction of fireproof buildings for the storage of combustible freight might not be thought expedient or economical," and that the problem was a difficult one to solve, at least with satisfaction.

Since that great fire nearly nine months have elapsed, and the problem is now approaching a solution—whether satisfactory or not, it remains for a trial of the devices and methods adopted by the Illinois Central in the reconstruction of its terminal facilities at Stuyvesant Docks to determine. Certain changes have been made in the style of the plant and in the details of the work done, but the general scheme of a great wharf, two elevators and three great warehouses for receiving, handling, storing and shipping grain, cotton, lumber and kindred and allied products has been perpetuated, and only such changes exist as were rationally necessary, dictated by several years use of the old plant.

A general plan of the former plant was shown in the *Railroad Gazette* May 13, 1904. Comparing that plan with the revised general plan of the present arrangement shown herewith hardly a change is noticed. One or two buildings are a little longer, a track here and there has been extended or moved, and a minor building has been omitted or replaced by a combination of several smaller ones. But generally the new structures are on the exact sites of the older ones, and this is so mainly because the old foundations were about all that were left after the fire had been put out and the wreck was cleared away. The pile foundations of elevators, freight-houses, wharves, etc., were generally uninjured and a certain amount of the concrete, stone and brick masonry, resting on these piles, and generally nearly or quite below the surface of the ground, was intact and as good as ever. Also, in the wharf work, a portion only of the piles was burned; and some wharf, and even some sections of the wooden wharf-shed, was not destroyed. Therefore the rebuilding was essentially on the old lines.

In order to explain just what changes have been made, and to state their object, the several structures built will be taken up in order, comparing the new and the old, and thus make the improvements clear. First to be considered are the two elevators.

Elevator D, the one first put up, was made originally in the usual style of wooden crib-work supported by heavy timber posts on masonry piers and on pile foundations. It had seven receiving sinks and elevators located between the tracks running through the elevator, and four shipping elevators delivering to four conveyor belts running out to the wharf. There was also a conveyor belt in the elevator to assist in the handling of grain, and a complete dust collecting system. The elevator building was covered with corrugated galvanized iron. It was operated by machinery installed in a brick power house adjoining the elevator about the middle and separated from it by brick fire-walls. A complete system of water pipes from tanks on the elevator roof supplied hydrants on each floor of the elevator and relays of hose on hose-reels were furnished on the several floors, machinery, scales, bins, etc. In other words, it was a fairly complete wooden elevator as built, say, ten years ago. This is being materially changed as rebuilt, not merely for giving better facilities but also with reference to fire resistance. The foundation has been much enlarged by driving additional piles. New boilers were also furnished. The principal changes as to fire protection were in the construction of entirely new conveyor galleries, both from the elevator to the wharf and also on the wharf, of completely fireproof character; structural iron work protected by concrete and corrugated iron being the materials used throughout, as shown in the detail plans herewith. As the old conveyor galleries are generally said by eye-witnesses to have acted as flues, extending the fire rapidly and creating drafts and spouts of flame by their continuous hollow and combustible construction, it is a marked improvement now to use materials which cannot burn, and which therefore cannot assist in converting a small blaze into a conflagration. It has been repeatedly claimed that Elevator E, the larger of the two original structures, would have withstood the exposure to the surrounding fire had it not been for its connection by the conveyor galleries with the rest of the construction (wharf-sheds and freight-houses). It is true that the galleries next the elevator were equipped with "Grinnell" sprinklers, but in the fierce fire and the strong drafts accompanying it the conveyor served as a flue to bridge over all petty obstructions, and the main elevator was finally burned, after withstanding the heat for some time.

The original Elevator E was also one of the better style of wooden elevators on a pile foundation with concreted basement, piers and foundation walls, heavy timber posts and cribbed bins. It had seven receiving and seven shipping legs and a complete set of spouts, conveyor belts, etc., to receive and store 1,500,000 bushels of grain, and to deliver the same to the wharf for loading vessels by four belts, conveyor galleries, etc. It was covered with corrugated galvanized iron. It had a completed dust-collecting apparatus, sending the sweepings to the boilers, and it had a separate brick power house in which were installed compound steam engines for operating the elevators and also for electric lighting; and also powerful pumps. It had two water tanks on the roof to which a system of internal pipes for water was connected, fully equipped with hydrants, hose, etc., on each floor of the elevator. This was independent of a complete system of "Grinnell" sprinklers, which was installed in accordance with standard insurance rules throughout the whole elevator from roof to basement. This apparatus was designed to act automatically, being operated directly by the heat opening each one of a series of sprinklers set on pipes in groups near the ceilings, the elevator heads and legs, spouts, etc.; in fact, near all combustible or easily burnable material in the elevator; the purpose of these being, of course, to throw out sprays of water as soon as the heat should be raised to such a temperature as to open the sprinklers and so to wet down any stuff that might easily burn and thus stay combustion. This style of apparatus is especially effective in mills of all kinds and its instalment always lessens the insurance rates when properly placed in use. It would undoubtedly be effective in the earlier stages of a fire, but less so as the fire increased in volume. How much service it actually did at Elevator E no one can tell.

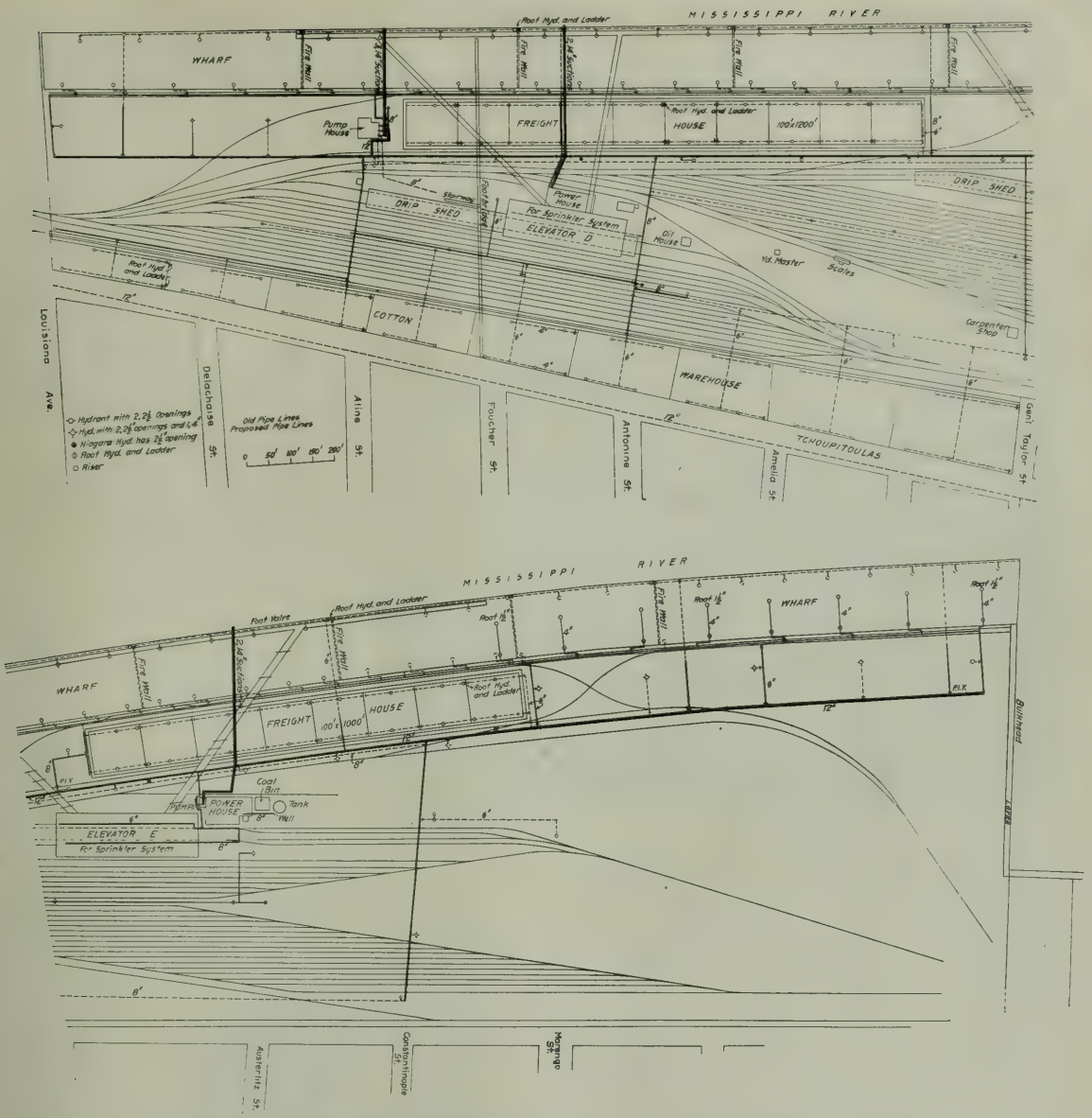
Foundation of East Freight House.

Foundation Work on Cotton Warehouse.

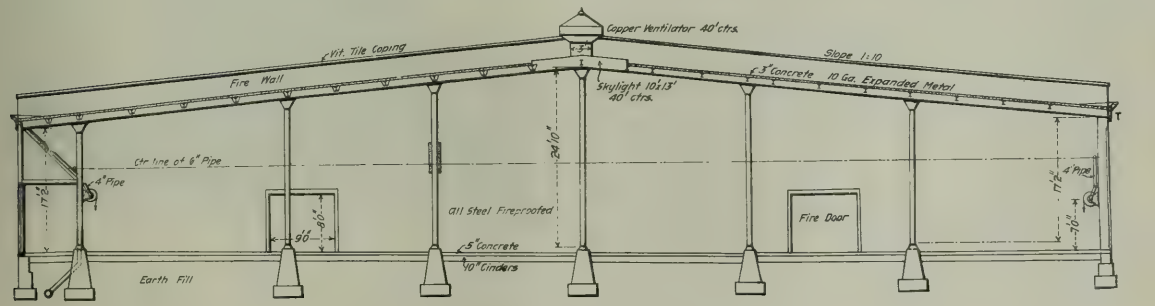
The newly built Elevator E has been modified from its earlier form in several respects. For greater convenience of operation another set of sinks has been put in and there is now a set each for receiving and for shipping grain. The cupola on top of the elevator has been correspondingly changed to make proper space for the belts, legs and heads. But few other, and those but minor, changes have been made within the building, but the exterior conveyor galleries to and on the wharf, like those for Elevator D, are of steel, iron and concrete, with the same object of furnishing nothing which can burn and so cutting the fire risk down to a minimum. With all these galleries made of metal, and the posts supporting them covered with concrete, they should stand as long as the wharf remains to support them, and cannot furnish fuel to swell another fire.

The wharf system extends from Louisiana avenue to Napoleon avenue along the left bank of the Mississippi river, being about 4,850 ft. long. It was built in three parts, about 2,100 ft. next to Louisiana avenue being built in 1895, the 1,500 ft. next up-stream, in 1898, and the rest in 1903. The earliest portion was made but

Laying Concrete Slab Roof on Freight House.

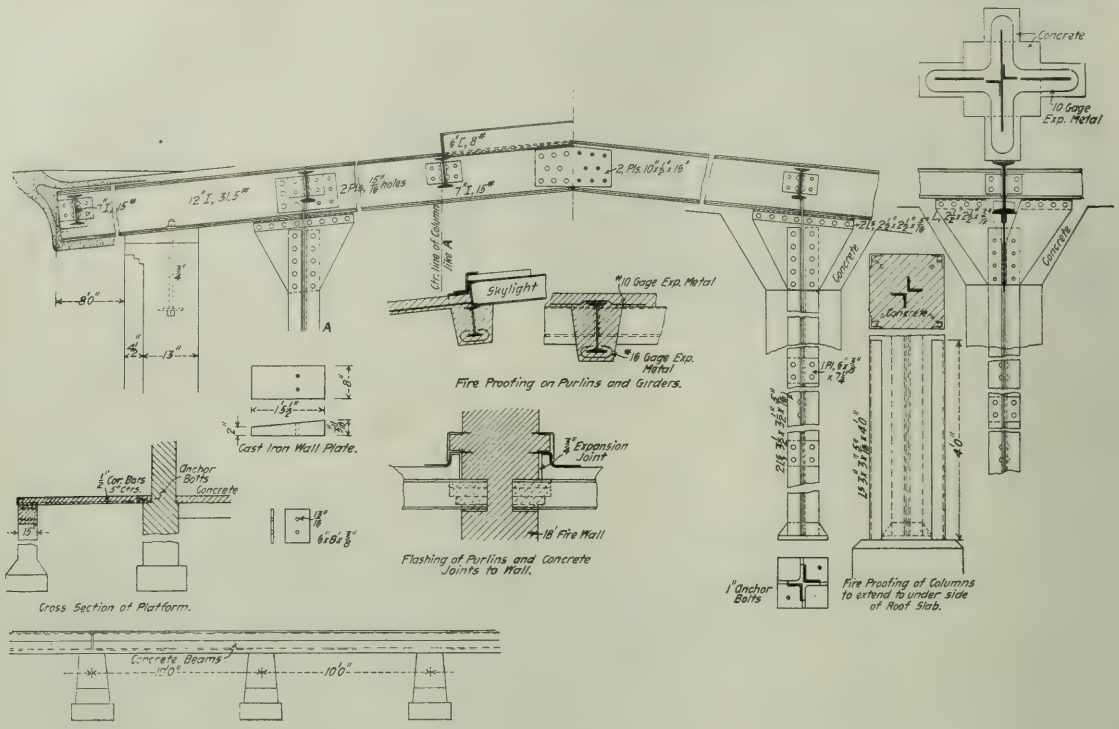


Plan of Stuyvesant Docks Showing Old and New Fire Mains and Hydrants in Buildings and Yards.



Typical Cross-Section of Cotton Warehouse, Large End.

100 ft. wide and was intended to carry locomotives and trains, and hence had some piles 5 ft. center to center for certain tracks. The wharf was not covered at first with any roof. As the railroad company came to use it they found it best not to run locomotives on it, and that even more space would be needed for storage, and, finally, that storage room was needed rather than tracks on the



Details of Fireproof Roof and Floor Construction in Freight House.

acter might have been made but it was decided not to take any chances of storing valuable merchandise under a leaky or uncertain roof and the decision to build a complete three-ply roof followed as a matter of course. This, though costing three to four times as much as a single composition coating, will in the long run be more economical than to pay heavy damages for injury to

wharf; so that in adding further to the original wharf, a width of 150 ft. was adopted as standard and the old wharf was widened to that size at the up-stream end next to the added wharf. Also the river front was relined, making an addition of 30 ft. at the down-stream end and building up-stream on a long curve for future increases. At the same time sheds were built over old and new portions, thus fitting them for great storehouses for lumber, staves, cotton, etc., in transit from cars to vessels, or vice versa. The earlier wharf was built of untreated yellow pine piles and timber, the second addition of cypress piles and timber, while the third front was made of creosoted piles (or where piles were spliced those parts exposed above water were treated), caps, floor-joists and braces, while the floor planks were untreated yellow pine. The material of the wharf shed, conveyors, etc., was also untreated except by painting with a fire-proofing composition. All but 500 or 600 ft. of this wharf, together with its shed and roof, was burned, a shift of wind permitting the saving of a small portion.

This has been replaced by a creosoted pile wharf, piles generally spaced 10 ft. center to center each way; piles full length up to say 65 ft., but spliced to 95 ft. or more in the front rows, the top pieces only being creosoted. Pile caps and floor joists and braces are also of creosoted yellow pine, while the floor is of untreated yellow pine. Over this is a wharf shed of skeleton steel construction on which is placed a reinforced concrete roof. The posts supporting the roof are jacketed with concrete as shown in the accompanying detail drawings. This roof is being made water-tight by building on it, in place, a three-ply composition felt roof. As the concrete on these roofs is 3¾ in. thick and is well reinforced with steel, it was thought that a waterproof covering of less expensive character might have sufficed. Several proposals were made, and the attempt to use a single coat of tar or asphaltic composition for this covering was tried, special pains being taken to see that all fine cracks in the concrete work were either avoided, or if made at first, that they should be filled with fresh mortar and made essentially tight before the application of the bituminous coat; but in spite of all efforts, a few days sufficed either to open the old cracks or to produce new ones, and a single coat would not shed the water. Possibly under the best conditions and with most careful workmanship, a water-tight coating of this inexpensive char-

flour, cement and kindred merchandise. When it is remembered that the roof of the wharf shed has an area of about 20 acres, the question assumes a magnitude that becomes impressive. One of

Rebuilding Elevator "D."

the photographic views shows the work of roof concreting, giving a clear idea of the method of construction, thickness of roof, details of steel-work, etc.

The freight houses are two in number, each 100 ft. wide be-

tween walls. No. 1 is 1,200 and No. 2 1,000 ft. long. As previously stated, the foundations of these were uninjured by the fire, but the posts, roofs and adjacent platforms were entirely destroyed, and the brick work of the outer walls and the partitions, or fire-walls, were so badly damaged that the only thing to do was to clear away everything nearly or quite to the level of the floors, and rebuild above that elevation. In rebuilding these houses opportunity was taken to make them entirely fireproof, no wood at all being used except for the usual wooden, metal-covered sliding fire doors, which are accepted by the insurance authorities as preferable even to double sheet-iron doors. The wooden posts formerly supporting the roof are replaced by steel, jacketed with concrete, and steel beams, channels, plates and angles are used instead of wooden purlins, rafters and joists. Reinforced concrete slabs take the place of wooden sheeting to make the surface of the roof. The platforms around the freight houses are made of concrete as well as the projecting roofs over them, using no wood at all. Here again, as in the case of the wharf sheds, it was finally decided to put a three-ply composition roofing upon the concrete base to make a watertight roof, not trusting to concrete, or mortar, or a single coat of composition, though all were experimented with. The attempt was made to get responsible roofing contractors to make such specifications as their experience might suggest, and to propose to put on a covering according to these specifications, giving a written guarantee to maintain a tight roof for three, five, or ten years, but no one was found willing to do this unless the specification was made to cover the construction of a roof laid in three or more thicknesses of felt, cemented by the usual composition coatings, built in place on top of the concrete. They all doubted the concrete, fearing it would crack and tear open, so that a single or a light covering could not be effective. One or two said that if they had done the concrete work they might possibly guarantee a single coat or covering to be effective, but as the concrete was done or was all under contract, no combination contract could then be let to cover the joint work. The roofing contractors were willing to put on anything the railroad company wished, but only at the cost and also at the risk of the railroad company, and in no case at contractor's risk. This settled the question in this case, but it might be valuable experience to attempt cheaper work under more favorable conditions. The writer believes it will be so done in the near future.

It is true that the structural steel deflects under the normal loading so as to create a tendency to crack the upper surfaces of the concrete slabs on the tops of both purlins and rafters at the points where tension is brought in the upper surfaces of the concrete. Can this be sufficiently resisted, say by the proper use of expanded metal of small mesh? And if so, and if the cracking is merely of a minute or microscopic character, will not a single coat of plastic composition be all that is needed to make a water-tight job? The writer understands that the use of such a meshed reinforcement should and would limit the cracking to such fine lines that it may alone, without any plastic covering, be impervious to water, and some tests which have been made tend to confirm this opinion. Of course, if the cracks are not very small, and if they open and shut under varying loads, such as wind, etc., the water will work through, and a concrete roof will be a leaky one. The question is, how much paint, pitch or asphalt is needed to stop the cracks, if there must be any; and must there be cracks, if we reinforce the concrete properly? This is a field for experiment and for careful work, and should be a profitable one for him who investigates it thoroughly.

There was a cotton warehouse in the original plant, about 1,400 ft. long and from 80 to 130 ft. wide, one story high, with railroad tracks on one side and a street on the other, the floor at about the level of a car floor, divided into sections for the storage of cotton and transfer from teams to cars. This was a wooden building and was totally destroyed. It is replaced by a longer building of fireproof construction, concrete foundations and floors, brick walls, steel posts, and reinforced concrete roof, which will be covered by a three-ply composition roof. This is fully explained by the plans and photographic views. The general plan is here carried out, as in the freight houses, of using no wood except for doors, and these are covered with metal as required by insurance rules. The building is divided into sections about 240 ft. long each, and doors are limited to a minimum number. There are no windows, and transoms are of iron, set with wire glass. The floor is at the level of car floors on the side of the building next to the track, and is about the height of a truck on the street side, and has a slope from side to side, varying with the width of the house. This structure extends from Louisiana avenue to General Taylor street, about 2,200 ft., and occupies all of the available width between Tchoupitoulas and Water streets, covering an area of 6½ acres. It is a vast improvement over the original temporary, combustible building which it replaces. It is the theory that should a fire occur in either the cotton warehouse or in one of the near freight houses, it could be confined to the particular section (120 ft. long in freight houses and 240 ft. long in cotton warehouse) in which it was located and might burn out there without extending to an adjacent section. Of course, the actual working of this theory cannot well be tested, but this shows the aim of the plans and it is believed that a long stride has been made towards the cutting down of fire risk.

To act as auxiliaries in putting out a fire, the old system of pumps, tanks, pipes and hydrants has been enlarged and made more convenient of operation. The general plan herewith

Freight House, Roof and Posts.

shows numerous details of these features. From this it may be seen that there are three pumping plants. One set is an independent pumping station near the east end of freight house No. 1 and southeast of Elevator D. This draws water directly from the river through three 14-in. suctions, but is also cross-connected to the large 100,000 gal. supply tanks near the two elevators and may be used to fill or draw from them, or to put pressure on the mains and hydrants by proper adjustment of the intermediate valves. There are also large pumps at each elevator power house, each having two 14-in. suctions directly from the river, each of which may at will, by suitable setting of valves, be made to perform any desired pumping duty. Lines of water mains are laid as shown on the plan, the pipes being properly graduated in size to correspond to the groups of hydrants located on the whole property, which they are designed to supply. These hydrants are of various sizes, the smaller having two 2½-in. connections, others one 4-in. and two 2½-in., and others being "Niagara" hydrants throwing 2½ to 3 in. streams. There are 12 of the latter, each being on a raised iron framework 8 or 10 ft. above the ground, and placed at commanding positions where their streams may be most effective. The smaller hydrants are distributed throughout the property, some on the ground among the tracks, others regularly disposed on the wharf and in the freight and warehouses and on the roofs, each having near it an abundant supply of rubber-lined fire hose, with reels, nozzles, etc. The water mains are all located under or between the tracks so far as possible, thus avoiding a disastrous error in the old scheme, namely, placing mains on the wharf, where their use was soon stopped by the fire.

As a further defence against the spreading of fire, the wharf is cut up into eight sections by seven fire-walls, and each warehouse is similarly sectionized by fire-walls. In the wharf these have pile foundations, and concrete bases extend to or below low-water mark or into the permanent ground, and the upper walls are generally of brick, 18 in. thick, strengthened by pilasters at frequent intervals. In all cases the fire-walls extend well above the roofs, or project around the sides of buildings to perfect the cut-offs. Doorways through these are reduced to the smallest possible num-

ber, and each is arranged to close automatically by double doors made of three thicknesses of wood covered with sheet iron (or tin) tightly soldered, and fastenings operating automatically through fusible links melting at a dangerous rise of temperature.

Supplementing these arrangements, there will be installed a complete electric alarm system with bells, signals and calls, so that the exact location of an incipient fire may be announced, and with the men trained to a properly devised fire drill, it is expected to put out a blaze instantly and before it may assume dangerous proportions. Such a drill was in practical use at the time of the fire, but as it occurred on Sunday evening, the force at hand was too small to be effective.

It is hoped that the provisions above described may suffice to prevent the recurrence of such a calamity as that of last February. While there are undoubtedly many further precautions and refinements of construction that might be effective to avoid or extinguish fires, there is always the question of cost; and the true meaning between extravagance and parsimony can be reached only by continued trials.

The work of rebuilding the Stuyvesant Docks has been handled by the bridge department of the Illinois Central, Mr. R. E. Gaut, Engineer of Bridges, and Mr. W. S. Greenfield, Resident Engineer at New Orleans. While some of the work has been done directly by the railroad company's men, the general work has been contracted to Geo. B. Swift Company and to James Stewart & Co., the former of Chicago, the latter of St. Louis. The work not being complete, no statement of cost can be made, but the estimate runs but little short of $2,000,000 to restore the whole work to first-class shape.

The Industrial Department.

The recent appointment by the North Eastern Railway of England of a Commercial Agent, a new officer in English railway organization, whose duties correspond with those of an American railroad Industrial Commissioner, leads to a review of the history of the railroad industrial department.

The first American railroad industrial department was established on Jan. 1, 1891, by the Chicago, Milwaukee & St. Paul, when Mr. Luis Jackson, now Industrial Commissioner of the Erie Railroad, began the organization of the St. Paul's industrial department, at whose head he remained for over 12 years. The idea of securing eastern manufacturers for western territory had earlier occurred to Mr. P. S. Eustis, then General Passenger Agent, now Passenger Traffic Manager of the Chicago, Burlington & Quincy, suggested by the establishment of a branch factory of a New England manufacturing concern at Aurora, Ill. It seemed probable that if advantages of a change of location were made clear to them other eastern manufacturers might be attracted to the west. Mr. Jackson, who had had training in the traffic department, was commissioned by Mr. Eustis to look into the possibilities of Burlington territory, with the words: "You get data on the possibilities. We have no instructions to give." As a result of his examination, circulars and pamphlets descriptive of Burlington territory were prepared and given a large and continued circulation, as many as 4,000,000 being eventually sent out. In the preparation of these circulars and examination of the possibilities of the territory the fuller idea of a department of railroading which should give its attention to commercial economy in relation to manufacturing was developed.

Mr. E. P. Ripley, now President of the Atchison, Topeka & Santa Fe, was at that time General Manager of the Chicago, Burlington & Quincy. It was after he became Third Vice-President of the Chicago, Milwaukee & St. Paul that the industrial department, with Mr. Jackson as Industrial Commissioner, was established. St. Paul territory was at once districted by resources, advantages and markets. Economic data was collected and put into print and railroad industrial advertising was for the first time begun. Hemlock bark resources on the line were made known through tannery papers in order to attract tanneries; water power and wood pulp, through paper mill journals; clays, through brick papers, and, in this way, a variety of industries were specially advertised by circulars and in trade and Eastern newspapers. Maps of the territory reached by the railroads were distributed, covering the location of particular resources and containing facts of interest to some particular class of manufacturers. One of these showed the location of the Lake Superior iron ore ranges and proved very popular among iron and steel manufacturers all over the country. Another was issued to promote the Wisconsin tobacco industry. It showed, shaded in brown, the areas in Wisconsin where tobacco was already being raised with profit, and at the same time showed the areas still open to profitable tobacco production. A copy of this map was sent to every post office, creamery and saloon in the counties available for tobacco culture. As a result, tobacco raising in those counties tremendously increased and considerable areas where none was grown before began to cultivate tobacco. The American Tobacco Company now employs hundreds of people during a third of the year in sorting tobacco in this part of St. Paul territory. To the Chicago, Milwaukee & St. Paul belongs the credit of being the first railroad company to adopt active measures of this sort to call the attention of manufacturers to the specific advantages of its territory.

Many mistaken ideas were prevalent when this first industrial department was started. It was thought, for instance, that its main endeavor would be to get factories to remove from one railroad to another, the railroad in that case acting merely as a real estate agent. This idea was promptly knocked on the head by the advertised announcement that the St. Paul road was not trying to get factories to remove from one part of the west to another.

In general, a railroad industrial department is not interested in getting manufacturing plants to change their base except in those cases where they are, economically speaking, wrongly located. Economic changes are constantly going on, and there are many factories which were established 40 or 50 years ago which have either outgrown available facilities or are now economically badly located in relation to sources of raw material or markets for finished products. The correct economic location of a steel works is no longer, as in earlier days, along the Atlantic ocean; but in the Buffalo, Youngstown, Cleveland, Pittsburg, or Chicago or Birmingham districts, where ore, coal and coke are conveniently available. Besides established manufacturing plants in need of more favorable locations there are always new companies going into business and new resources to develop, either through outside capital ignorant of the opportunities or by opening the eyes of local capital to local advantages.

The industrial department should not be considered to have developed from the land and immigration department, although of late years many land and immigration departments have gone into the business of endeavoring to secure industries, and the titles of several have been changed to land, immigration and industrial department, or to land and industrial department, or to immigration and industrial department. The Chicago, Milwaukee & St. Paul had an immigration bureau for 30 years before its industrial department was started. Nearly every western road had an immigration bureau and many land and immigration bureaus, but no road had an industrial department before 1891. The distinction is similar to that between the United States Department of Agriculture and the more recently created Department of Commerce and Labor. It is quite possible on railroads which run through agricultural rather than manufacturing territory to work the land, immigration and industrial departments together, but in such cases the industrial side of the department is likely to be subordinated to its land and immigration activities. This is natural enough, for obviously a territory must be well settled and cultivated before anything in the way of manufacturing can be expected to develop. The straight-out industrial department deals with manufactures and aims primarily to develop raw materials and other resources as a basis for the location in its territory of profitable manufacturing industries.

Since the establishment of the first industrial department by the St. Paul in 1891, many other railroads have established similar departments or extended their land or immigration departments to cover the establishment of industries. In the east, the Erie, Lehigh Valley, New York Central, Delaware & Hudson, Baltimore & Ohio and Seaboard Air Line have industrial departments; the Delaware, Lackawanna & Western an industrial and advertising department, the Southern a land and industrial department, and the Louisville & Nashville an immigration and industrial department.

West of Chicago, the Illinois Central, Burlington and Wisconsin Central soon followed the example of the St. Paul in establishing an industrial department. The Atchison, Topeka & Santa Fe, Chicago & Alton, Chicago & Eastern Illinois, Great Northern, Missouri Pacific and St. Louis & San Francisco also have Industrial Agents or Commissioners. The Chicago & North-Western's industrial department is the most lately established, and on January 1 a similar department is to be established by the Wabash. Most of these roads have a separate land or immigration department. The Minneapolis, St. Paul & Sault Ste. Marie has a Town Site and Industrial Agent, and the head of the Wisconsin Central's department has the title of Land and Industrial Commissioner.

This incomplete list shows the spread of the original railroad industrial idea. Yet in spite of this development, this is perhaps one of the least generally known railroad departments, and, furthermore, is probably not what most people think it is. It is not easy to bring into a definition its object and duties.

The following extract from a publication of the Santa Fe gives in concrete form an idea of the purposes of that company's industrial department:

"To ascertain and bring to the attention of interested manufacturers all resources of new materials along the lines.

"To co-operate with and encourage the citizens of its territory in the establishment of industries which local conditions, markets or other conditions favor.

"To bring opportunities for investment in its tributary territory to the attention of investors.

"To aid producers along its lines to extend their markets and to foster an interchange of commodities along its system.

"To encourage and aid in the introduction of new and profitable products.

"To keep in touch with developments and discoveries in its mineral territory and to aid miners and prospectors in bringing their claims to the attention of capital."

It will be seen from this description that the industrial department is a sort of information bureau, also a "facilitating" bureau. A large department force is not required, the average being three or four men. But its work and methods presuppose the active co-operation of all other departments. The primary object is, of course, the creation of traffic, and the head of the department must be thoroughly versed in traffic matters, education in this department being perhaps the best training for the position. The Industrial Commissioner reports to the Freight Traffic Manager or to the President direct.

A very large part of the work of the department is to ascertain and bring to the attention of interested manufacturers resources of raw materials along its railroad's lines. On the Santa Fe system there are countless examples in which manufacturing plants have been located as a direct result of the efforts of the industrial department. As concrete examples, may be cited Portland cement, glass and brick works in Kansas, and the beet sugar industry in Colorado. To this department on the Santa Fe belongs the credit for first demonstrating the practicability of beet sugar production in Colorado, of interesting capital for building the first plant and of nurturing and encouraging the industry since that time. Experiences with the other three industries mentioned were of a similar nature, all of which now contribute a profitable traffic not only to the Santa Fe but to other roads as well.

Another feature of the work of the department, and one for which too much credit cannot be given, is in actively aiding in the scientific investigation and development of any newly discovered material, product, or process which gives promise of being of commercial value. An example of this is a weed or plant growing in the West from which it has been thought rubber could be obtained. The matter was taken up with the Department of Agriculture at Washington, and also at the same time the interest of rubber manufacturers was enlisted. This investigation, which is still under way, may yield important results, or, on the other hand, may prove of no practical value whatever and be abandoned. It is sometimes the case that the department may work several years on such an experiment, or in getting the first industry of its kind established in a new field; that is, the difficulty is to find the man or concern in that line looking for a change or for enlargement, willing to put money into the venture.

The department keeps closely in touch with commercial bodies in all towns on the system, the head knowing personally the secretaries of these organizations. Some departments will investigate for these associations any industrial concern which wishes to come to town, or which they may be trying to induce to come to town, and if found to be all right, encouragement is offered and all assistance at the department's command tendered. Acquaintance with the banks in every town is an item of the department's assets, for this makes it possible for a concern in need of a bank's assistance in getting established to more readily obtain aid through the recommendation of the department, although the latter assumes no responsibility in the matter.

Its head must be familiar with every condition affecting the welfare of the system, be it condition of crops or live stock, the volume and direction of various exports, or what not; in fact, about one-fifth of its efforts are directed to the collection of information. It is a bureau of information for the other departments and is expected to be able instantly to supply any industrial information desired. One valuable source of information is the station agents, with whom the department keeps closely in touch and uses to the fullest extent.

An industrial department in the West is actively and materially interested in the matter of irrigation, being desirous of having started all of the irrigation work possible. It co-operates with the Government in this work. It also co-operates actively with the Department of Agriculture, and with State boards in the dissemination of knowledge about land and what it will grow best.

A concrete example will make clear its work of "facilitating." A man desired to enlist the interest of a certain road in a project which had to be referred to the President for final decision. This man did not know how to go to work to get it through promptly and undoubtedly would have encountered difficulties in bringing it intelligently to the President's attention. By submitting the situation to the Industrial Commissioner, the latter obtained in quick time from various departments of the road the necessary information and had the case ready in suitable form for the President's attention, in a very short time. It must always be borne in mind that the department directs its efforts mostly to getting things started, to bringing the right people together. Details are left to the proper men and departments of the road directly interested, the industrial department, however, keeping track of developments and giving all possible suggestions and assistance from its own knowledge and experience.

The publications of the industrial department are part of the general scheme of industrial development of the railroad's territory. Similar in idea to the iron ore or tobacco maps of St. Paul territory already described, though more comprehensive than either is the industrial map published this year by the Erie Railroad. This shows in colors the bituminous and anthracite coal areas, the oil and gas areas and those which include coal, oil and gas, along the Erie lines. This map was made from charts of the United States geological survey, and on account of its accuracy has had a large general use throughout Erie territory. Annually a pamphlet is issued containing a list of new manufacturing plants located during the year on the Erie and photographs of some of the most important new plants in process of construction. This is really a results-summary of the work of the department during the year. Circulars for special industries include one giving a list of the limestone, bluestone and sandstone quarries and another showing the location of lumber in the log in commercial quantities in Erie territory.

The land and industrial department of the Southern Railway publishes a monthly newspaper called "The Southern Field," devoted to the agricultural, manufacturing, mining and business interests of the country tributary to its lines. Through detailed descriptions of the advantages of the territory in relation to some particular industry and photographs of actual forests, mines, orchards and products, opportunities are brought directly before a wide range of possible homeseekers, investors and manufacturers. The Southern also, through district agents of the industrial department, local real estate agents and the station agents along the line, keeps in close touch with possibilities and industrial progress. From information given by men on the ground, the department comes into possession of a mass of information of the very greatest value in the intelligent and successful carrying out of its duties. Water powers, new industries established or additions to existing industries, land sales by local real estate agents, purchasers of farms, good roads' development, timber and mineral lands existing and for sale, number of and new banks, churches, schools, academies and colleges in each locality, municipal government or the lack of it, boards of trade, municipal and public improvements, Northern and Western people recently located, farms for sale, new industries proposed and real estate sold are some of the facts of which the department keeps a record. Some of these inquiries are made monthly. Thus there is on file at the central office a complete industrial record of the territory.

On publications of roads like the Chicago & North-Western, which are constantly opening up new territory to the westward, the immigration idea is generally most strongly urged. "New Homes in the West" is the title of one of these circulars issued to attract homeseekers to new territory soon to be thrown open to settlement. This road also publishes lists of industrial opportunities and business openings on its lines. These go into detail as to the kind of business and where it is needed. They also include a list of factory buildings for sale.

The Wisconsin Central issues circulars on the dairy industry in Wisconsin, land drainage, the hay crop, "Timber Propositions As We See Them," and "Wisconsin and Its Opportunities," the latter including a soil map and many photographs of Wisconsin farms and products.

The Baltimore & Ohio some time ago issued a book entitled "Industrial Opportunities," containing descriptions of mineral lands, analyses of ore and of limestone, locations of deposits of sand, clay and stone, farm and fruit lands, factory sites and special inducements offered by towns along its line. The Lehigh Valley has a similar book in press. These examples cover pretty fully the typical publications of a railroad industrial department.

Although the industrial department is numerically a small one, it is easy to see how important its activities are to the prosperity of its railroad. To develop the territory industrially, to bring capital and opportunities together, to increase the number of manufacturing plants on the line, to extend the use and commercial development of natural resources and bring about the greatest possible growth and prosperity of its towns and cities are all matters of vital importance to a railroad's traffic, which means to a railroad's prosperity. On the modern railroad industrial department depends very largely the success of these measures.

Foreign Railroad Notes.

St. Petersburg newspapers published during the railroad strike say that however blamable the conduct of the railroad men was, nevertheless it could hardly be expected that they could longer endure the treatment they have been receiving without some violent expression of their dissatisfaction. They made known their discontent last February, and it was generally acknowledged that their pay was shamefully insufficient, and their other complaints well founded; yet in the estimates recently presented for next

year's expenditures no provision was made for bettering their condition. Under these circumstances they have easily and very generally been converted to the wildest revolutionary doctrines.

A Swiss life insurance company has agreed to insure members of a railroad men's temperance society for 4 per cent. less than the premiums charged to non-members; and a Swiss accident insurance company which for some time has made a rebate of 10 per cent. to total abstainers is so well satisfied with the result that it will make the rebate 15 per cent. after 1905.

Washington Correspondence.

WASHINGTON, December 19.—The most important railroad legislation development of the past week was the introduction to-day of the bill prepared by Senator Dolliver, of Iowa, proposing to empower the Interstate Commerce Commission to fix maximum rates. Senator Dolliver is looked upon as the most extreme advocate of governmental rate making on the Republican side of the Senate Committee on Interstate and Foreign Commerce, and additional significance is given to his bill by the indications that it probably embodies the exact ideas of the President more nearly than any other measure that has yet been brought forward. The President has let it be known that he will not openly endorse any particular rate bill as an administration measure, and Senator Dolliver does not represent that his bill has received the Presidential approval. The idea that it is to be regarded as the administration bill is based on the fact that Senator Dolliver has been in frequent consultation with President Roosevelt and Attorney-General Moody on the subject of railroad legislation. The latest of these conferences took place at the White House last night, when there was also present former Judge Cowan, of Texas, one of the men most prominently associated with Mr. E. P. Bacon, of Milwaukee, in his campaign for enlarging the powers of the Interstate Commerce Commission. Prior to this conference Mr. Dolliver had had a few copies of his bill printed, and the idea that it is an administration measure has been strengthened by the fact that when he introduced it to-day he had made several very important changes in the printed text, presumably as a result of the criticism of the President and the Attorney-General.

In the main, Senator Dolliver followed the general plan of the bill prepared by the Interstate Commerce Commission, but he departed from it in several important particulars. While both the Commission bill and the new Esch-Townsend bill propose to empower the Commission to prescribe both maximum and minimum rates, the Dolliver bill would restrict it to the making of maximum rates. The Commission bill proposes to empower the Commission "to determine what will be a just, fairly remunerative, and reasonable rate." The Dolliver bill would have it "determine and prescribe what will, in its judgment, be a just and reasonable maximum rate." The words "in its judgment" were inserted by Mr. Dolliver, and the words "fairly remunerative" were stricken out by him after the conference of last night. Both changes are being subjected to criticism. It is contended by critics of this bill that the proposition to expressly authorize the Commission to fix rates in accordance with its judgment is a direct proposition to confer upon that body discretionary legislative power and would be unconstitutional for the reason that it does not contemplate the making of rates in accordance with a standard prescribed by the judgment of Congress but in accordance with the judgment of the Commission. The effect of striking out the words "fairly remunerative" it is contended would be to attempt to preclude the Commission from taking into consideration, in determining the justness of a rate, all question as to whether it would yield a fair return upon the capital invested in the railroad or not. Taking these two changes together, it will be seen that the Dolliver bill proposes to give the Commission more absolute power over rates and, through the rates, over railroad property, than any other bill that has yet been proposed for the fixing of maximum rates.

In addition to eliminating the provision in the Commission bill for the fixing of minimum rates, Senator Dolliver also struck out, after the White House conference, a provision that he had inserted to empower the Commission to "determine and prescribe the just and reasonable relation of rates," intended to empower the Commission to fix minimum rates and prescribe differentials without expressly saying so.

The Dolliver bill differs from the Commission bill, and from the new Esch-Townsend bill, in proposing to retain the existing law as to the length of notice required for the raising or lowering of a published rate, with the addition of a provision permitting the Commission to allow changes on less than the notice specified and to modify the requirements as to the publishing and filing of tariffs, either in particular instances or by a general order.

The provisions of the Dolliver bill for the judicial review of the orders of the Commission differ very much in form from the corresponding provisions of the Commission bill, but it is contended by critics of the Dolliver bill that its effect would be practically the same and that the court of review would be limited to the consideration of the single question whether the new rate ordered by the Commission was one that could or could not be constitutionally prescribed by the legislative branch of the government. It is contended that an order of the Commission made under the provisions of this bill could only be set aside on the ground that the rate made was so low as to amount to the confiscation of the property of the railroad.

It is not yet clear whether the House or the Senate will be the first body to act upon railroad legislation, but the action of the House will be considered as of relatively little importance. It is recognized that the real battle is to be fought out in the Senate. The generally prevailing opinion is that a compromise will be agreed upon finally that will give the Commission authority to make rates in some form, but it is clear that such a compromise will be adopted only after a very hard fight. Senator Foraker, of Ohio, will take the lead in the Interstate Commerce Committee and in the Senate in opposing any such compromise. He is even more strongly opposed to giving the Commission the rate-making power in any form than are most of the officials of the railroads. His opposition is based on the ground that conferring this enormous power on a political administrative body would be a dangerous departure from the fundamental principles on which the government of the United States is founded and that it is possible to provide for the effective and speedy correction of every unreasonable rate and every railroad abuse through the courts of the United States without resorting to a measure that he would regard as little short of revolutionary.

J. C. W.

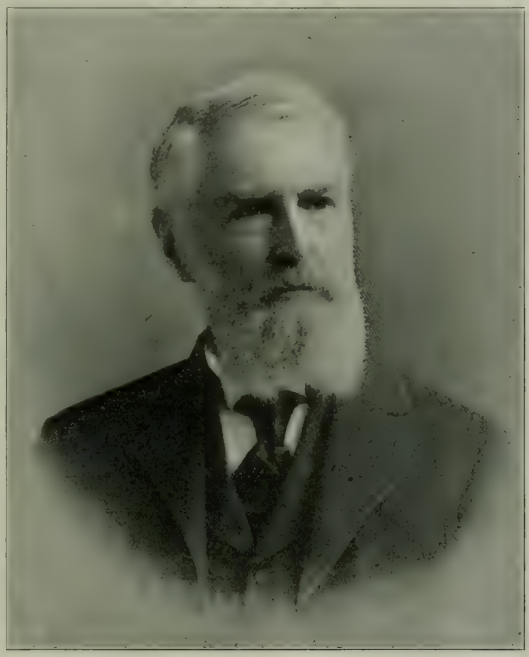
The Charing Cross Roof Failure.

Engineering in its issue of December 8 gives some meagre facts about the collapse of part of the train shed roof of the Charing Cross Station, London, which occurred on December 5 and killed and injured a number of persons on the platforms underneath. The information available seems to effectually refute the theory advanced that the cause of the failure was the weakened condition of the truss members resulting from the corrosive action of the gases rising from locomotives to which the structure has been exposed for 45 years. The train shed was built in 1860 from the designs of Sir John Hawkshaw. The roof structure consists of braced arches of 130 ft. 6 in. span with a rise of 45 ft. spaced 35 center to center and carried on brick side walls. Between the arches the glass roof is carried by 18 latticed purlins, 1 ft. 7½ in. deep, which support light T-iron frames in which the glass is bedded. The arch rib of the main trusses consists of a single plate 18 in. x ½ in. with 6-in. x 3-in. x ½-in. angles. The bracing truss consists of struts and diagonals made up of two 6-in. x 3-in. x ½-in. angles and bottom tie rods of round iron varying from 4¾ in. to 4⅝ in. in diameter. No member of the main trusses is less than ½ in. thick and all members are wrought iron, of supposedly good quality. The structure has been painted from time to time as it seemed to require it, and there were no superficial evidences of weakness at the time of the failure. The arches are fixed in the masonry at one end and carried by a suspended link at the other and not on roller bearings. The end truss and the one next to it fell at the time of the collapse. The first fracture is said to have taken place in one of the tie bars of the second truss about one-quarter of the way out from the west wall, and the loud snap of this member gave warning to several men below who escaped. This tie bar was originally 4⅝ in. in diameter. There was no wind at the time the accident happened or any load on the roof other than the normal dead load. Assuming that the arches were designed with a factor of safety of 3, the reduction of effective cross-sectional area in the tie rod to account for the failure would correspond to a reduction in diameter of nearly 2 in. Of course, some other members of the truss may have wasted away under corrosive action and thrown an exceptional stress on the tie bar which failed, but this is doubtful. That vague, but well-known phenomenon, fatigue of metal, is a much more likely explanation of the failure than corrosion. It usually occurs under just such circumstances as this, minimum load and no apparent preliminary signs of fracture. There is one strong lesson to be learned from this accident. Engineers must not put too much faith in the quality and strength and endurance under heavy loads of steel and iron. The factor of safety should be taken high enough to prevent overloading with resultant fatigue. A saving of a few pounds of metal in the beginning is not balanced by the collapse of the structure many years later when the overloaded members give way and break without warning. The engineers of years ago knew little or nothing about fatigue of metals." Since the experiments of Wöhler, Spangenburg, Thurston and others, the theory has become generally accepted but too frequently neglected. If within the next few years other structures of this kind and age fail under similar circumstances then it will be time to look carefully into the condition of all the more modern structures. We know comparatively little about the subject and to be on the safe side should follow the axiom of whist players, "When in doubt play trumps." As for corrosion we need worry but little. It is what takes place inside the metal that is uncertain. The outside shows for itself.

General Herman Haupt.

The death of this distinguished engineer, whose life has covered the development of the railroad epoch of this and other countries, occurred on the morning of December 14, while returning, with his son, from New York to Washington, where he resided. A long career so full of experience is of great interest, for through his fertility of resource great problems in the art of transportation have been solved.

General Haupt was born in Philadelphia on March 26, 1817. His father died when he was but 12 years old and left a widow with a family of seven children to be cared for. There were no free schools so that the youth earned his tuition by mending quill pens and caring for the fire in winter. At the early age of 13 he received an appointment from President Andrew Jackson to the Military Academy. He entered the next year and graduated in 1835. He was one of the youngest to enter the army and was the senior alumnus at the time of his death. In 1838 he married Ann Cecilia Keller, the daughter of the Lutheran pastor at Gettysburg, where he established a seminary for boys and subsequently for girls, until elected Professor of Mathematics in Pennsylvania College in 1844, which position he held until called to revise the location of the Middle division of the Pennsylvania from Harrisburg, Pa., to Altoona, in 1847. Prior to this he had been engaged on the Norristown & Valle Railroad under Henry R. Campbell, in 1835, and the next year, although only 19, he was appointed Assistant Engineer in the state service and located the line from Gettysburg to the Potomac, across the South Mountain, which is now a part of the Western Maryland. Thus it was he met his wife, and they gave to the world 11 children, of whom seven are still living. In 1840, he was engaged on the York & Wrightsville, and here he began the investigation of the strength of the old lattice trusses leading up to his first essay entitled "Hints on Bridge Construction," which provoked much discussion and led to the more elaborate work published by the Appletons in 1851, which soon became the standard work on the science of bridge construction. In 1848 he was made Principal Assistant to J. Edgar Thomson, and on the opening of the division he was placed in charge as Superintendent and prepared the system which has served as the basis for the magnificent development of the road. In the annual report of 1853, Mr. Haupt said: "To secure a traffic of 3,000,000 tons and make the road an instrument of incalculable good to the citizens of the state, low rates with moderate dividends, must indicate the settled policy upon which the operations are to be conducted." This was at a time when the possibility of so great tonnage was thought to be Utopian.



Herman Haupt

Under his supervision as Chief Engineer, the entire road was opened to Pittsburg, and, in 1855, he was asked to act as Consulting Engineer for the Hoosac Tunnel. He soon discovered that to make it a success it would be necessary to surrender his important interests in Pennsylvania and give his undivided attention to the great problem of connecting the seaboard of the eastern states with the granaries of the West by penetrating the mountain by a five mile tunnel. This required the complete reorganization and financing of a project then unprecedented in magnitude, and which was violently opposed by rival interests. This work was successfully inaugurated and was progressing satisfactorily when the civil war and a change of administration called for the services of a man of experience and integrity to maintain the communications with the armies in the field. He was appointed, by President Lincoln, Chief of the Bureau of Military Railroads, and he organized construction corps and systems for the rapid destruction or construction of railroads and bridges, as necessity demanded. His achievements were great because of the incredibly short time required to restore interrupted communications and this system made Sherman's march to the sea a possibility. He foresaw and correctly interpreted General Lee's strategic movement after Meade had relieved Hooker as Commander of the Army of the Potomac, and by early information and rapid movements succeeded in having the position at Gettysburg, with which he was so familiar, held and made impregnable. It is said that if his urgent entreaties had been heeded, the defeated army could not have escaped to Virginia and the war would have been ended at once. Tirelessly, by day or night, without consideration of personal comfort or necessities, he perfected his bureau and its personnel and the opening up of communications with the front so that he was early offered a commission as Brigadier General "for faithful and meritorious services."

The Hoosac tunnel exigencies required more rapid work than was possible by hand labor and led to the invention and successful introduction of his portable, percussion drills, afterwards so successfully used in the great European tunnels through the Alps, under the name of the McKean Rock Drill. Another of Haupt's achievements was the securing of a continuous right-of-way for a pipe line from the oil regions to the seaboard, prior to the existence of any general laws, and the subsequent building of a line which reduced the cost of transportation on this important commodity from 40 to 4 cents a barrel. This was accomplished at a time when the independent producers could secure no sufficient railroad transportation. Since its success, general pipe-line laws have been passed and the system is now in extensive operation. Another of the impulses which this many-sided engineer gave to his profession and the world, was the practical introduction of compressed air for motors and mining machinery and for power, when transmitted long distances, under high potentials, from cheap water-power plants. In 1881 he was appointed General Manager of the Northern Pacific, which position he held until 1884, after the completion and opening of the line in the fall of 1883. He secured the great terminals, so necessary for the rapid handling and interchange of freight. His judgment was severely criticized when he urged the purchase of the Powelton estate, on the west bank of the Schuylkill, for the Pennsylvania road, at a time when it was thought to be wholly unnecessary, but this land to-day constitutes a small part of the present yards of that company. To facilitate the movement of freight at the western end of the State of Pennsylvania, he also designed a system of improvements in the Ohio river for the creation of a 6-ft. stage, at all seasons, which the river interests proposed to construct at a cost of $1,000,000 between Pittsburg and Wheeling, but the control of the works of this class by the Government prevented the project from being carried out, at the time. In 1879 he was also President of the U. S. Hydrogen Co., organized to generate and apply that element to metallurgical and heating purposes. He was actively interested in the Holly system of steam heating and the application of the physical sciences to the arts.

His later years have been spent in the evolution of a pure, cheap, and nutritious food from the waste products of the dairy, so that humanity might have a "well balanced ration," at a reasonable cost, which could be readily used and transported to all parts of the globe and be of service in the army, navy, at sea or on land, in homes or hospitals, in short, wherever pure milk is required, and which would keep for months without decomposition. It was in making a visit to the works of the National Nutrient Company in Jersey City that he was overtaken by the heart failure, which terminated so laudable a career.

His later years have been devoted to social, humane and scientific study and writing, and it was his purpose, if his life had been prolonged, to prepare a series of papers on these topics. At the solicitation of friends he has published in his "Memoirs" some of the principal events of the Civil War and

the system used by his corps in an illustrated subscription volume.

As a man General Haupt was unostentatious, domestic, loving, tender-hearted, upright in all his dealings with his fellow-men, having a keen sense of justice, righteousness and obligation to duty regardless of appearances, faithful to every trust, and in every act inspired by his strong faith in the brotherhood of man and the Fatherhood of God. His life has been an honor to his profession and a blessing to humanity. He was an instance of a man whom the Lord delighted to honor.

Interstate Commerce Commission's Annual Report.

Secretary Moseley has issued a synopsis of the Nineteenth Annual Report of the Interstate Commerce Commission, from which we extract the following paragraphs:

The Commission sets forth the general reasons for proposed amendments in the form of a bill, which has been submitted to the Senate Committee on Interstate Commerce in compliance with a request therefor. This bill has been abstracted in the *Railroad Gazette* (December 8, p. 529). The most important amendment is delegation of authority to the Commission to determine what rate should be substituted for the future in place of one found, after-hearing, to be unlawful, with the further provision that the order of the Commission prescribing such substituted rate shall take effect within a reasonable time. The Commission recommends that the phrase "under common control, management or arrangement," in the first section of the law, be omitted. This would make the regulating statute apply to certain classes of carriers now exempt from its application and rquirements. The definition of the term "transportation" should be enlarged so as to include the charges for various services, such as refrigeration and the like, which are now claimed to be beyond the authority of the Commission. The obligation to furnish and provide the services here referred to is also proposed, which is likewise a point now in dispute. For perishable commodities artificial refrigeration is necessary, and the ice is just as essential as the hauling of the car. The owner of the commodity transported cannot provide the refrigeration, and the consequences of an exorbitant icing charge are precisely as serious as the same kind of extortion would be in the transportation charge itself.

The furnishing of refrigeration is a part of the transportation itself, and the Commission recommends that these charges should be put on the same basis as all other freight charges, so far as they can be.

While the third section of the act to regulate commerce attempts to secure the interchange of traffic by connecting railways, carriers are now under no legal obligation to establish through routes or joint rates and may, at their pleasure, withdraw from such arrangements, thus defeating the purpose of the law. To prevent this the Commission should have authority to order railways to continue through routes and joint rates which are in effect and to prescribe divisions in case the carriers fail to agree, discriminations against individuals and against particular species of traffic can be effected by the refusal of a carrier to establish a joint rate.

By means of terminal roads, elevators and private cars, the carrier, by paying owners an extravagant sum for the service prefers him to other shippers of like property. This may happen in any case where the shipper is the owner of any of the facilities of transportation or performs any part of the transfer service. These methods are at the present time more or less resorted to with the effect of preferring one shipper to another. The Commission should be empowered in a case of this kind to determine whether the allowance to the property owner is a just and reasonable compensation for the service rendered, and to fix a limit which shall not be exceeded in the payment made therefor. Such a remedy would not be altogether adequate, and any remedy is extremely difficult of application, but nothing better appears to be available.

An efficient means of discovering illegal practices would be found in authority to prescribe the form in which books of accounts shall be kept by railways. This recommendation has been urged upon the attention of Congress in previous reports, and it is earnestly renewed at this time. Probably no one thing would go further than this toward the detection and punishment of rebates and kindred wrongdoing. Certain carriers now refuse to make the statistical returns required by the Commission. Admitting the right of a railway company to use its money as it sees fit, it is certainly proper that the Government should know what use is made of it, and whether the rates and charges imposed are legitimate. The Supreme Court has held that the Federal courts have no power to compel the making of these returns by mandamus, and the act itself imposes no penalty of consequence for failure to make the returns. The proposed bill provides a suitable penalty for unreasonable failure to make these returns and that the Federal courts shall have statutory authority to act by mandamus.

A new section is proposed to be added to the law to expressly authorize the Commission to review and modify its own decisions. The last paragraph of the new section limits the duration of an order of the Commission by providing that an order which has been complied with for the period of one year shall not thereafter be in force as against the carrier so complying.

In 1903 and 1904 the Commission explained the Elkins law, and made favorable comments upon its operation; but further experience compels the Commission to modify in some degree those hopeful expectations. Various devices for evading the law have been brought into use, and the actual payment of rebates as such has been here and there resumed. Instances of this kind have been established by convincing proof, on which prosecutions have been commenced and are now pending. More frequently the unjust preference is brought about by methods which may escape the penalties of the law, but which plainly operate to defeat its purpose. While this does not imply any want of satisfaction with the act of 1903, which is regarded as a most admirable measure, nor any belief that there is a general return to former practices, it does mean that this type of evil has by no means disappeared and that it is liable to increase unless effectively restrained.

The Commission recommends that the accident report law of 1901 be amended so as to require that accidents of every kind and to all classes of persons shall be included in the monthly reports. Accidents could then be omitted in the annual reports.

The report shows 568 complaints filed with the Commission during the year, including both formal and informal proceedings; investigations on formal complaint, 65, involving the rates of 321 carriers. Seventy-nine hearings and investigations were held in Washington and other cities. Six cases were settled through concession of relief by the carriers and 22 cases were discontinued.

Forty-five formal decisions have been rendered during the year. This number, greater than in any previous year, includes cases of unreasonable rates, discrimination between localities, between commodities, and between persons and also in facilities of transportation, with some cases involving departure from published tariff rates and some relating chiefly to reparation. Nearly every kind of action prohibited by the regulating statute has been the subject of decision and order during the past year. Eleven of the cases are discussed in the report.

Proceedings for injunction under the Elkins act have been begun in the Santa Fe rebate case, the case against the Milwaukee Refrigerator Transit Company, and the Pabst Brewing Company and the Chesapeake & Ohio coal case.

Criminal indictments have been returned in the western district of Kentucky against Zorn, Williams and Bushfield, alleging acceptance of rebates. Samuel Weil, B. S. Cusey, V. D. Shipworth and C. E. Todd, of the Schwarzschild & Sulzberger Company, have been convicted for conspiring to obtain transportation at less than the published rates. The defendants were sentenced to pay fines amounting to $25,000. Cases against the Western & Atlantic and against the Illinois Central and others based upon alleged pooling have been discontinued. The court decisions which have been rendered during the year, construing the act to regulate commerce, are briefly stated in the report.

STATISTICS.

The preliminary income report for the year ending June 30, 1905, includes returns for 752 companies, representing an operated mileage of 214,477.82 miles. The gross earnings of the railways on the mileage were $2,073,177,325; passenger, $572,109,366; freight, $1,449,182,702; miscellaneous, $51,885,257. Gross earnings from operation averaged $9,666 per mile of line, which is higher than ever before. The final report for the year ending June 30, 1904, showed total gross earnings of $1,975,174,091, or $9,306 per mile. The operating expenses of the railways embraced in the current preliminary report amounted to $1,383,584,404, or $6,451 per mile of line. The preliminary report shows net earnings, $689,592,921; and for the year ending June 30, 1904, $634,674,561. The present report shows $114,636,642 received in the form of income from investments in the stocks and bonds of railway and other corporations and from other miscellaneous sources, making total income, $804,229,563. The aggregate deductions chargeable against this income were $713,994,800. The principal items included in such deductions were interest on funded debt, rents of leased lines, permanent improvements charged to income, taxes (which were $58,533,381) and dividends. Thus the surplus resulting from the operations of these roads was $90,234,763. The complete report for the year ending June 30, 1904, covering both operating and leased roads, showed a surplus of $56,729,331, and the like report for 1903 a surplus of $99,227,469.

The present report shows dividends to the amount of $196,080,237; dividends declared by practically the same roads in 1904 were $184,313,472; increase $11,766,765. The preliminary reports are confined to operating roads, and so exclude dividends declared by subsidiary companies.

The Commission has included in its report some extracts from the recently issued report on the "Commercial valuation of railway operating property in the United States," prepared by the Bureau of the Census. (*Railroad Gazette*, August 18, p. 168.)

SAFETY APPLIANCES AND ACCIDENTS.

Within the past year decided improvement has taken place in the condition of safety appliances on all roads subject to the pro-

visions of the statute, and at no time since the safety appliance law became effective have the results of its operation been so satisfactory as at present. The courts have clearly defined the statute, leaving no room for doubt concerning its application, and the practice with regard to safety appliances is now substantially uniform throughout the country. Another important factor in the betterment of conditions is the abrogation of local agreements at many prominent interchange points, whereby carriers, with the idea of facilitating the movement of traffic, received and delivered cars in defective condition. This action resulted from conferences held with railroad officials at the instance of the Commission. The rule now coming into general observance is that cars will neither be received from nor delivered to connecting roads when safety appliances do not in all respects meet the requirements of the law.

There is a noticeable tendency toward uniformity in couplers and uncoupling attachments and an increase in their strength, decreasing the number of defects. Grab irons are receiving much better attention than formerly. Sill steps, ladders and roof hand holds, when defective, introduce a great element of danger, and these appliances should be covered by the statute.

The great progress in the use of air brakes has been accompanied by marked deterioration in the condition of hand brakes, which may be needed in times of emergency. There is still room for improvement in the maintenance of retaining valves.

On October 1, 1905, out of a total of 1,790,113 freight cars 1,564,396 were equipped with air brakes. About 111,122 private cars are also practically all equipped with this appliance. The Commission has ordered that on and after August 1, 1906, a minimum of 75 per cent. of the cars in all trains required to be operated by power brakes must have their brakes used and operated. This is in lieu of the present lawful minimum of 50 per cent. It is expected this increase will hasten the abandonment of old and light cars which are a menace to safety.

With few exceptions carriers have cheerfully co-operated with the Commission in its efforts to secure compliance with the law, such violations as the Commission has been compelled to report for prosecution being due to laxity of subordinate officials or employees in the performance of their duties, or to their failure to observe instructions, rather than to willful intent of responsible officials to evade or resist the law.

The Commission employs 18 inspectors. With this small number delay in the investigation of complaints is inevitable, subjecting the Government to the charge of laxity to the administration of the law. Some roads complain that successive charges of violation are brought against them, while other roads, which are perhaps greater offenders, escape without prosecution. This is due entirely to insufficiency of the inspection service. The list of roads against which prosecutions have been entered represents merely the area of activity of the inspection service. As a matter of fact, conditions may be vastly better on many roads that have been prosecuted than on roads which have entirely escaped prosecution. Many lives have been saved and many injuries averted through the administration of this law, and a necessary element of proper administration is the maintenance of an adequate inspection service.

Concerning hours of labor on railroads, the Commission refers to the need of a high standard of physical and mental condition for certain classes of employees and care on the part of supervisory officers to see that proper regulations are maintained; but it appears that rules on this subject have been very poorly enforced.

The accidents shown in the monthly reports made by railroads under the law of March 3, 1901, have been regularly published in the Commission's quarterly bulletins. The block system, the lack of which is the cause of those accidents in the most numerous class (rear and butting collisions) is again recommended. The Commission further recommends that the Government should investigate train accidents and promptly furnish the facts concerning them.

The Cost of Locomotive Operation.

XVIII.

BY GEORGE R. HENDERSON.

(*Continued from page 520.*)

FIRING UP AND CALLING.

Firing-up is done in a variety of ways. The old method was to use wood—scrap or cord-wood, as was available, and even to this day we see piles of fire-wood about the roundhouses. A common allowance was one-eighth of a cord to a fire, and if wood costs $2.50 a cord, which is a common price in some localities, the material used would represent about 30 cents.

Fuel oil is quite a favorite method nowadays, and reports are made which indicate a very low cost (about 3 cents per fire), but as a matter of fact, the oil is used to ignite the coal, and we may not obtain the same heating effects as with the wood, and it is only proper to charge an amount of coal that, with the oil, would equal the heat of the wood. It is often an advantage, moreover, to obtain wood ashes on the grate, as with some coals, the oil blast has a tendency to fuse them and form a clinker on the grate bars. The amount of coal used in addition to the wood or oil has been given as low as 500 lbs. and as high as 1,500 lbs., as much depends upon the size of engine, etc.

The cost of the fuel has already been discussed, therefore the labor will be considered here only. The question of firing up engines in a roundhouse is of much importance and must be done by a careful man—boilers have been ruined by incompetent hands building a fire in a boiler that contained no water. After the fire has been lighted, the engine must be watched until taken from the house, and the attendant must see that the water level is maintained, and that the boiler is not allowed to blow-off. One fire builder can attend to a roundhouse turning perhaps 40 engines in 24 hours, that would be 20 fires to start during his watch, or about half an hour's attention per locomotive, and as such men are paid low wages, the labor would probably amount to 10 cents for each fire started. The exact amount will depend on the detail arrangements but the amount is such a small proportion of our operating expenses that it will hardly pay to discuss it further.

Calling is generally performed by boys or young men. The former earn about $15 a month—sometimes $20, and they are usually expected to possess a bicycle. If a call takes 15 minutes, as two men must be summoned for each engine, there would be a total time needed of one-half hour per engine, so that the cost of such work should not run over 3 or 4 cents to each locomotive despatched. Between calls the boys do office work, so that the actual expense is trifling.

Handling.

It is usual to group the various items considered in the last articles under the general term of "Handling Locomotives," by which is meant the various duties performed during their stay at a terminal, exclusive of repairs. Sometimes the labor of the coal chute attendance are included, and also boiler washers, but these are actually chargeable to the fuel and water accounts; but although the former is frequently so charged, the latter seldom is treated in this manner.

If we summarize the different items in accordance with our review we find as follows:

Hostlering	50 cents per engine.
Turning	5 " " "
Cleaning fires	15 " " "
Wiping	50 " " "
Inspecting	15 " " "
Firing up	10 " " "
Calling	5 " " "
Total	$1.50

Inspection of a number of performance sheets of several prominent roads, both eastern and western, shows an average of about 1.3 cents per mile for the different roads. The average mileage per month is perhaps 3,600, which would mean 120 miles a day, and assuming that each engine would reach a terminal once a day we have $120 \times 1.3 = \$1.56$ as the costs, which compares closely with an estimate of $1.50 above given.

The statement of costs found in the *Railroad Gazette* of Feb. 19, 1904, indicates a wide variation—from 13 cents to $1.80. It is evident that the first figure is worthless. The average for the items enumerated above and for 11 roads reported in the article mentioned, is $1.36 per engine. If washing out is frequent and is also charged to this account, as well as the labor on coal trestles, then the total will probably be nearer $2 an engine than $1.50. Under any circumstances, the variation, considered as a percentage of the total cost of operation, will be insignificant, but even this discrepancy can be reduced if we know the conditions existing at the terminal points and make corrections accordingly.

It will be noticed at once that these several items, comprised in the general term "handling" are all practically independent of either the distance traveled, the speed attained, or the load hauled, unless the run is so short that cleaning fires and wiping are eliminated, as in the case of brief turn-around trips. Otherwise the cost of terminal expenses is a definite one, and would be as heavy for an engine which had made a 100 mile trip as for another which may have run twice this distance. This leads us at once to the proposition that we cannot decrease these charges by any variation in speed or train load, but by making a greater mileage or a longer trip between terminals, these items may be reduced on a mileage or a ton-mileage basis.

For some years it was customary to divide a road up into engine divisions of about 100 miles each; nowadays the tendency is to increase this to 150 or 200 miles. There is a limit to the length in that the freight trains may not be able to cover it in sufficient time so as not to exhaust the crews. The writer has known of 200 mile divisions that have required over 40 hours for their traverse, which is very excessive. If 12 miles an hour be maintained between terminals (including lay-outs) it will require 12 to 13 hours to make a trip of 150 miles under ordinary conditions, and if unusual delays occur, this will easily extend to 16 or 18 hours, which is quite long enough—too long in fact—for men to stay continuously on duty. With a double-track road, and not too

much passenger traffic to clear, 200 miles can be handled to good advantage, but with single track it is likely that 150 miles is about the maximum length that it would be wise to use for engine divisions in freight service. Passenger runs can be considerably longer, and are often arranged to cover two freight divisions.

Applications.

The application of the foregoing to actual practice is, of course, the important result for which this study has been undertaken, and in order to make this clear a number of hypothetical cases will be worked out, so as to fully illustrate the method of procedure under different circumstances.

Let us see how the investigation will generally be brought to a start. A division of a road exists with a certain combination of grades and levels, curves and tangents. To handle the traffic over this division, a number of locomotives have been provided of definite type or types. There is probably (at least at times) all the freight that can be comfortably hauled by the number of locomotives assigned to that division. The problem, then, that confronts the transportation official is two-fold: To haul the freight at a minimum cost and to obtain the maximum amount of work every month (or week) out of each locomotive in working order. It may be that in working for one result, say low cost, the maximum ton-miles may not be gotten out of the engine; then it will depend upon the amount of business offered, whether it is most desirable to haul more freight at a higher cost, or less at a reduced cost. In times of traffic congestion there is no hesitation in accepting the first alternative. But, as will be shown, it may sometimes happen that not only a low cost per ton-mile, but a high monthly movement per engine can be obtained by judiciously fixing train loads and speeds, and when this is possible of accomplishment, we have obtained the schedule of maximum efficiency, both as to cost and quantity of traffic moved.

As may be expected, the computations necessary for analyzing this subject are lengthy and complicated, but there is so much to be gained by a proper knowledge and observance of the laws involved, that it is well worth the amount of study required. It is evident that there may be any number of operating divisions differing one from the other, and a variety of engines may be placed upon them, so that it would be impossible to present more than a few typical cases. We shall therefore assume certain profiles and consider that they are operated by locomotives of a uniform standard, and it will be clear from what has gone before that any combination may be worked out in a similar manner.

(To be continued.)

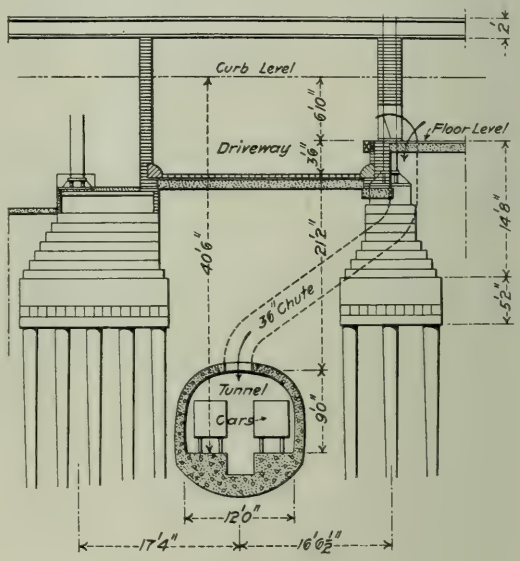
Mail Handling Facilities of the Chicago Freight Tunnels.

The Illinois Tunnel Company, owning the Chicago freight tunnels, has a contract with the United States Government for the transportation of all classes of mails between the general post office and the railroad stations, and also between the stations. A map of this tunnel system was published in the *Railroad Gazette* July 28, 1905, and showed it to reach all of the principal passenger terminals of the city. The arrangement for carrying the mails requires special connections and facilities at all of these terminals and at the post office, which occupies the square bounded by Jackson boulevard, Dearborn, Adams and Clark streets. In order to obtain a suitable arrangement at the latter place the tunnel company applied to the Government for permission to construct a tunnel under the building at the grade of the existing tunnels, through from Adams street to Jackson boulevard, beneath the driveway under the building, where there were no piles. A commission of engineers was appointed to determine whether such a tunnel could be made without endangering the building foundations in any way. This commission consisted of Gunwald Aus, former Chief Engineer U. S. Supervising Architect's office, Kort Berle, his successor, and General William Sooy Smith, C. E., Chicago. Messrs. Aus and Berle were, of course, familiar with the plans of the building, and General Smith had superintended the construction of its foundations. After careful examination and study of the plans and conditions the commission reported favorably, expressly stipulating, however, that extreme care be exercised in the execution of the work. Permission was therefore granted to build the tunnel under the supervision of an engineer appointed by the Government, General Smith being selected to serve in this capacity.

A transverse section through the tunnel at the center of the building is shown herewith. The purpose of the tunnel is to enable the tunnel cars to be run under the building and unload their contents into a conveyor which discharges in the distributing room; also to receive outgoing mail through suitable chutes, as shown by the drawing. The driveway above the tunnel is the one used by the mail wagons in receiving and delivering their loads.

The building is supported on 5,020 piles, driven without sharpening, to bed-rock or hard-pan. The material through which the tunnel passes is clay of sufficient stiffness and strength to permit its excavation in short sections to a distance of 6 to 10 ft. in advance of the concrete lining that was put in each of these sections as soon as the excavatian was made. A centering of tongued-and-grooved 2 in. plank supported by heavy steel ribs 2 ft. 6 in. c. to c., was put in and the concrete lining resting upon this centering was well tamped, filling the space between the centering and the surrounding surface of the clay. This concrete was 2 ft. thick at the crown of the arch and increased to 2 ft. 6 in. at the springing line. It consisted of 1 part Atlas Portland cement, 2 parts clean sand and 3 parts crushed granite of 2 in. maximum dimension, thoroughly mixed by machinery. It set very hard within four days so that the centering could be safely removed after the expiration of that time; although for the most part it was not taken out in less than a week from the time it was put in place. The work was prosecuted from each end toward the center simultaneously and whenever it became necessary to stop work on either end temporarily the face of the heading was planked and strongly braced to prevent any possibility of slipping.

So carefully was the work done that not the slightest amount of slippage in the surrounding materials occurred. Any such movement was guarded against with the utmost care, as had it been allowed to occur even slightly it undoubtedly would have increased with suddenness, exerting a considerable lateral pressure on the adjacent piles. Any bending under this pressure might have resulted in breakage of the pile under the load carried, permitting settlements and consequent damage to the building. General Smith

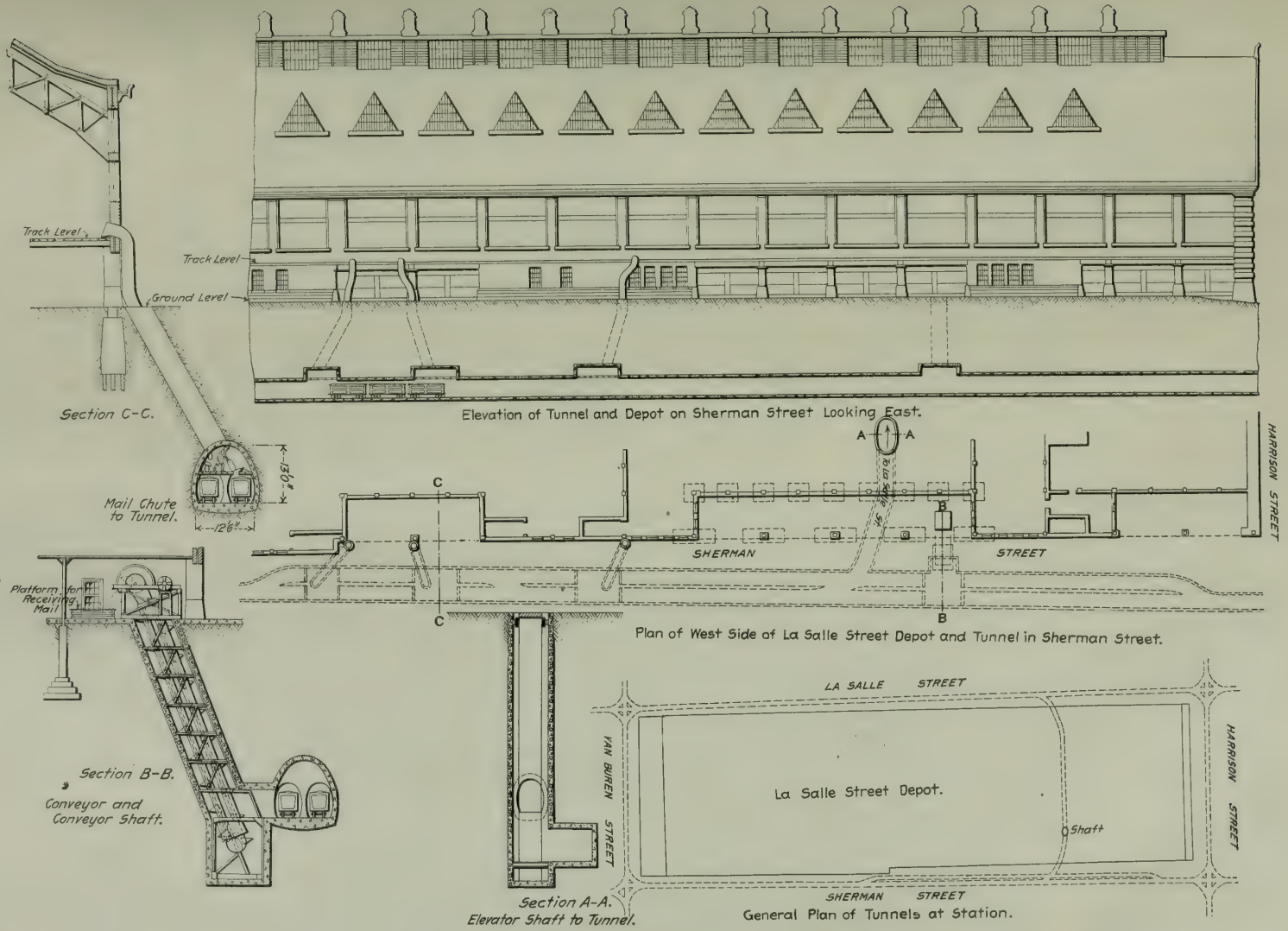


Transverse Section at Center of Building.

was assisted in the work by D. A. Graham, and by F. E. Lockwood, in the employ of the Government.

At the present time connections are being made at two stations: La Salle street, which is the Lake Shore-Rock Island terminal, and Union station, on Canal and Adams streets. The La Salle plan is illustrated herewith as typical. From the general plan it will be seen that the existing tunnels surround the station on all four sides. For convenience of handling the cars and to facilitate the handling of baggage, also included in this plan, a cross-connection is being driven under the train-shed from Sherman street to La Salle street. Under Sherman street, for practically the length of the train-shed, a second bore is being driven, giving a double track arrangement with crossovers between the two tracks.

Outgoing mail will be delivered by the tunnel cars to a conveyor, which automatically delivers it onto a receiving platform in the mail room under the elevated tracks of the terminal. The details of the arrangement are shown at section B B. For incoming mail three chutes are provided at suitable points toward the inner end of the train-shed, as shown by the plans, for delivery to the tunnel cars. The mouths of these chutes are just above the track floor of the train-shed and they pass through the west wall of the latter. Each chute discharges on a platform at the level of the tunnel top, the mail pouches being dropped through traps in the platform into the cars. Headroom above the platform is provided by enlarging the excavation at this point to the width of the twin bore, 12 ft. 6 in., and a height of 13 ft. From the cross-over tunnel to La Salle street an elevator shaft will connect with



Chicago Freight Tunnels; Connection With the General Post Office.

the room above. In it will be installed an electric baggage elevator of 20,000 lbs. capacity and a speed of 100 f.p.m.

The amount of mail to be carried daily by the tunnels when the system is in full operation is estimated at 700 tons. It is hoped that the service can be inaugurated by the first of January or shortly thereafter. The cars to be used in this service were described in the *Railroad Gazette* June 24, 1904. They were designed by Mr. W. P. Bettendorf, of the Bettendorf Axle Company, Davenport, Iowa.

The work at the stations is in charge of Mr. George W. Jackson, Chief Engineer of the Illinois Telephone Construction Company, who kindly furnished the plans of the La Salle street station arrangement. We are indebted to Gen. Wm. Sooy Smith for the drawing and information relative to the work at the general post office.

Electrification on the Pennsylvania Railroad.

The following is the official statement by the General Electric Company: Hitherto the electrification of steam roads has been confined practically to terminal facilities and local service over short distances, so that the recent decision of the Pennsylvania Railroad to equip electrically a portion of its system between Camden and Atlantic City, New Jersey, is of the greatest interest. The developments which have taken place at New York under the direction of the New York Central and New York, New Haven & Hartford railroads have focused the eyes of the engineering world on this branch of railroad engineering. This further advance of electric traction, coming as it does when this special phase of railroading is fresh in the minds of the engineers, marks another milepost passed in the march of progress of electric traction.

That portion of the Pennsylvania Railroad about to be electrified, comprises sixty-four miles of steam road lying between Camden and Atlantic City, New Jersey. The route includes the station of Newfield, between which city and Camden there is already a double track roadway. The double tracking will be continued to Atlantic City, following the line of the single track already existing between that city and Newfield. Over this double track line an express electric service will be established, cars having a headway of fifteen minutes and making the run from Camden to Atlantic City in eighty minutes without stops. The maximum speed of the cars will be between 55 and 60 miles per hour.

In addition to the through service to Atlantic City there will be a half-hourly local service, consisting of trains of two cars between Camden and Millville, 40 miles, and ten-minute service of single cars between Camden and Woodbury, 8½ miles. Full service will call for 58 hours in operation, each equipped with two 220-h.p. direct current motors, known as GE-69. The motors will be similar to those now being manufactured by the General Electric Co. for the equipments of the New York terminal of the New York Central & Hudson River Railroad. These motors will be controlled by the Sprague-General Electric automatic multiple-unit system, which will permit the operation of cars in trains, all of the motors being under the control of the motorman in the cab of the forward car.

The third-rail system will be used throughout, except on the section between Camden and Woodbury, and Newfield and Millville, where the cars will be run on overhead trolley, the speed on these sections being less than on the main line.

Power for the operation of the cars will be supplied from a power house located at Camden, containing three 2,000-k.w. General Electric-Curtis turbines of the three-phase alternating-current 25-cycle type. Transmission at a potential of 33,000 volts will be made to six substations between Camden and Atlantic City, and the seventh substation at Millville to supply that section of the line between Millville and Newfield. A total capacity of 11,000 kw. in rotary converters is provided in the substations delivering direct current to the third-rail at a potential of 650 volts. Individual units will have a capacity of 750 k.w., and will be of the standard General Electric type. They will be started from the alternating current end by means of taps on the step-down transformers in accordance with standard General Electric practice.

A New Railroad in Ecuador.

The Government of Ecuador will build a railroad from Ambato, in the province of Tunguraughua, to San Antonio, at the head of navigation on the Curaray river, 120 miles. The object is to develop the rich district east of the Andes mountains, which abounds in cedar, rosewood, rubber and the many hard and dye woods characteristic of the upper Amazon country, and which is at present inaccessible through lack of transportation facilities. The new line will also shorten the distance for transporting the upper Amazon rubber, by connecting with the Guayaquil & Quito Railway at Ambato, thence to the port of Guayaquil on the Pacific side, making a haul by rail of 277 miles, and the entire distance to New York 4,000 miles, instead of 7,000 miles, as at present by way of the Amazon river. Besides the many valuable woods, the soil is exceedingly rich and the climate healthy.

Starting at an elevation of 8,500 ft. at Ambato the road will follow the valleys of the Rio Ambato and Rio Pastaza to a point near the town of Barrancas, a short distance from the gold country, thence across the Barrancas plains to San Antonio on the Rio Curaray, at an elevation of 2,700 ft. The maximum grade will be 2 per cent. compensated, for a maximum curvature of 7 deg. The gage will be 42 in.

Eventually electricity will be the motive power. The cascade of the Rio Pastaza has a sheer drop of 198 ft., capable of developing 260,000 h.p. in the dry season, which lasts from March until December. Three other falls conveniently located on tributaries are capable of 10,000 h.p. each, assuring abundance of power.

The estimated cost of construction and equipment is $6,000,000 gold, which the Government will appropriate from special funds for this purpose, $1,000,000 of which will be spent during the coming year. In a few weeks a plant necessary to put 2,000 men at work will be purchased in this country, and it is expected that actual work will commence in three months.

The Government has appointed a commission of seven, including members of the different political parties, to supervise this work, headed by Luis A. Martinez, Director General of Public Works, of Quito. The reconnoissance was made by Chas. H. Moore, First Assistant Engineer of the Erie Railroad, who recently returned from Ecuador, and details of the survey have been worked out by his assistants, W. G. Fox, formerly division engineer on the location of White River branch of the Missouri Pacific, and W. A. Welch, formerly resident engineer, Pittsburg, Shawmut & Northern.

Shop Fads and Fancies.

In a paper read before the Western Railway Club at the October meeting Mr. W. E. Symons called attention to the expensiveness of certain shop fads and fancies, and showed how much trouble had been created by seemingly insignificant mistakes. He told of one lot of locomotives that had been carefully designed and inspected, but upon being placed in service were found to be very unsatisfactory because of high fuel consumption. The application of the indicator showed an exceedingly defective steam distribution, due to excessive clearance; when it was found that the pistons were 5 in. thick instead of 6 in. For temporary relief the eccentrics were given more angular advance, thus providing about ¼ to $^{7}/_{16}$ in. lead until pistons of the required thickness could be secured. Following this the eccentrics were moved back to normal positions, providing about $^{3}/_{32}$ lead. It is worthy of mention in a comparison of the engine performances before and after the change had been made, where conditions of speed, etc., were about the same, that there was a gain of 96.73 horse-power in one case and 42.9 in the other, and this with about 25 per cent. less fuel, engine running cool and using about one-quarter less water.

It requires only a slight arithmetical calculation to find how many thousand dollars half a dozen engines in this condition would waste in one year, even on a road of some considerable size where no such structural defects exist, even where the question of value, adjustment and steam distribution has been passed by, on account of "our standards," or the idea that as long as "she sounds square it's all right." It is a fair guess to say that 20 per cent. on hundreds of thousands of dollars could be saved by going into the matter in both a "theoretic" and "practical" manner, that would not conflict with sound engineering principles.

Another case was cited where badly steaming engines, whose delays were invariably attributed to poor coal, were found to have but from 18 to 23 per cent. opening in the grates. A certain engine limped badly at high speeds, but was all right when running slow. The application of an indicator showed a contracted passage in the steam pipe on one side, caused by a piece of the core falling out and shutting off more than one-half of the pipe. A new pipe was applied and all the trouble removed.

As a rule, the efforts made to remedy engine failures are largely in proportion to the number of failures, instead of being directed toward any particular character of failure, and very little distinction is made in the different ones; when if one would only pause to analyze them, it is plain that some result from improper manipulation of the engine, some from defective design, some from structural defects or faulty workmanship, and some from a combination of two or more of the above causes. It is to what may be called combination defects that attention should be drawn.

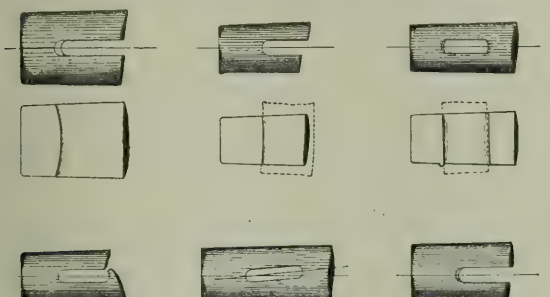
There is probably no part of an engine where so much depends on good, honest efficient work on the part of the machinist employed as in fitting up and assembling for service the crosshead end of a piston rod.

The designs, or various so-called standards, are, in my opinion, open to criticism, in that they represent in many instances the ideas, fads, fancies or hobbies of some individual rather than being based on sound engineering principles. Aside from this lament-

able feature, however, the question of defective or poor workmanship is of vital importance, and has not received the attention it deserves. A large percentage of piston rods which fail on the road are improperly fitted to the cross-head or the keyway, and in some instances actually mutilated, and this is sometimes almost unknown to the machinist who may drive the key home in assembling these parts, although he should inspect with a view of detecting any faulty workmanship even though someone else may have been responsible for it. One of the prime reasons why it is possible for an engine to leave the shops in this condition is, that it is one of the parts of an engine which can be put together in a manner so defective as to be actually dangerous, and still leave no trace or clew by which to detect it.

Some years ago, while in charge of the motive power department on a line with six sub-divions, I noticed we were having a great many engine failures due to broken piston rods. The most searching inquiries were made, and positive orders were sent out to thoroughly investigate and apply the necessary remedy, to which the Master Mechanics invariably answered that they were complying; yet no results were forthcoming. The number seemingly increased and on one or two divisions it almost took on the form of an epidemic. The sterotyped excuse was almost invariably "poor material."

I ordered the end broken off in each case, sent to my office along with the report of the accident, with the result that almost without exception the failures were due to such miserably inefficient shop methods as to admit of neither defense nor apology. A few samples of these badly mutilated and broken rods were taken at random, their true dimensions and condition reduced to a drawing, blue prints made therefrom and displayed in each shop under the caption or heading of an object lesson. A meeting of Master Mechanics and foremen was held and the question of broken piston rods passed into history.



Specimens of Mutilated Piston Rods.

The accompanying illustration is a reproduction of the mechanical monstrosities referred to.

As for power plants, modern establishments economically administered are few and far between, and the great majority could not stand an investigation. Some years ago, the saw and planing mill of a small railroad company was found to be producing less than half of its original and rated capacity. In short, matters were in such bad shape that somethinng had to be done. Indicator cards taken from the engine showed such defective steam distribution that the valve gear was overhauled, the mill being shut down for the purpose. At the end of five days the mill was in shape to cut from 48,000 to 50,000 feet per day.

Summary of case:—

Reduced output of mill (30,000 ft. per day at $10 per 1,000), 6 mos.	$46,800
Four extra firemen, 6 months, $2.00 per day	1,248
Four cords of wood per day, 6 months, $2.60 per cord	1,248
Total	$50,246

which was remedied for the trivial sum of about $150.

The Pekin-Hankow Railroad.

Trains are now running over this road between Hankow and Pekin, 754 miles, though the operating department does not encourage through passenger traffic and does not intend to do so until the completion of the bridge over the Yellow River. At present the journey takes four days, no traveling being done at night. After the completion of the bridge it is proposed to run trains through in thirty-six hours, and they will have sleeping and dining cars. At present, the foreigner who wishes to ride in comfort must engage a special car and must furnish his own blankets and pillows so as to sleep in the car at night. He also has to take along a servant so as to provide his own meals. The native population throughout the line has the appearance of being strong and healthy as well as contented. Few beggars are seen. There is not an advertisement in sight, except one of American cigarettes at Pao-Ting-Fu. The railroad telegraph line is equipped for the use of telephones, and telephones are carried on trains for use in emergency, the "fish-pole" arrangement being used to connect with the line.—*Report from Consul-General Sammons.*

A press despatch announces that this road was opened for traffic on November 14. Special trains from the two termini carried guests to the point where the new road crosses the Yellow river. Among these guests were representatives from the consulates and legations of France, Belgium, Germany and Russia.

Train Accidents in the United States in November.[1]

unf, 1st, St. Louis & San Francisco, Compton, I. T., a southbound passenger train was derailed by a cow and the engine was overturned. The engineman was killed and the fireman seriously injured.

unx, 2d, Atchison, Topeka & Santa Fe, Stillwater, O. T., a mixed train with a dead engine at the rear was derailed, the tender of the dead engine jumping the track near a bridge, and this engine and one car broke down two spans of the bridge and fell to the stream below. One employee riding in the dead engine was injured.

*rc, 3d, Michigan Central, Hartsdale, Ind., a gravel train with an engine at the rear, standing on the main track, preparatory to moving into a connecting track leading to the Indiana Harbor Railroad, was run into at the rear by a westbound freight train, damaging both engines and wrecking one car in the freight train and the caboose of the gravel train. A brakeman of the gravel train was killed and another trainman and a man riding with a car of horses on the freight train was injured. The wreck took fire and was partly burned up.

*xc, 3d, 2 a. m., Fort Worth & Denver City, Clarendon, Tex., a freight train ascending a grade was divided in consequence of the inability of the engine to haul the whole of it, and the cars left behind were accidentally started, in some way not explained, and ran back on the main track some distance and into the head of a following freight, wrecking the engine and 11 cars. The wreck took fire and was mostly burned up. One brakeman was killed and two other trainmen were injured.

†xc, 3d, Southern Pacific, Santa Margarita, Cal., collision of passenger trains; 19 passengers injured, two of them fatally.

o, 3d, Houston & Texas Central, Ennis, Tex., the locomotive of a freight engine was wrecked by the explosion of its boiler; the engineman and one brakeman were killed and the fireman was injured.

xc, 4th, Central of Georgia, Gordon, Ga., collision of freight trains; conductor killed, four other trainmen injured, one of them fatally.

unx, 5th, Southern Pacific, Galveston, Tex., a passenger train was derailed on a sharp curve and the engineman and fireman were severely scalded, the fireman fatally.

bc, 6th, Baltimore & Ohio, Washington, Pa., butting collision of freight trains in a tunnel; one engineman killed and two other trainmen injured.

*bc, 7th, 5 a. m., New York Central & Hudson River, Liverpool, N. Y., butting collision between a southbound freight and a northbound passenger train, wrecking both engines and several cars, all of which fell down a bank. A freight car loaded with matches took fire and the combustible part of the wreck was burned up. Four trainmen were killed. The freight train had disregarded a meeting order.

xc, 7th, 1 a. m., Buffalo, N. Y., collision between a freight train of the Delaware, Lackawanna & Western and a freight of the Buffalo Creek Railroad; one engineman killed.

dr, 7th, Pennsylvania road, Hastings, Pa., a passenger train was derailed by a broken rail and the engineman and fireman were injured.

bc, 8th, Delaware, Lackawanna & Western, Hunlocks Creek, Pa., butting collision between a passenger train and a freight train, both running at full speed. Six trainmen were killed and several

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defects of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more persons.

other persons were injured. The freight train had run past an appointed meeting station. The engineman of this train, who was killed, was held responsible by a coroner's jury. The jury also charged the conductor with negligence in not examining air-brake angle cocks before beginning his trip.

rc, 9th, Northern Pacific, Missoula, Mont., a freight train standing in the yard was run into at the rear by a passenger train, and 20 persons were injured. There was a dense fog at the time.

xc, 9th, Pennsylvania road, Granville, Pa., collision at converging tracks between a passenger train and a mail train, both moving in the same direction. One engine and two mail cars were wrecked and one fireman was killed.

unf, 9th, Alabama & Vicksburg, Bovina, Miss., a passenger train was derailed by running over a bovine, and the engine and tender fell down a bank. The engineman was severely burned.

rc, 10th, Norfolk & Western, Iager, W. Va., rear collision of freight trains; three trainmen killed, two injured.

unx, 11th, 3 a. m., Southern Railway, Burnsville, Miss., passenger train No. 42 was derailed and one passenger car was overturned. One passenger was injured.

unx, 11th, Texas & Pacific, Aledo, Tex., eastbound passenger train No. 6, consisting of two engines and 15 cars, was derailed, and three passenger cars were badly damaged. One fireman was killed and eight other persons were injured.

bc, 13th, Philadelphia, Baltimore & Washington, Nottingham, Pa., butting collision of passenger trains, wrecking both engines. One engineman was killed and two other trainmen and several passengers were injured.

xc, 13th, Chicago, Rock Island & Pacific, Dover, O. T. a freight train broke in two and the rear portion afterward ran into the forward one, injuring several passengers and two trainmen.

*eq, 13th, Delaware & Hudson, Dyes, N. Y., passenger train No. 5, running at high speed, was derailed, making a bad wreck. The mail car took fire and was burned up. The fireman was killed and a mail clerk and several passengers were injured. A broken journal, or some other defect in one of the trucks, is believed to have been the cause.

dn, 13th, Bessemer & Lake Erie, Shenango, Pa., a freight train approaching the crossing of the Erie road became uncontrollable and was derailed at the derailing switch, 10 cars being ditched.

unx, 13th, Southern Railway, Greenville, Miss., a work train was derailed and the engine was overturned. Seven employees were injured.

xc, 16th, Southern Railway, Salisbury, N. C., an empty engine, running backward, collided with a train carrying a large number of employees to Salisbury from the shops at Spencer, and eight employees were injured. In the employees' train the engine was at the rear.

unx, 17th, St. Louis & San Francisco, Deckerville, Ark, a passenger train was derailed, from some cause unknown, and several passenger cars were overturned and fell down a bank; but although all of the passengers were badly shaken, no one was seriously injured.

rc, 18th, Baltimore & Ohio, Rawlings, Md., a freight train which was taking water was run into at the rear by a following freight, and the engine, caboose and several cars were overturned and fell down a bank. One brakeman was killed and two other trainmen were injured, one of them fatally.

rc, 19th, Minneapolis, St. Paul & Ste. Marie, Detroit, Minn., a freight train, standing at a station, was run into at the rear by a following freight, wrecking the engine and caboose. In the caboose were the conductor, his wife and one daughter. Two of these were killed and the third was injured.

bc, 19th, Baltimore & Ohio, Warren, Ohio, butting collision of freight trains, wrecking both engines and several cars. One fireman and one brakeman were killed and one engineman was injured.

unx, 19th, Lehigh Valley, Tonawanda, N. Y., a car in a freight train of the Lehigh Valley was derailed and fell across the adjacent main track of the New York Central & Hudson River, and was run into by a freight of the N. Y. C. moving in the opposite direction. The engine of this train was overturned and the engineman was killed.

dn, 20th, Erie road, Falconer, N. Y., eastbound passenger train No. 8 was derailed at a derailing switch, and the enginemen of both of the two engines drawing the train were killed. The train was running at good speed and the enginemen evidently disregarded the stop signal at the block station.

rc, 23d, Southern Railway, Columbiana, Ala., a freight train which had been stopped because of some defect in the engine was run into at the rear by a following freight, and the engineman of the standing train, who was under the engine, was killed.

bc, 23d, Baltimore & Ohio, Albion, Ind., butting collision of work trains making a bad wreck and causing the death of three trainmen and two laborers. Several others were injured, two of them fatally. There was a dense fog at the time. Conflicting orders had been given by the despatcher, so that both trains had orders giving them the right of way.

†xc, 24th, Boston & Maine, Wayland, Mass., a passenger train ran over a misplaced switch and collided with a freight train standing on the side track, badly damaging both engines and three freight cars. One of the cars in the passenger train was wrecked for half its length and one passenger, an infant of two years, was killed. The passenger engineman and the mother of the child were severely injured.

eq, 24th, 6 a. m., Pennsylvania road, Thompsontown, Pa., several cars in a westbound freight train were derailed by the sudden stoppage due to the rupture of an air-brake hose and the consequent automatic application of the air brakes, and fell across the adjoining westbound passenger track. Newspaper train No. 23, on this track, ran into the wreck and its engine and all of its three cars were badly damaged. There was a dense fog at the time. One brakeman of the freight was killed and eight other trainmen were injured.

bc, 25th, 6 p. m., Missouri Pacific, Leeds, Mo., butting collision between a passenger train and a switching freight train which was using the main track without right, damaging both engines and several freight cars. Five trainmen and about 30 passengers were injured, all of them slightly.

†o, 25th, Norfolk & Western, Bluefield, W. Va., passenger train No. 16 was split at a switch and part of the cars entered a side track. The passengers were greatly alarmed and many of them tried to get out of the cars. Two of these were injured, one of them fatally.

†*rc, 26th, 8:13 p. m., Boston & Maine, Baker Bridge, Mass., a westbound accommodation train, just starting from the station, was run into at the rear by a following express train drawn by two engines, and both of the two passenger cars of the way train were wrecked. Seventeen persons, mostly passengers on the local train, were killed, or fatally injured, and about 30 other persons were injured. The accommodation train was considerably behind time and the rear brakeman had thrown off two or three fusees, but these were not heeded by the runner of the leading engine of the express. This runner also disregarded two caution signals displayed by highway crossing watchmen. The runner of the second engine of the express shut off steam on seeing one of the caution signals, but did not apply brakes; neither did he signal to the leading engineman. This accident was reported in the *Railroad Gazette* of December 1, page 520; December 8, page 541, and December 15, page 566.

xc, 26th, Boston & Maine, South Waterboro, Me., collision of freight trains at a meeting station, wrecking both engines and nine cars; both firemen and one brakeman were killed.

o, 26th, Colorado Southern, Boreas Pass, Col., three cars of a passenger train were lifted from the rails by a high wind, but all of them remained upright and were stopped before they had fallen off the roadbed.

bc, 28th, Kansas City Southern, Horatio, Ark., butting collision of freight trains, wrecking both engines and seven cars. One engineman and one fireman were killed.

unf, 28th, Pittsburg, Cincinnati, Chicago & St. Louis, Kenneth, Ind., a freight train was derailed at a culvert which had been partially washed out, and 18 cars were ditched. Two trainmen were injured.

rc, 29th, 6:20 p. m., Boston & Maine, East Everett, Mass., a northbound local passenger train of six cars, about three minutes behind time, was run into at the rear by a following freight train consisting of two engines and 33 cars, which had left the last preceding station about one minute behind the passenger train. About 20 passengers were slightly injured. The freight engineman had disregarded three automatic block signals set against him, and the passenger train was 2,000 feet beyond the third signal. This accident was reported in the *Railroad Gazette*, December 15.

bc, 29th, Chesapeake & Ohio, Charlottesville, Va., an empty engine, deserted by the engineman because of the approach of a runaway freight car, on another track, which threatened to collide with him, had its throttle valve opened in some way and ran some distance on the main track to a point where it met two engines coming in the opposite direction, with which it collided. Four employees were injured and all three engines were badly damaged.

unf, 29th, Zwolle & Eastern, Zwolle, La., a freight train was derailed by a tree which had fallen across the track, and the engine, one box car and five loaded log cars were wrecked. One person was killed and five were injured.

unx, 29th, Atchison, Topeka & Santa Fe, Romero, N. Mex., passenger train No. 1, consisting of two engines and seven cars, was derailed, the second engine and first four cars being overturned and one passenger car badly damaged. One engineman was scalded to death and four trainmen and several other persons were injured.

dn, 30th, Norfolk & Western, Davy, W. Va., a westbound freight train was derailed at a misplaced switch and the engine and several cars were wrecked; engineman and fireman were killed.

unx, 30th, 10 p. m., Central of New Jersey, Penn Haven Junction, Pa., a passenger train running at full speed was derailed and the engine and first two cars fell down a high bank into Lehigh river. The fireman and an employee of the road riding in the first passenger car were killed and 12 persons were injured.

RAILROAD GAZETTE

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VOL. XXXIX., No. 26. FRIDAY, DECEMBER 29, 1905.

Mr. Frank J. Sprague's announcement last week that he was prepared to undertake the design and installation of 1500-volt, direct current heavy electric traction systems is interesting. He gives no details of his proposed system, but it must involve many new and necessarily untried services and methods. His proposal is as radical a departure from any previous practice in direct current installations as was the use of single or polyphase alternating current on the line. Almost from the beginning of electric traction 500 volts was considered the maximum safe limit of line potential, and even in the latest installations like the Interborough Subway and the New York Central Electric Zone 600 volts is the normal potential. Aside from one or two isolated and unsuccessful experiments, the generation and transmission of direct current at any higher potential than 800 volts has not yet been attempted in any field, so that Mr. Sprague's proposal to use a voltage more than two and a half times greater than the accepted maximum is indeed startling. If it can be done, as he claims, economically and safely, his invention will rank higher than his previous work which has given him the standing among electrical engineers which entitles this proposal to serious consideration. The greatest difficulty with high potential direct current generators and motors is the excessive sparking at the commutator segments if the number of segments is kept within narrow limits. To keep down the sparking, either the number of segments must be increased directly as the voltage, or two or more medium potential machines could be connected in series and thus produce a current of high voltage. Both of these methods have heretofore been considered objectionable, perhaps without reason, or Mr. Sprague may intend to depart altogether from previous practice and make a generator working on a new principle. The advantages of high potential transmission in the way of saving in copper and gain in efficiency hold true for direct current as well as for alternating current. We are quite ready to admit his claim that trebling the potential on the line under ordinary circumstances would permit increasing the distance between sub-stations about five times, with a consequent saving in sub-station apparatus. It is in the motor and control equipments on the cars that the greatest difficulty with high potential currents has been met. Connecting two or more motors permanently in series might prove disastrous in case one motor broke down and the entire load was thrown on its mate; and this is one of the commonest failures in electric traction. With the limited clearance under the cars there would be great difficulty in increasing the size of the commutator proportionately to the increase in voltage to prevent sparking; and the danger of grounded circuits through defective insulation would be enormously increased. Here again, the inventor may have departed from the old lines and adapted a new system of generation to a new system of transformation into mechanical energy. A more definite announcement of what Mr. Sprague proposes to do and how he is going to do it will be awaited with interest. Just now we are making only surmises based on what has been done.

The New York State Railroad Commission finds* that the signal was disregarded by the engineman of the Poughkeepsie train, in the case of the New York City collision of December 19, and thus disposes of the conjecture that the signalman may have turned the signal against the train after it was too late to make a stop; but aside from this the views and recommendations of the Commission will be regarded by most railroad men as hasty and ill-considered. The only sound and rational utterance in the report is that condemning the fixtures that support the emergency axes and other tools in the passenger cars, which, it appears, held the tools so firmly that there was delay in putting them to use. Whether it is the New Haven or the Central cars that are thus criticised does not appear. The Commission believes that a towerman should be allowed no discretion. The reasons for this are not given and can only be guessed. To forbid signalmen to move trains according to the needs of the local situation, as they arise, a hundred times a day, and which cannot without frequent delays be referred to some one else, who is out of sight, would be to forbid a practice which is common at all the busiest junctions and crossings throughout the country. To require a despatcher to control, by telegraph or telephone, the movements of trains at two or more junctions or crossovers not near each other is to introduce unneces-

*The New York State Railroad Commissioners reporting on the collision which occurred on the elevated structure of the New York Central & Hudson River Railroad, near 104th St., New York, Dec. 19, say:

"We find that the system of signals in use at this point is a modern one. We are of the opinion that the accident was caused by a combination of circumstances. We are confident that the signal was disregarded. The New Haven train was crossed over from Track 4 to Track 3 by Towerman Dwyer, on his own initiative.

"We are decidedly of the opinion that no such discretion should be exercised by men in the tower at this point, and that all train movements should be governed from a central point where all the conditions as regards the movements of trains on the road can be and are known by the central directing authority.

"It appears from the evidence that the emergency tools in the coaches are so securely fastened that it is a work of great difficulty to release them. A better system that will facilitate their release in emergencies should be adopted."

sary complications. The train despatcher on every railroad, depending always on the telegraph, may be said to do all of his work at a disadvantage. In great emergencies, and in many local situations where permanent busy conditions exist, he has to do just the opposite of what the New York Commissioners now propose. He has to delegate his authority to a man "on the ground"—that is, one close to the scene of the train-movements to be supervised. The statement of the towerman at 106th street that he diverted the New Haven train by order of the despatcher indicates, no doubt, that the despatcher keeps as close watch over the movements at 106th street as he can; and, very likely, that an attempt has been made to have all movements directed from the despatcher's office and that the attempt has failed. If a towerman exercises bad judgment there may be a question whether a more competent towerman is needed, but there is no question, in a case like this, that it would be a disadvantage to divide his authority with a man at a distance. But the Commissioners do not say that the towerman's judgment was wrong. In his case, as with that of the Poughkeepsie engineman, they appear to have reached a decision without first hearing all sides. The engineman, having been arrested on a criminal charge refused to testify before the Commissioners; and yet they have found and reported that he disregarded the signal!

Even the layman can see that to move traffic promptly at junctions or crossover tracks on a line where one train follows another every two minutes, or oftener, and where there are two main tracks for each direction, with trains running at varying speeds, the only way to make all movements with a minimum of delay is to lodge the largest discretion possible with the man in immediate control of the switches and signals. Either one of those two trains on the evening of December 19 might have been delayed a few minutes in the last two miles before reaching 106th street; the delay might have been such as to make necessary a different disposition of one or the other of them on reaching that tower; and the question what to do would have to be—ought to be—decided in perhaps half a minute, or less. To consult the despatcher might take two or three minutes; and every half minute counts. What could the despatcher have done in this case? He could have forbidden the New Haven train to cross to track No. 3 until the Poughkeepsie train had arrived and had been brought to a stand clear of the crossover. But such practice as that, besides causing frequent delays, discredits all the signals on the road. It says to the enginemen that a stop signal (with a suitable corresponding distant signal) is not depended on to stop them; which implies that when a train must be stopped something besides a stop signal and a distant signal will be used. At other places the stop signal *is* depended on. Could anything be more directly subversive of discipline?

RAILROAD BUILT IN 1905

Official returns from the majority of the railroad companies in the country, supplemented by figures furnished by the State Railroad Commissions and our own current records, show that approximately 4,388 miles of new main track have been built in the United States during the calendar year 1905. This figure includes 96 miles of new main track entirely relocated but does not include second track, sidings, nor electric lines. The sum total is 556 miles larger than last year's figure—3,832 miles—which was the smallest reported since 1898, when 3,265 miles were built. The actual increase over last year amounts to about 15 per cent., but this by no means represents the extent of railroad construction work during the year. The low figure in 1904 was largely due to industrial depression, and especially to the consequent suspension of work by some of the larger railroads on all new building which was not absolutely necessary, owing to the sharp decreases in earnings. Within the latter part of the current year, as a result of the large increases in earnings, work on many of these lines has been resumed but in a good many instances not completed. A large number also, of entirely new lines, work on which is well under way, have little or no track laid to contribute to the year's total. One factor which has delayed putting new mileage into operation has been the difficulty of getting rails, owing to the tremendous demand for iron and steel. More than one road on which grading has been completed has for this reason been compelled to postpone track laying until next spring. Several very large projects by existing lines have developed during the year, but have not progressed far enough to be included under the head of new mileage built. Within the next two years two or three of these should add a very large amount to the country's mileage. The Chicago, Milwaukee & St. Paul's Pacific extension will include from 1,500 to 2,500 miles of line; the Western Pacific, from Salt Lake City to San Francisco, nearly 1,000 miles; the Kansas City, Mexico & Orient has some 1,000 miles yet to build, and, in Canada, the Grand Trunk Pacific and Canadian Northern have together several thousand miles in prospect.

New main track mileage is reported in 47 states and territories, including Alaska, where 13 miles of new track were built. North Dakota leads the list with track laid on 520 miles, an increase of 488 miles over 1904. This was largely due to the completion of the new Minneapolis, St. Paul & Sault Ste. Marie connecting line from Thief River Falls, Minn., to Kenmare, N. Dak., through the heart of the Great Northern's branch line territory. The Great Northern itself built 120 miles of branch lines in the state during the year. Texas, which led the list last year with 323 miles, is second this year with 338 miles. Illinois is third with 250 miles, and Arkansas fourth with just under 200 miles. To have a state so full of railroads as Illinois come third in the list is an unusual result. The largest decrease reported is in Missouri, where only 49 miles were built, as compared with 270 miles in 1904. California, Minnesota, Mississippi and Pennsylvania, besides, each show 100 miles or more less than last year. The largest decrease in 1904 was in Oklahoma Territory, where 661 miles of new track were laid in 1903. Indian Territory also showed a similar decrease in 1904. The fact that the amount of new mileage built in these two territories in 1905 is in each case a decrease from the low figure in 1904 is pretty good proof that the most available situations in this a few years ago undeveloped territory are already seized upon. In addition to the four states already mentioned, which lead the list, Indiana, West Virginia, Oklahoma, Tennessee, Wisconsin, North Carolina, New Mexico, Mississippi, Georgia, South Dakota, Idaho, Minnesota and Alabama, in descending order of amount, built over 100 miles of main track in 1905. No new mileage was reported in Connecticut, New Hampshire, Delaware or Montana.

The number of miles built in Canada was 1,180, an increase of more than 300 per cent. over 1904, when 316 miles were built. This result is due primarily to the large amount of new track laid by one company in the western part of the Dominion, the Canadian Northern, which completed 600 miles of line. Much of this was, of course, nearly or entirely graded at the close of 1904, and the laying of the rails was all that remained to put it in operation. The Canadian Pacific in the same region also completed 277 miles of line. Mexico shows an increase of over 100 per cent., the mileage built being 238 against 115 in 1904. Several narrow gage mining and lumber roads which laid track during the year are not included in this total.

The following table shows our figures for mileage built in the United States during the last thirteen years:

1893.....	3,024	1898.....	3,265	1902.....	6,026
1894.....	1,760	1899.....	4,569	1903.....	5,652
1895.....	1,428	1900.....	4,894	1904.....	3,832
1896.....	1,692	1901.....	5,368	1905.....	4,388
1897.....	2,109				

A table of the new mileage built this year, classified by states, is given elsewhere in this issue.

STANDARD HEIGHT OF COUPLERS

There is a movement on foot to have the Master Car Builders' Association recommend to Congress a change in the Safety Appliance Law requiring couplers to be maintained with the center line between the maximum and minimum limits of 34½ in. and 33 in. from top of rail. At the October meeting of the Western Railway Club, Mr. J. J. Hennessey, of the Chicago, Milwaukee & St. Paul, introduced a topical discussion, advocating an increase in the allowable variation from 3 in. to 4 in., making the maximum height 35 in. and the minimum height 31 in. It is proposed to bring the subject up for discussion at future meetings of the other railroad clubs throughout the country, and bring such moral suasion to bear on the Master Car Builders' Association at its meeting next June as to force it to make the necessary recommendation.

Mr. Hennessey called attention to the serious delays in interchange resulting from the refusal to accept the many cars now in service, which are higher or lower than the prescribed limits, and the continual expense of trying to keep the height of couplers up

to the standard. One in every ten cars standing on the repair tracks needed attention in this respect. He went on to show in detail the settlement which takes place in a car. The figures are as follows: Wear on journal bearings, ⅜ in.; on journals, ¼ in.; on wheels, ¼ in.; on carry iron and bottom of coupler shank, ¼ in. each; on small wearing parts and settlement of arch-bars, ¼ in.; permanent set of springs, ⅜ in.; set of overhang of car from bolster to end sill, ⅜ in.; difference between empty and loaded height of car, 1½ in.; total, 3⅞ in. The vertical movement of couplers when running on the road he found not to exceed 2 in. On these figures as a basis he recommended an increase to 4 in. The majority of the members favored the recommendation, some even going so far as to say that 4 in. was not enough; 5 in. should be allowed.

This same agitation was begun in 1898, but it soon died out. In that year a committee of the Master Car Builders' Association was appointed to confer with the American Railway Association and the Interstate Commerce Commission with a view to having the allowable variation increased to 4 in. This committee reported in 1899 that it was inadvisable to recommend the change at that time for the reason that because of the link slot in the knuckles then in use, any increase in limits of height of couplers would result, in many cases, in only two knuckle lugs of adjoining couplers being in contact, causing frequent breakage of the knuckles and parting of trains. The committee recommended that action be deferred until the use of solid knuckles should become general. That was a convenient way of laying the matter to one side then, but now it has come up again.

The solid knuckle is now almost universally used, and many roads have increased the depth of the knuckle face from 9 in. to 10 in., and even to 11 in., as on engine and tender couplers. The change was made to gain strength in the knuckle, not to provide for additional vertical movement. Taking Mr. Hennessey's figures of 3⅞ in. settlement and 2 in. vertical movement when running, the total is 5⅞ in. With a 9-in. coupler face this leaves only 3⅛ in. of depth to resist the entire strain to which the coupler may be subjected. This extreme displacement of the center line of draft throws all the strain on the upper half of the knuckle pin and the top lug of the low coupler, and the lower part of the pin and the bottom lug of the high coupler, a condition much worse than when only the top and bottom lugs of two adjacent knuckles were in contact. In this case the lug on the coupler head is broken or the pin is bent and the coupler put out of operation, while formerly the knuckle broke. In a coupler the knuckle should be what a fuse is in an electric circuit, the part that goes first under excessive load. It can be replaced without taking down the draft gear and spare ones can be carried on the train for emergency uses. If a coupler breaks there is only the choice of setting out the car or chaining up.

Another argument brought forward by Mr. Hennessey is that inspection is more rigid now than formerly, and that loaded cars are refused when the coupler heights are only ¼ more or less than the requirements. He claims that the 4-in. limit of variation would permit greater freedom of interchange. If the railroads do not want to live up to the 3-in. requirement it is only a question of time when they would want to encroach on the 4-in. limit. So long as they are compelled to the railroads can and will keep their equipment up to standard in this respect. It may cost a good deal to lighten up old cars, raise the center plates and put them in proper condition, but it pays in the end. Displacement of the center line of draft is responsible for most of the broken and buckled sills, broken draft gear, couplers and knuckles, and oftentimes the complete destruction of a car in a minor collision. It is to be hoped that the Master Car Builders' Association as a whole will not commit itself to any action which encourages poor car building and lax maintenance.

THE RECEIVERSHIP RECORD OF 1905

The list of railroad receiverships during the year 1905 is on its face a remarkable one in that during the most prosperous year in the history of railroads in this country, ten roads have confessed their inability to meet charges—a larger number than in any of the previous four years. These ten bankrupt companies represent 3,796 miles of line and over $175,000,000 of total capital, which is more mileage and capital than has come under the jurisdiction of the courts in any of the preceding nine years. It is necessary to go back to 1896, the last year rich in receiverships of the disastrous 1893 period, when over 5,400 miles of railroad, with a total capitalization of over $275,000,000 failed, to find what seems to be a more disastrous year for American railroads. This result, so widely at variance with the actual fact, is, of course, due solely to the Cincinnati, Hamilton & Dayton and Pere Marquette receiverships; these the result, not of hard times, but of the most flagrant sort of railroad high finance, which had loaded the properties involved with some $70,000,000 of new debt. Leaving these two companies out of the account, the other eight railroads show a total mileage of 575 miles and total capitalization (stock and bonds) of $23,738,700, against roads with a mileage of 744 miles, representing a capitalization of about $36,000,000 failed in 1904. Therefore, disregarding the two exceptional receiverships of the year, the record is a thoroughly satisfactory one.

The list of railroad receiverships during the current calendar year is as follows:

Receiverships During 1905.

Name of road.	Mileage.	Bonds.	Stock.	Date receivership.
Ohio River & Western*	111	$600,000	$1,200,000	Jan. 25.
Phillips & Rangeley (2-ft. gage)	50	200,000	90,400	Feb. 1.
Warren & Corsicana Pacific	27	60,000†	100,000	Feb. 14.
Pontiac, Oxford & Northern	101	400,000	1,000,000	Mar. 25.
Port Angeles Pacific	6‡	120,000§	310,000	May 29.
Pittsb'g, Shawmut & Northern	209	7,053,600	11,700,000	Aug. 1.
Wiscasset, Waterville & Farmington (2-ft. gage)	27	850,000	150,000	Nov. 22.
Toluca, Marquette & Northern	57	671,800	243,900	Oct. 7.
Cincinnati, Hamilton & Dayton Pere Marquette	1,012 2,196	135,350,700*a*	14,925,500*b*	Dec. 4.
Total, ten roads	3,796	$145,306,100	$29,728,800	
Total bonds and stock		$175,034,900		

*Receivership terminated March 31.
†Mortgage notes.
‡Built 1903; 80 miles additional projected.
§At rate of $20,000 a mile; $2,000,000 authorized.
a Including securities guaranteed.
b C., H. & D. stock; Pere Marquette stock (guaranteed) included in bonds.

Since the dark days of 1893, when 74 railroads with a total of nearly 30,000 miles of line came under the jurisdiction of the courts, followed by receiverships of over 100 roads, aggregating 16,500 miles of line in the succeeding three years, it has come about in less than a decade that great bankrupt systems have been brought to a condition of stable prosperity and the railroad receivership has been practically eliminated from the financial situation. It has remained largely to be taken advantage of by a few scattered, small and poorly situated railroads which have not found a place in any of the consolidations, and also as a convenient means of clearing up complicated legal situations. During the four years previous to 1905 only 26 railroads, with an average mileage of about 50 miles each, suffered receivership. Throughout the first seven months of the current year the record of failures shows little change from this satisfactory result, five railroads with an average mileage of less than 60 miles each, going into receivers' hands. It is the last five months—the most prosperous of the year—which have blackened the record. On August 1st a receiver was appointed for the Pittsburg, Shawmut & Northern, a soft coal road in northwestern Pennsylvania, operating over 200 miles of line. Up to this date it could be said that no railroad of more than 125 miles was under the jurisdiction of the courts. Early in December came the climax of the Cincinnati, Hamilton & Dayton fiasco, followed by a receivership for this normally prosperous property, and for its late acquisition, the Pere Marquette. Together, these two railroads include some 3,200 miles of line, a total in itself larger than the mileage of railroads which went into receivers' hands in any of the last nine years. This in itself shows how far the past year's receivership total comes from representing the present prosperity of the railroads of the country.

Of the other roads, the Ohio River & Western had as lately as 1903 undergone reorganization. Its 1905 receivership was soon terminated (on March 31) by the return of the road to its owners. The Pontiac, Oxford & Northern had similarly passed through an earlier receivership. The Port Angeles Pacific, when receivers were appointed, had completed only six miles of a projected line from Port Angeles, Washington, south to a connection with the Northern Pacific near Grays Harbor. The receivership of the Pittsburg, Shawmut & Northern came as a necessary step in a reorganization which is to give the road more working capital and enable the construction of north and south outlets toward Buffalo and Pittsburg. The Toluca, Marquette & Northern belonged to the Charles J. Devlin chain of financial enterprises in Kansas. With the failure of Mr. Devlin's banks, the road was on November 22 put in the hands of the three present receivers, one of whom is James E. Hurley, General Manager of the Atchison, Topeka & Santa Fe. This makes it likely that that company, whose main line in Illinois it crosses, will soon come into possession of the road. The year has been a disastrous one for only one

class of roads, those with the unusually narrow gage of two feet. The Phillips & Rangeley and the Wiscasset, Waterville & Farmington represent over one-half the total 2-ft. mileage in the United States. The Warren & Corsicana Pacific was originally a 3-ft. gage lumber road, which has since been made standard gage. Under present methods of railroad operation it is not hard to understand the handicap under which narrow gage railroads operate and the consequent likelihood of failure to meet charges on their part.

With the exception of the Ohio River & Western, which, as already mentioned, stayed only a little more than two months in receivers' hands, all of the last year's receiverships remain in force at its close. We are informed that the receivership of the Warren & Corsicana Pacific will probably be continued for the next two or three years. This will probably be true of several of the other small roads. If it is possible to judge by the activity of the Pittsburg, Shawmut & Northern management in beginning work on a southward extension or the extensive coal resources of the road, its receivership should before very long be terminated. The Cincinnati, Hamilton & Dayton and Pere Marquette tangle will take some time to straighten out. Already it is announced that the attempt will be made to break the purchase of the Chicago, Cincinnati & Louisville, which, by the way, is not directly involved in receivership, by the Pere Marquette, and the lease of the Pere Marquette to the C., H. & D.

When the reorganization is complete, it is not unlikely that the parts of the quondam Great Central Route will be acquired by those of the trunk lines which can use them most effectively. On account of its many points of competition with the Michigan Central, it has seemed probable that the Pere Marquette will come under Vanderbilt control. It is not likely to be bought directly by the Michigan Central because of laws prohibiting common ownership of competing lines, but the Lake Shore might easily be employed as a holding company. The Cincinnati, Hamilton & Dayton, by itself a valuable property, if for no other reason, as a large originator of traffic and part owner of the Cincinnati, New Orleans & Texas Pacific, can hardly long remain independent. The Pennsylvania or the Erie seem the most likely purchasers. It is not unlikely that the Erie would consider the road, released from burdensome contracts and controlling, as it does, the Erie's entrance into Cincinnati, a desirable purchase. The Chicago, Cincinnati & Louisville, a weak road between Cincinnati and Chicago, which has not yet acquired its Chicago entrance, must also in all probability find its way into the protecting control of some one of the strong trunk lines.

The C., H. & D. and Pere Marquette receiverships point their moral strongly enough as a warning against financial manipulation of a railroad's credit instead of development as an operating property. It may be hoped the lesson will not have been preached in vain. Aside from these exceptions, the small extent of the year's failures is only another evidence of the country's present tremendous prosperity.

Profits from Electrification of Street Railways.

The great profits coined during the last decade, especially in eastern cities, by the shifting to electric equipment of the old horse railways is a familiar fact which has not yet reached its ultimate. Not so familiar, and, indeed, very rare, have been actual examples measuring accurately those profits under the common device of recapitalization. A case called to our attention is that of the Fair Haven & Westville Horse Railway Company, the corporation which first laid street railway tracks in the city of New Haven, Conn., about half a century ago. It was prosperous and paid 8 per cent. dividends for many years before it adopted the trolley. Later it absorbed the whole of the New Haven street railway system and of the region roundabout. The table annexed, with fractions of shares (par $25 each) omitted to simplify the figures, shows the evolved recapitalizations and profits of the stockholders:

January,	1894.	Bought at $55.....	100	shares.....cost,	$5,500
June,	1894.	Increase, 1 for 2....	50	" ..... "	1,250
March,	1897.	Increase, 1 for 2....	75	" ..... "	1,875
Nov.,	1898.	Stock dividend	225	" ..... "	.....
October,	1899.	Increase 1 for 4....	112	" ..... "	2,800
October,	1901.	" 1 " 5....	132	" ..... "	3,300
October,	1902.	" 1 " 6....	115	" ..... "	2,875
June,	1903.	" 1 " 4....	202	" ..... "	5,050
			1,011		$22,650
Average cost per share					$22.40

The table, enlarged in ratio to an original purchase of 100 shares, is based on an actual transaction. In the spring of 1904 the New York, New Haven & Hartford (Steam) Railroad Company bought up the Fair Haven & Westville and later practically extinguished its stock. The purchasing corporation paid 2 for 1 in its own 3½ per cent. debentures worth in the market 96, bringing the market value of the shares of the street railway to 48. The final summary, therefore, shows that the original investment of 100 shares in 1894 became 1,011 shares during ten years and was worth $48,528 as against a total cost of $22,650, or a profit of $25,878, or about 114 per cent.—this after receiving 8 per cent. dividends for a year and 5 per cent. on the increased capital for six years since. The progressive increase ten-fold of the capital stock will be noted as also the stock dividend of 100 per cent., which by no means is an accurate hydrometer as a number of the absorbed companies of the Fair Haven & Westville were very dropsical. As a final fact it may be added that the New York, New Haven & Hartford Company has made such a good thing out of its purchase that the old street railway shareholders now regret that they sold out at all. This case of electrification profits, based on the popularity and operating economy of the trolley, has, doubtless, many a parallel in the older American cities. Besides its value as an objective study it exemplifies the obstructions and inequities which befog capitalization of street railways as a basis for municipal purchase and control.

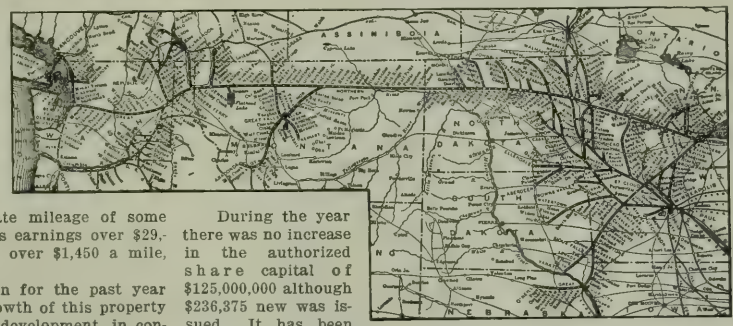
The officers of the Peninsula division of the Chicago & North-Western have given a fine exhibition of their resourcefulness and of the excellence of their organization by running a hundred miles of busy line for two days without the telegraph; but in attempting to tell just *what* they have done, we are baffled, because no details are given. Operating officers would often do well to take a leaf from the experience of the engineering and legal departments, to the extent of imitating the methods of those departments in preparing precise and full records of exceptional accomplishments, even at the expense of some time and money. Such records often prove valuable, and they are always interesting for publication. We have in mind a time-saving scheme for the management of passenger trains at meeting points on single track which was put in use on 20 miles of a prominent road near New York City a few years ago, but which could not be satisfactorily described because the amount or degree of saving was not carefully recorded. The time saved at each meeting was small, but yet it was large enough (with the added safety) to warrant the expense of the change in tracks and signals, and to merit the attention of superintendents of other roads; but no data had been recorded to show how many train movements had been bettered, how many dollars saved or how many complaints forestalled. By establishing long sidings, and having a full equipment of interlocked switches and signals, passenger trains could meet each other in most cases without stopping, and always without flagging. The saving in time proved to be a marked benefit. But that was all that we could learn. This C. & N.-W. incident is like that one. The Peninsula division includes 464 miles of road. In October a sleet storm paralyzed the telegraph for 48 hours. In this emergency every iron mine would have had to shut down on account of the shortage of cars unless the road was kept running. The train dispatcher was temporarily out of the game. But they managed, "on a single track line, without telegraph lines, for two days and nights, to keep every iron and copper mine in the district supplied with cars and moved all trains practically on time." This is the substance of the report, as given to a newspaper, leaving out the erroneous parts; and the really instructive figures were not touched upon. The reporter did not learn enough to make a really descriptive account; and he not only failed to show what the officers and trainmen actually had done, but in his effort to make a good "story" grossly exaggerated the few statistics that were given. The "4,071 cars moved" (not 4,971) represented the business of two days on the division; but we learn that the paralysis of the telegraph affected only 100 miles. The management of the trains without the aid of the telegraph was highly creditable to all concerned, especially as two temporary dispatching offices had to be established; but the emergency work did not cover 464 miles, or even 100 miles, for a part of the 100 is double track. We can ask the reader to join us in congratulating the North-Western people on having done some fine work, but we cannot tell him what the work was!

From Chicago, the birthplace of sensations, it is announced that the railroads are going to "tell on each other," or, in more dignified phrase, are going to unite in assisting the Interstate Commerce Commission in exposing those intricate and varied methods of rate cutting, the secret practice of which has hitherto been the cause of so many railroad woes. The traffic officers have gone so far as to make an appointment with the Interstate Commerce Commission at Washington this week, and it is said that there will be a frank though informal conference on ways and means. It is said that fourteen traffic officers will take part in this conference. As this number includes many conservative men, it is by no means unlikely that some useful result may follow. The hope, aroused by the Elkins bill of 1903, that the abolition of imprisonment would clear the atmosphere by making it much easier to get evidence of rate cutting, has been long deferred; but it is never too late to mend. To expose your competitor's unlawful act does, indeed,

seem unneighborly; but how much worse is it than to try to punish him by becoming a law-breaker yourself? Another motive for now using every possible means to expose unlawful rate making is found in the recent action of the Federal district attorneys in prosecuting freight agents and shippers under the conspiracy law, as was done in the case of the Chicago packers who paid $25,000 in fines. Under that law imprisonment still remains one of the penalties, and it applies to a freight agent who conspires with another person to break a federal law, notwithstanding the efforts of Mr. Elkins to keep railroad men out of jail. The names of the committee which is visiting Washington are said to be: J. C. Stubbs, Union and Southern Pacific, chairman; Darius Miller, Chicago, Burlington & Quincy; H. R. McCullough, Chicago & North-Western; W. B. Biddle, Chicago, Rock Island & Pacific; J. H. Hiland, Chicago, Milwaukee & St. Paul; J. T. Harahan, Illinois Central; C. S. Clarke, Missouri Pacific; A. S. Dodge, Chicago & Eastern Illinois; S. C. Stickney, Chicago Great Western; Burton Johnson, Wisconsin Central; Benjamin Campbell, Great Northern; J. M. Hannaford, Northern Pacific; H. L. Sielcken, Kansas City Southern, and A. A. Allen, Missouri, Kansas & Texas. Some reports give a list somewhat different, but all lists are made up of high officers, indicating a serious determination.

Great Northern.

In 1902 Mr. Hill said, or was reported to say, that the gross earnings of the three properties making up the Northern Securities Company would, in the ensuing year (1903), reach $150,000,000. The magnitude of the figure surprised many people, for not only great in itself, it required great increases for its fulfillment. It is interesting to note, therefore, how the earnings of these three properties have worked out in the last three years. In 1902 they earned $131,214,882 with 18,377 miles of line. In 1903 these properties fell slightly short of Mr. Hill's estimate, but they nevertheless earned $149,566,131, with a mileage of 18,921. In 1904 they exceeded the 150-million mark, earning $151,810,119 with 19,312 miles of line, and during the current fiscal year they increased this to $160,222,020. It is worth while to consider these figures not alone in their merely statistical sense, but to realize what it means in the growth of the country when these three railroad companies, which are now operating an aggregate mileage of some 20,000, have in four years increased their gross earnings over $29,000,000. The increase alone has amounted to over $1,450 a mile, in spite of the increase in mileage.



Great Northern.

The gross earnings of the Great Northern for the past year amounted to $43,526,088. The characteristic growth of this property in recent years has been through branch line development, in connection with the main stem stretching across the country from St. Paul and Duluth to Seattle and Vancouver. It must be left to the branch lines to bring in a constantly increasing source of tonnage from the rich agricultural lands through which the road runs, and also from the iron country, smaller in extent but very profitable. It is to be regretted that the annual reports of the company do not give in greater detail a statement of the kinds of freight which contribute to the constantly swelling ton-mile totals, for it would be interesting to know what proportion of the whole amount is Oriental freight, as against the two great staples of grain and iron ore for home consumption. Freight traffic contributed $33,512,744 of the total earnings this year, and ton-miles of revenue freight *increased* 818,358,569 units during the year. It must be recollected, however, that the year 1904, like 1901, was an off year for the company, in the sense that earnings, both gross and net, were smaller than in the year immediately preceding. Comparisons, therefore, show up uncommonly favorable for 1905, yet, skipping 1904 and going back to 1903, the year which previously beat all traffic records by tremendous figures, it is seen that gross earnings this year beat the record by some $3,000,000.

The Great Northern this year prints a table, which is not specially instructive, but is rather amusing, showing what revenue would have been collected on the 1905 traffic if it had been charged on the basis of the average ton-mile rate in 1881, from which it is deduced that the voluntary reduction of rates during the 25 years has saved this year's shippers over $87,000,000. Of course, the obvious fallacy here is that the 1905 traffic would not and could not have moved at the 1881 basis whether the company so wished it or not; also that great increases in heavy traffic hauled long distances pulls the average rate down mechanically. But in spite of these defects, the table is interesting as showing the broad tendency in American railroad development. The average ton-mile rate in 1881 was 2.8 cents; during all the years between that year and 1905 there has only been a single one (1904) when the average rate was higher than it was in the year immediately preceding, and in 1905 the average rate had fallen to .792 cent.

Operating expenses increased during the year from $20,594,363 to $21,441,927, leaving net earnings $22,084,161 in 1905, as against $19,462,991 in 1904. In spite of the large increases in traffic the item of conducting transportation showed a considerable decrease during the year. This decrease was occasioned at the same time that a considerable increase was shown in the cost of station service. Although full cost statistics are not given, the saving may doubtless be attributable in part to less cost of coal and in part to the great care which the company took, in common with other large roads of the country, to cut down its expenses to the smallest possible limit, after the rather extravagant years 1903 and 1904. As a specific way in which an economy has been effected this year, it is worthy of note that the train load, always surprising in consideration of the country traversed and the character of the freight, was increased this year to an average of 522½ tons (revenue), an increase of 75 tons over the 1904 loading. The number of cars per freight train mile was increased to 37⅓. The tons of revenue freight per loaded car was increased from 18 to 20, and freight train-mile earnings were increased from $4.06 to $4.20, although the ton-mile rate was reduced from .893 cent to .792 cent. It is also noteworthy, in the face of the larger traffic, that the helping mileage of freight locomotives decreased 16,357 miles, and of passenger locomotives, 30,933 miles, a decrease greater than the total passenger helping mileage in 1905.

The increases in the operating account were chargeable primarily to maintenance. The company does not publish figures which enable a statement to be made of the maintenance charge per locomotive and per freight car and passenger car, as would be desirable. The entire charge for maintenance of equipment, however, increased from $3,138,693 to $3,749,131, while the number of locomotives in service decreased from 708 to 707, although the number of freight cars increased from 32,375 to 32,870. The charge for maintenance of way and structures was $5,571,189, as against $5,083,264 last year. The current figure is at the rate of $973 per route mile.

During the year there was no increase in the authorized share capital of $125,000,000 although $236,375 new was issued. It has been the policy of the company to advance sums to its proprietary companies for construction purposes, and receive their stock in payment, and $17,000,000 of such stock was acquired during the year. The expenditure made on the capital account by proprietary companies for work completed or under construction aggregated $788,806, chiefly chargeable to the Seattle & Montana and to the Eastern Railway of Minnesota. The funded debt in the hands of the public increased approximately $4,000,000 during the year, which brings the total capitalization of the system for which the Great Northern Railway Company is responsible, directly or under guarantee, up to $225,479,064, bonds and stock. This is at the rate of approximately $36,316 bonds and stock per mile of main track, a very sound and conservative showing.

The following table summarizes principal statistics of the year's operation:

	1905.	1904.
Mileage, June 30	6,110	5,951
Freight earnings	$33,013,722	$29,944,300
Passenger earnings	8,000,467	7,747,300
Mail earnings	1,035,937	1,017,204
Gross earnings	43,526,088	40,051,353
Conducting transportation	10,468,218	10,740,242
Maint. way and structures	5,571,189	5,083,264
Maint. of equipment	3,749,131	3,138,693
Operating expenses	21,441,927	20,594,363
Net earnings	22,084,161	19,462,991

NEW PUBLICATIONS.

Steam Engineering. By W. W. F. Pullen, M. Inst. M. E., etc. The Scientific Publishing Co., Manchester, England.

Following out the statement made on the title page, the book is a treatise on boilers, steam, gas and oil engines, and is intended for the use of elementary students in technical schools and science classes. For a book of 454 pages, it contains a large amount of guiding data. It cannot be expected to treat exhaustively all of the subjects that it touches upon, which includes a synopsis of mechanical laws and definitions, steam engines, both reciprocating and turbine, and the measurement of their power; boilers and their auxil-

iary machinery with a measurement of heat; the indicator and the slide valve, with a final chapter on the internal combustion engine. The conciseness and clearness are features that appeal to the reader. Item after item is taken up and treated in a paragraph or in several pages, as its importance may warrant, but invariably in a manner that tells its story and leaves nothing of what has been said doubtful or in the dark.

As the treatise is prepared for the use of students, a brief outline is given of numbers of experiments intended to establish the truth of the statements that have been made. While ostensibly for elementary students they contain many suggestions that are of value to engineers who have original investigations on hand. In the study of the indicator card several defective ones are given, with the reasons for their defects; a method that could well be followed by most writers on the subject, who are rather disposed to ignore faults due solely to the improper adjustment of the instrument. These are little things, but they count mightily in the value of a book to the practical worker, to whom, by the way, it must be borne in mind, this does not claim to cater; nevertheless it cannot fail to be a very handy book of reference on the shelves of any engineer who is engaged along these lines.

Lippincott's New Gazetteer of the World. Edited by Angelo Heilprin, of the Sheffield Scientific School of Yale University, late President of the Geographical Society of Philadelphia, etc., and by Louis Heilprin, author of the Historical Reference Book, etc. Philadelphia and London: J. B. Lippincott Company, 1905. A complete pronouncing gazetteer of the world. 2,052 pages, 6½x10½ in. Price, $10.

In the advance of civilization along imperialistic lines, the reader now has to know so much about India and South Africa, Australia, Japan, China, the Philippines and Cuba that the old geographical handy reference books have lost much of their value. A faithful and successful attempt has been made in the new Lippincott Gazetteer to array all the towns of the world where the reader can learn at least something about them (including the way their names are spelled and pronounced) at a moment's notice. In the publisher's note attention is called to the fact that Lippincott's Pronouncing Gazetteer, in its different editions, has been before the public for just half a century, the first edition having made its appearance in 1855. The present publication, which is printed new from cover to cover, is a new work embodying little more than the frame-work of its predecessor. The editors explain that the standards of inclusion have to be varied in different parts of the world according to what might be called the market for information. The critical student of obscure geography will find some omissions, but he will be much more impressed by what he finds than by what he does not find. A gazetteer is a pretty indispensable part of the equipment of any first-class library or editorial office at the present time, and it is just and fair to say that Lippincott's is the best gazetteer there is.

American Railroad Rates. By Judge Walter C. Noyes. 276 pages, 5½x8 in. Published by Little, Brown & Company, Boston, 1905. Cloth. $1.50.

After a year of the widest publicity about all details of railroad operation, which have been expounded and discussed in a campaign of education directed respectively for and against rate regulation by the Government, a theoretic discussion of the subject labors under a considerable disadvantage. Judge Noyes has written a thoroughly careful résumé of the entire subject of American railroad rates and rate making. His points are brought out clearly, and he uses throughout a system of tabulating, by means of numbered paragraphs, of the arguments on the main points at issue in such a manner that the situation is made very plain to the reader. The disadvantage already referred to—that the reading public is tired of the subject—will probably prevent the book from being fully appreciated at present, but it constitutes a document which should have considerable historical value as showing accurately and fairly the existing situation at the period when the clamor for Federal interference received its most definite impetus.

Electrical Pocket Book and Diary for 1906.—The Technical Publishing Co., Ltd., Manchester, 1905. Leather, gilt edges, 3¼ in. x 5½ in., 440 pages. Price, 1*s.* 6*d.*

This is one of the series of "The Practical Engineer" pocket-books, and contains information of much the same character as that included in other similar handy reference books. Most of the data relates to English practice and the complete Board of Trade requirements are included. A small diary printed on ruled section paper is bound in the back of the book and is a useful and convenient adjunct.

Pocket Book of Mechanical Engineering.—By Charles S. Sames. Published by the author: Jersey City, N. J. 1905. Flexible leather; 168 pages. Price, $1.50.

This is a new addition to the list of engineering pocket books, and while it is not so large as most of the others in point of size it contains in very condensed and well arranged form a goodly amount of data, formulæ, examples and theory. The general divisions of the book are: Mathematics, Chemical Data, Properties of Material, Strength of Materials and Machine Design, Energy and Transmission of Power, Heat and Steam Engines, Hydraulics, Shop Data and Electrotechnics. An excellent index adds much to the convenience and value of the book.

The Practical Engineer Pocket Book—1906 Edition. The Technical Publishing Co., Ltd., Manchester, 1905. Leather, gilt edges, 3½ in. x 5½ in., 600 pages. Price. 1*s.* 6*d.*

The 1906 edition of this standard English engineering pocket book has been completely revised and some new matter added, including notes on Recent Tests of Mechanical Stokers, Forced Draft, Indicators, Emery Wheels, Gas Producers, etc. It has been kept within reasonable limits of size and is a handy and valuable little volume in every respect, although naturally more suitable for English than American engineers.

TRADE CATALOGUES.

The Walschaert Valve Gear.—A fully illustrated and well gotten up catalogue descriptive of the Walschaert valve gear is being distributed by the American Locomotive Company. A general description of this gear, prepared by Carl J. Mellin, is given, as well as a number of illustrations showing the gear in detail and as applied to various types of locomotives. A table of the comparative weights of the Stephenson and Walschaert valve gears is given, in which it is shown that from 1,200 to 1,700 lbs. can be saved by the use of the Walschaert gear. The opinions of the Walschaert gear as expressed by a number of eminent railroad men and other authorities are also given, as well as a statement by H. F. Ball, Superintendent of Motive Power of the L. S. & M. S., in regard to the results obtained with it in actual service.

Fuel Economy.—The Falls Hollow Stay Bolt Co., Cuyahoga Falls, Ohio, has had reprinted in pamphlet form two recent papers by Mr. John Livingstone read before the St. Louis Railroad Club and the New York Railroad Club. The paper read before the St. Louis Railroad Club is entitled "Coal. Its Uneconomic Use and Abuse Generally, by Steam Makers but Especially by the Railways, and How to Save Full Fifty Per Cent." It advocates the use of hollow staybolts to admit air into the firebox in sufficient quantities to cause complete combustion of the coal fired. The New York Railroad Club paper is entitled "The Quality and Utility of Solid, Flexible and Hollow Staybolts," and is a comparison of these three types of staybolts.

Transformers.—Bulletin No. 1,047 of the electrical department of the Allis-Chalmers Co., Cincinnati, Ohio, illustrates and describes the Bullock oil-insulated transformers for high-tension alternating currents. These transformers are made in all sizes and in two types, self-cooled and water-cooled. The self-cooled type is made up to 300 k.w. capacity and the water-cooled type from 100 k.w. capacity up. They are made to step-up or step-down the voltage to or from as high as 50,000 volts, and are built for either 25-cycle or 60-cycle circuits.

Single Phase Railway Apparatus.—In circular No. 1,127 of the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., the Westinghouse electric and electro-pneumatic, multiple-unit control systems for single-phase alternating current car equipments are illustrated and described together with sliding contact and bow trolleys for use on high-speed lines.

Locomotive Blow-Off Valves.—The Lunkenheimer Company, Cincinnati, Ohio, sends a two-leaf pamphlet printed in colors describing the Lunkenheimer locomotive blow-off valve, a new valve recently placed on the market. In addition to illustrating and describing the device in detail, the method of attachment to the boiler is illustrated.

Friction Clutches.—The Reliance friction clutch is illustrated and described in Bulletin No. 1,202 of the Allis-Chalmers Co., Milwaukee, Wis. They are made in sizes to transmit from 30 to 425 h.p. at 100 r.p.m.

Multipolar Motors and Generators.—Bullock multipolar motors and generators are illustrated and described in Bulletin No. 1,046 of the Allis-Chalmers Co., electrical department, Cincinnati, Ohio.

Crane Motors.—The Northern Electrical Mfg. Co.'s enclosed type of crane motor is described in Bulletin No. 32.

"The Scott Special."—The Santa Fe has prepared an interesting account of the record-breaking run of the "Scott Special" from Los Angeles, Cal., to Chicago, in July. (*Railroad Gazette*, Sept. 8.) The narrative was written by a member of the party and describes all

of the interesting details of the trip. The account is illustrated by portraits of the principals, of the enginemen, views of the train and typical locomotives, and gives a map of the line and a profile. There is also an appropriate cover design.

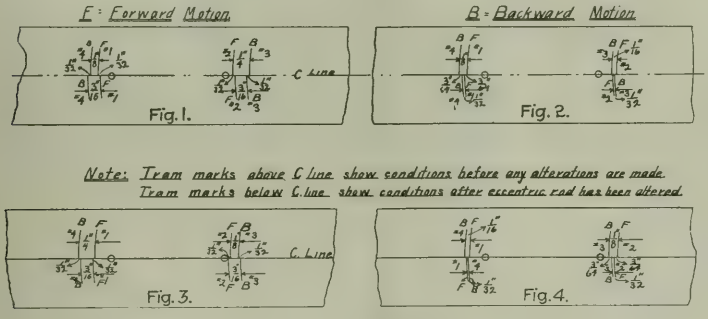
CONTRIBUTIONS

Setting Valves With the Walschaert Gear.

Philadelphia, Dec. 22, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of December 8 was an article on this subject by Mr. T. F. Crawford describing the method in use at the Baldwin Locomotive Works. A number of misstatements in that article should be corrected for the benefit of those who may be called upon to set valves with the Walschaert gear.


F = Forward Motion
B = Backward Motion
C Line
Fig. 1.
Fig. 2.
Note: Tram marks above C line show conditions before any alterations are made.
Tram marks below C line show conditions after eccentric rod has been altered.
C. Line
Fig. 3.
Fig. 4.

Figs. 1 to 4—Tram Marks on Valve Stem.

Mr. Crawford says that the eccentric rod should be shortened when the backward motion laps the forward motion. This is correct only for the particular case to which he refers which is reproduced in Fig. 1, herewith. It is desired to alter the eccentric rod in such a way that the ¼ in. will be reduced and the ⅛ in. increased until they are equal. Four points must be moved; therefore we take one-fourth of the difference between ¼ in. and ⅛ in. or $^1/_{32}$ in. to obtain the amount of the movement of the valve rod for each point. So if point No. 1 is moved to the right $^1/_{32}$ in., point No. 2 to the right $^1/_{32}$ in., point No. 3 to the left $^1/_{32}$ in. and point No. 4 to the left $^1/_{32}$ in., we have $^3/_{16}$ in. between points 1 and 4 and $^3/_{16}$ in. between points 2 and 3. The forward gear has a direct motion and the backward gear has an indirect motion. If now, the eccentric rod be altered enough to move the valve stem so that point No. 1 will come $^1/_{32}$ in. to the right and point No. 4 $^1/_{32}$ in. to the left, the rod must be shortened. Taking up points 2 and 3, it will be seen that shortening the eccentric rod moves point No. 2 to the right and point No. 3 to the left the desired amounts. In this case the statement made is correct.

But let us transfer the quantities ¼ in. and ⅛ in., leaving the other conditions the same. (See Fig. 3.) We still have to move the points $^1/_{32}$ in., but this time in the opposite direction to make them equalize. Point No. 1 moves $^1/_{32}$ in. to the left and point No. 4 moves $^1/_{32}$ in. to the right, while point No. 2 moves $^1/_{32}$ in. to the left and point No. 3 moves $^1/_{32}$ in. to the right. Hence if the eccentric rod be lengthened instead of shortened, points 4 and 1 will approach and points 2 and 3 will separate as is desired. Therefore it will be seen that the statement that the rod should be shortened is not true for all cases. In the above cases we have $^3/_{16}$ in. more lead on the backward motion than on the forward motion. It now remains to move the eccentric so that the $^3/_{16}$ in. will be divided. Unless this is done the movement would be $^3/_{64}$ in. on the valve stem.

In Fig. 2 we have ⅛ in. between points 4 and 1 and $^1/_{16}$ in. between points 2 and 3. Since both points of the forward motion fall on the same side of the corresponding points for the backward motion we add the quantities and take one-fourth of the sum, which gives $^3/_{64}$ in. as the amount of movement on the valve stem. From the figure it is evident that by lengthening the eccentric rod the desired movement will be obtained and that the backward motion laps the forward $^1/_{32}$ in. on both ends, which leaves $^1/_{64}$ in. to be taken up by moving the eccentric.

Referring to Fig. 4 we have the quantities transposed, which requires the eccentric rod to be shortened, but this time we have the forward motion lapping the backward motion by $^1/_{32}$ in., which necessitates an eccentric movement of $^1/_{64}$ in. in the opposite direction to that in the case previously considered. The object of this manipulation is to adjust for equal lead for both points in forward motion and equal lead for both points in backward motion and then to equalize the leads for both motions by the eccentric.

The second error in the article is the statement of the reason for using three-quarters of the amount of movement shown on the valve stem in altering the length of the eccentric arm. It has been shown why one-quarter of the sum or difference is taken for equalizing the lead in forward and backward motions. The reason for taking three times this amount in the particular case under consideration in altering the eccentric rod is derived by an entirely different method from that assumed by Mr. Crawford.

In Fig. 5 is shown the arrangement of the gear and its parts. The link is suspended at the center of the slotted portion and from this center C to the point of attachment of the eccentric rod is the arm B. The distance from C to the center of the link block when in full gear backward or forward motion is the arm A. The ratio of these lever arms determines the amount of the valve stem movement to be taken in altering the eccentric rod.

Let a = amount of movement on the valve stem.
x = amount of alteration required on eccentric rod.

Then A:B::a:x or A x = B a from which $x = \left(\frac{B}{A}\right) a$. The ratio of $\frac{B}{A}$ for the gear in question—the Pennsylvania Railroad consolidation engines—is approximately 3 to 1; hence the eccentric rod is altered three times the amount shown on the valve stem. In this case, the amount was ¼, hence the rod is altered three times ¼ or ¾. It is evident that this ratio will be different for every different design of gear and must be furnished to the men who set the valves by some one familiar with the design of the gear.

In the case of the Pennsylvania Walschaert gear the crank arm or eccentric was keyed fast to the main pin before being brought to the erecting shop, the position being located by means of a template. Therefore, if the eccentric was located too far ahead or too far back the result would be to increase the lead in one motion and reduce it in the other motion. This eccentric arm was so accurately located in this way that out of an order of 160 locomotives the lead did not vary more than $^3/_{64}$ in. from the amount designed to be given, which was ¼ in., and this extreme error was found only in a very few cases, most of them being perfect.

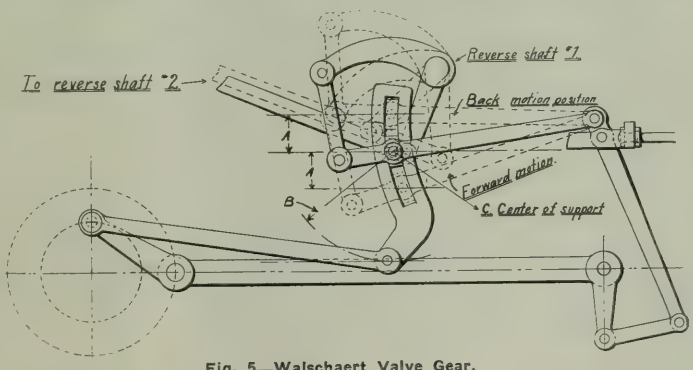


Fig. 5—Walschaert Valve Gear.

It is interesting to note why any alteration of the eccentric rod was found necessary. The standard design on the Pennsylvania Railroad is to have a link made from one piece of metal, and on the Walschaert gear the arm to which the eccentric rod is attached is merely an extension of the link. The links are case-hardened to give a hard wearing surface and, in the process of hardening, the metal has a tendency to warp. The arm to which the eccentric rod is attached moves back in some instances and ahead in others. This movement of the metal requires a like adjustment of the eccentric rod, as it is not considered good practice to attempt to bend this arm back to place after it has been hardened. This is an error which cannot be allowed for in the manufacture of the link.

s no two pieces of metal perform alike in the process of case-ardening owing to different degrees of expansion and contraction.

ROY C. HARDING,
Track Foreman on Valves, Baldwin Locomotive Works.

An Engineman's Reply to Criticism.

South Portland, Me., Dec. 20, 1905.

To the Editor of the Railroad Gazette:

The extracts from the paper of the claim department of the A. B. & C. Railroad in the *Railroad Gazette* of Dec. 15 are of no small interest to the fraternity. To the layman its don'ts, and its recommendations, will appeal strongly as being very easy to carry out. But the layman generally sees but one side of the case, and draws his conclusions accordingly. To men who know both sides, who know all the whys and wherefores, the matter looks different. At the outset, however, I will agree with the author of the paper that a majority of the accidents are caused by bull-headedness. Others are purely unavoidable, and no amount of vigilance can forestall them. The author asks, in connection with one accident, should not trains be blocked one station apart? I fully agree with him that this is the only *absolute* prevention of rear collisions, this rule to apply under all circumstances. But the average official will hold up his hands in horror and say, impossible! We could never get trains over the road were we to adhere to such a rule as that. That does not in the slightest degree alter the fact of its absolute safety, and at the end of the year the company will make a better financial showing, beside establishing a record for safety. To be sure, there are very many violations of rules winked at by officials as long as nothing happens. Some day something happens and the official eye is opened to the thing winked at. It is then too late.

The author says don't run curves, etc. As long as enginemen are hounded for every minute lost they are going to try and make time regardless of curves, and will take many chances rather than be asked to explain, by telegraph, the reason of each minute's loss of time. The time is expected to be made, rain or shine, snow or blow, regardless of zero weather. Not long since a brother engineman on a fast night run lost a minute between stations. On reaching the next station up comes the conductor with a message, why did you lose a minute between A and B? This reply was perhaps not very satisfactory: "Tell them I did not run fast enough." Perhaps there were some curves he did not dare run so fast around. Yet, why did you lose a minute? Just as if that minute was the last. It is very fine to talk about making a station stop, then another for a waterplug, and be nagged because you do not make the time.

It is indeed aggravating to have all the dishes slide along the table of the diner at every stop, but is the engineman always to blame? In many cases the engineman cannot handle the air as nicely as "the other fellow"; that is where the "air car" fails. You can make pretty stops in the car with the "dummies," but all the explanations in the world cannot help you do the same on the road in practice.

As to brake-shoes, grease plugs, etc., mentioned by the author, the closest possible inspection will not always detect a crack in the former, and if detected, you are not sure after reporting a shoe that it will be replaced by a new one. So much roundhouse work nowadays is done with the pencil! As to the latter, possibly grease cups are meant. Pounding rods will break off cups as fast as they are put on. Surely the engineman is not to blame for that. The engine is a "pool" engine; nobody owns it except the company, and the company don't seem to care. In this connection the advice to agents is good: "Chase the people off the platform when a flyer is about to pass"!

J. V. N. CHENEY.

The recent collision caused by a drunken engineman has moved the Prussian Minister of Public Works to issue an order which positively forbids the use of intoxicating drinks while on duty and imposes severe penalties for its violation. The manner in which the temperance movement has spread on the German railroads is notable. But a few years ago the few men who advocated it were looked upon as cranks, and their efforts seemed to be rather discouraged than otherwise by the authorities; now the tendency is all in the other direction, and apparently a trainman known to be a total abstainer will have the preference, and the one who is known to tipple a little will find it hard to keep his place, to say nothing of getting promotion.

New St. Louis Freight Terminals of the Wabash.

The Wabash recently completed and is now occupying large new freight terminals in St. Louis, extending from Franklin avenue on the south to Biddle street on the north and Fourth street on the west to Second street on the east. The Missouri line of

Inbound Freight House of the Wabash at St. Louis.

the Wabash enters St. Louis from two direction by branching at Ferguson, northwest of the city. One line, known as the main line to Union Station, enters from the west side and forms almost exactly an east-and-west center line through the city. This is the line that was used for the shuttle trains during the World's Fair. It is used for through passenger traffic, through business for the West from the Frisco, and for freight service for through cars to and from Cupples station, which serves the commercial interests in its neighborhood.

Interior of Inbound Freight House of the Wabash at St. Louis.

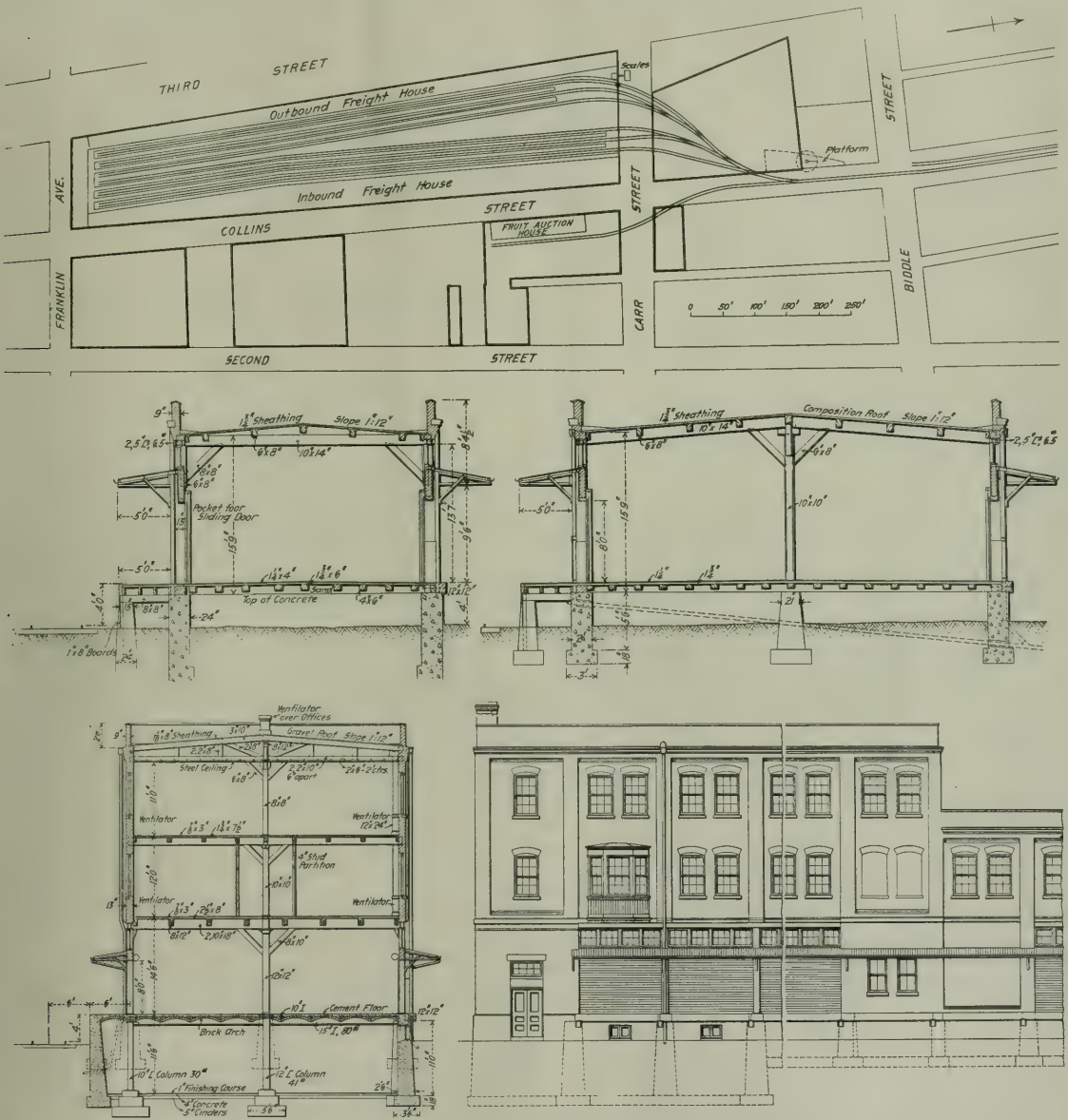
The other line enters the city from the north and approximately parallels and is quite close to the river, running as far as Olive street and the Levee. Considerable suburban business is handled over this line, but the principal function is in connection with freight traffic to and from the west; the freight trains for the west being received and made up at Luther yard, about 5½ miles from Olive street. The line from the East connects with this line by the Merchants' bridge, and also reaches the new terminals over Eads bridge, further south, the freight houses being only about two blocks north of the latter.

Illustrations of the new terminals are shown herewith. They occupy approximately 300,000 sq. ft. of ground close to the heart of the city and are said to provide the most extensive facilities of their kind in St. Louis. The inbound freight house has 81,000

sq. ft. of floor space, including the basement, and the outbound house 22,000 sq. ft. There is track room for about 130 cars and all of the cars on all of the tracks are available to either or both houses. In addition, there is a "fruit auction house" with about 4,400 sq. ft. and two tracks adjoining.

The inbound house is two stories high for 501 ft. of its length and one-story for the remaining 345 ft., with a three-story office portion. The outbound house is one-story high throughout, its construction being similar to the inbound house. Sections through the inbound house are shown herewith to illustrate the details of construction. Referring to the section through the office portion, the foundations are concrete and the columns in the basement are channels. The first floor is cement laid over brick arches sprung between 10-in. I-beams supported by 15-in. 80-lb. I-beams. The building walls are brick, the interior construction above the first floor is timber, and the roof is gravel. The first and second floors are crowned 2 in. Both sides of the house have steel rolling doors. The track side has a 5-ft. platform and both sides a 5-ft. canopy. The one-story portion of the house, which was added after the part just described had been completed, has no basement, the space between foundation walls being filled in. It has a wooden floor, composition roof and sliding doors. The width of this portion reduces from 42 ft. where it adjoins the higher portion, to 24 ft. at the south end, owing to the irregularity of the property.

There are six tracks between the inbound and outbound houses with island platforms 6-ft. wide between tracks except the center two. As already mentioned, there is track room here for about 130 cars. In addition to these facilities the capacity of the team tracks for the delivery and reception of car-load freight at North Market street, about a mile north of the freight houses, has been doubled, and the yard enlarged, macadamized and generally improved, putting them in shape to take care of all the car-load business offered, which was formerly handled on both sides of the river. These yards extend from North Market street on the south to Branch street on the north and have ten acres occupied by tracks.



General Plan of Wabash St. Louis Freight Terminal, Showing Elevation and Cross Sections of Freight House.

The fruit auction house is across Collins street from the inbound house. It is brick, 30 ft. x 50 ft. This building is a species of produce exchange, controlled by a stock company called "The American Central Fruit Auction Company," organized for the purpose of auctioning fruit for commission dealers, under the direction

of a manager. There is one other similar house in St. Louis, controlled by another company.

The total cost of the terminals, exclusive of the property, was $165,000. We are indebted to Mr. Henry Miller, General Manager, and Mr. A. O. Cunningham, Chief Engineer, for the data.

Railroad Built in 1905.

Table Showing Mileage Built in 1905, Classified by States.

	No. of Cos. building.	1905.	No. of Cos. building.	1904.
Alabama	4	103.08	5	110.64
Alaska	2	13	2	15
Arizona	1	45.47	1	59.66
Arkansas	11	198.51	9	142.43
California	6	34.27	11	191.3
Colorado	4	83.15	5	139.1
Florida	4	10.80	4	54.67
Georgia	6	120	7	119
Idaho	5	109.7	1	13.39
Illinois	8	249.49	7	162.78
Indiana	3	171.79	3	39
Indian Territory	4	98.4	4	150.49
Iowa	3	15.20	2	29
Kansas	2	21.60	1	29
Kentucky	5	76.45	1	20
Louisiana	10	99.30	7	128.61
Maine	2	65.26	2	20
Maryland	1	40.70	1	15.8
Massachusetts	1	1	..	...
Michigan	9	87.76	5	21.7
Minnesota	5	108.29	2	221.49
Mississippi	5	120.5	7	267.93
Missouri	3	48.99	7	270.44
Montana	..	...	1	67.29
Nebraska	1	47	..	...
Nevada	3	86.99	2	176.50
New Jersey	1	9.90	2	7.64
New Mexico	3	122.5	2	10.62
New York	4	49.68	1	2
North Carolina	8	124.5	6	49.2
North Dakota	4	520.75	1	32.85
Ohio	3	84.06	5	83.3
Oklahoma Ter.	3	154.4	4	163.22
Oregon	5	68.42	1	23
Pennsylvania	8	76.7	15	195.85
Rhode Island	1	3.5	..	...
South Carolina	2	28	3	17.3
South Dakota	4	116	1	20
Tennessee	5	151.2	3	98.9
Texas	9	338.5	9	323.28
Utah	5	66.02	2	10
Vermont	1	5	..	...
Virginia	2	13.96	2	12.94
Washington	3	49.50	3	53.31
West Virginia	8	165.23	8	174.78
Wisconsin	7	142.65	5	81.85
Wyoming	2	40.85	1	7
Total, United States	198	4,388.02	172	3,832.26
Canada	11	1,180.86	7	316.39
Mexico	5	238.42	4	115.75

UNITED STATES.

ALABAMA.

Alabama Central—Booth Station to Autaugaville	8.00
Bay Minette & Fort Morgan (L. & N.)—Bay Minette to Foley	36.52
Birmingham Mineral (L. & N.)—Huntsville branch No. 2, from Altoona to Moragne	15.56
Escambia—Florida State line to Camp Eleven	43.00
	103.08

ALASKA.

Alaska Central—Not specified	8.00
Council City & Solomon River—From East Fork of Solomon River to mouth of John's Creek	5.00
	13.00

ARIZONA.

Arizona & California (A., T. & S. F.)—From five miles west of Wickenburg west	45.47

ARKANSAS.

Arkansas & Gulf—Cypress to Arkansas-Louisiana State line	1.20
Bonnerville Southwestern (S. L. & S. F.)—Estico to end of track	3.00
Cherry Valley (S. L. & S. F.)—Halberts to end of track	6.00
Fourche River Valley & Indian Territory—Esau southeast	9.00
Little Rock & Southern (C., R. I. & P.)—Haskells towards Fordyce	35.00
Memphis, Helena & Louisiana (Mo. Pac.)—From Latour south to Watson	56.00
Pine Bluff & Western—Sheridan to Benton	23.00
St. Louis, Iron Mountain & Southern (Mo. Pac.)—Bergman to Arkansas-Missouri State line	18.31
Thornton & Alexandria—Thornton to Calhoun	20.00
Tyronza Central (S. L. & S. F.)—Lepanto to end of track	3.00
Ultima Thule, Arkadelphia & Mississippi—Daleville to Sparkman Junction	24.00
	198.51

CALIFORNIA.

Butte County—Stirling City to Gallagher	7.00
Ione & Eastern—Ione to Martell	12.00
McLoud River—Algoma to Bartle, 4.00 miles; Bartle to end of track, 3.00 miles; total	7.00
Pajaro Valley Consolidated—Spreckles to Buena Vista	5.50
San Francisco & Northwestern (A., T. & S. F.)—End of track to Shively	1.30
San Pedro, Los Angeles & Salt Lake—In Los Angeles	1.47
	34.27

COLORADO.

Colorado & Southern—Wellington to Waverly, 4.80 miles; Wellington to North, 1.20 miles; total	6.00
Denver & Rio Grande—Carbon to Colorado-New Mexico State line	18.15
Denver, Northwestern & Pacific—Arrow to Sulphur Springs	34.00
Great Western—Windsor to Eaton, 13.00 miles; Johnstown to Liberty, 12.00 miles; total	25.00
	83.15

FLORIDA.

Escambia—Century to Florida-Alabama State line	3.00
Florida West Shore—Sarasota to Fruitville	3.80
Jacksonville Terminal—Not specified	1.00
Plant City, Arcadia & Gulf—Keysville to Welcome	3.00
	10.80

GEORGIA.

Atlanta, Knoxville & Northern (L. & N.)—Tennessee-Georgia State line to Cartersville	62.20
Darien & Western—Tibet to Weefanie	15.00
Dublin & Southwestern—Rentz to Eastman	18.00
Georgia Northern of Georgia—Okhawn to Boston	5.80
Reidsville & Southeastern (D. & W.)—Reidsville to Glenville	16.00
Tallulah Falls—Clayton to Passover	3.00
	120.00

IDAHO.

Malad Valley (O. S. L.)—Utah State line to Malad City	13.60
Minidoka & Southwestern (O. S. L.)—Minidoka to Twin Falls	59.10
Pacific & Idaho Northern—Council to Salmon Junction, 1.25 miles; Council to end of track, 3.75 miles; total	5.00
St. Anthony (O. S. L.)—Elva branch, Elva to Menan, 10.20 miles; Sugar City branch, Sugar City to Snake River, 5.80 miles; total	16.00
Yellowstone Park (O. S. L.)—St. Anthony to Marysville	16.00
	109.70

ILLINOIS.

Chicago & Illinois Western—McCook to Hawthorne, 12.00 miles; Gary to Willow Springs, 3.00 miles; total	15.00
Chicago & State Line (C. & N.-W.)—Lake Bluff north to Illinois-Wisconsin State line	10.30
Chicago Southern (So. Ind.)—Humrick-Chicago line	60.00
Illinois Central—Zeigler toward Herrin	2.00
Illinois, Iowa & Minnesota—Rockford to DeKalb, 37.31 miles; Aurora to Momence, 59.73 miles; total	97.04
Illinois Terminal—Cotters to Le Claire	4.60
Indiana Harbor (L.S. & M.S.)—Danville to Indiana-Illinois State line	8.49
Northern & Southern Illinois (C., B. & Q.)—Centralia to Herron	52.06
	249.49

INDIANA.

Indiana Harbor (L. S. & M. S.)—Indiana-Illinois State line near Danville, Ind., to Osborne	95.79
Indianapolis Southern (Ill. Cent.)—Indianapolis to Unionville	51.00
Southern Indiana—Five miles north of Terre Haute to Indiana-Illinois State line near Humrick, Ill.	25.00
	171.79

INDIAN TERRITORY.

Atchison, Topeka & Santa Fe—Owasso to Tulsa	10.28
Midland Valley—Tulsa to Skiatook	15.10
Chicago, Rock Island & Pacific—Colgate to Lehigh	6.52
Missouri, Oklahoma & Gulf—Corretta to Wagoner, 8.20 miles; Muskogee to Dustin, 58.30 miles; total	66.50
	98.40

IOWA.

Chicago, Anamosa & Northern—From a point 2.50 miles southeast of Prairieburg to Coggon	9.20
Colfax Northern—No. 8 Junction to Shaft No. 8	2.00
Newton & Northwestern—Goddard to Colfax	4.00
	15.20

KANSAS.

Denver, Enid & Gulf—Oklahoma-Kansas State line to Kiowa	1.60
Topeka & Northwestern (Union Pac.)—Menoken to Station No. 2	20.00
	21.60

KENTUCKY.

Chesapeake & Ohio—Allendale to Elkhorn	43.00
Cincinnati, Flemingsburg & Southeastern—Johnson to Hillsboro	17.00
Licking Valley—Morgan to Blackwater	6.00
Louisville & Nashville—Cumberland Valley branch, up left fork of Straight Creek	1.45
Southern—Harrodsburg to Danville	9.00
	76.45

LOUISIANA.

Arkansas & Gulf—Arkansas-Louisiana State line south to Laark	5.80
Jasper & Eastern (A., T. & S. F.)—Sabine River to De Ridder	22.50
Kentwood & Eastern—Not specified	2.00
Little Rock & Monroe—Sterlington to Monroe	16.00
Louisiana Nickel Plate—Not specified	2.00
New Orleans, Natchany & Natchez—From Montpelier north	4.00
New Orleans Terminal—Not specified	5.00
Shreveport, Jonesboro & Natchez—Jonesboro to Gars Mill	12.00
Texas & Pacific—Simmsport to Melville	22.00
Tremont & Gulf—Chatham to four miles south of Beaucoup	8.00
	99.30

MAINE

Northern Maine Seaport—Searsport to South Lagrange, 53.26 miles; Stockton to Cape Jellison, 2 miles; total	55.26
Somerset—Dead Water to Lake Moxie	10.00
	65.26

MARYLAND.

Western Maryland—Hancock west toward Cumberland	40.70

MASSACHUSETTS.

Boston & Maine—East Deerfield, connecting the Connecticut River and Fitchburg divisions	1.00

MICHIGAN.

Boyne City, Gaylord & Alpena—Camp 10 to Gaylord	15.00
Chicago & North-Western—Wisconsin-Michigan State line to Saunders	0.91
Escambia & Lake Superior—Not specified	6.00
Grand Rapids Terminal (Grand Trunk)—In Grand Rapids	1.52
Manistee & Grand Rapids—Section 28 in Osceola County to Marion	6.96
Manistique—Diller to Curtis	6.00
Marquette & South Eastern—West Yard to Big Bay	24.00
*Michigan Central—Kalamazoo to Lawton	15.31
Michigan Central—Logging branches	4.00
Munising—East branch, northeast to Cousino	8.06
	87.76

MINNESOTA.

Duluth & Northern Minnesota—Beaver to point two miles north of North Branch Junction, 6.00 miles; North Branch Junction to point two miles beyond Swan Toole, 7.00 miles; total	13.00
Duluth, Missabe & Northern—Keenan to Sherwood	8.04*
Great Northern—Red Lake Falls to Dugdale, on Duluth-Crookston line	15.00
Minneapolis, Red Lake & Manitoba—Bemidji to Nebish	26.25
Minneapolis, St. Paul & Sault Ste. Marie—Thief River Falls west to Red River	46.00
	108.29

MISSISSIPPI.

Gulf & Ship Island—Silver Creek branch, Silver Creek south, 8.00 miles; Columbia north, 3.00 miles; total	11.00

*Change in location of old main line.

Mississippi Central—Silver Creek west to Pearl river..... 7.50
Mobile, Jackson & Kansas City—Newton to Noxapater, 43.50 miles; Ackerman to Houston, 35.00 miles; Decatur Junction to Decatur, 1.00 miles; total..... 80.00
Natchez, Columbia & Mobile—Roonville east..... 2.00
Yazoo & Mississippi Valley—Hendon south, 2.00 miles; Webb toward Parchman, 1.00 mile; Helm northwest, 7.00 miles; Silver City toward Kelso, 10.00 miles; total..... 20.00
120.50

MISSOURI.

Missouri Southern—Crab Tree branch, Crab Tree to Pinedale, 13.00 miles; Corridon branch, Corridon to Jackson, 9.00 miles; total.. 22.00
St. Louis, Iron Mountain & Southern—Galena to Arkansas-Missouri State line, 21.69 miles; Thebes bridge approaches, 3.91 miles; total..... 25.60
Union Terminal—Extension to Lake Contrary..... 1.39
48.99

NEBRASKA.

Great Northern—Sioux City-Ashland line (C., B. & Q. connection).. 47.00

NEVADA.

Nevada & California (formerly Carson & Colorado) (So. Pac.)—Fort Churchill to Hazen..... 27.99
San Pedro, Los Angeles & Salt Lake—Borax to Bard..... 24.00
Tonopah & Goldfield—Tonopah to Goldfield..... 35.00
86.99

NEW JERSEY.

Central of New Jersey—Spur to Brill street, Newark, 0.36 miles; in Bayonne, 0.60 miles; total..... 0.96
Lehigh Valley—Elizabeth to Irvington..... 2.94
Rahway Valley—Kenilworth to Summit..... 6.00
9.90

NEW MEXICO.

Denver & Rio Grande—Colorado-New Mexico State line to Farmington..... 29.50
Eastern Railway of New Mex. (A., T. & S. F.)—Texico to Brazil Springs, 51.00 miles; Llano to Montencino, 14.00 miles; Willard west, 16.00 miles; Sais toward Abo Canyon, 2.00 miles; total 83.00
Santa Fe, Raton & Eastern—Raton east..... 10.00
122.50

NEW YORK.

Buffalo & Susquehanna—Wellsville to Canadea, 26.00 miles; Sandusky to Yorkshire, 7.00 miles; total..... 33.00
Delaware & Eastern—Arkville to Union Grove..... 10.00
Delaware & Hudson—Warrensburg to Thurman..... 3.40
Glen Cove (Long Island)—Sea Cliff Station to Glen Cove Harbor.... 3.28
49.68

NORTH CAROLINA.

Atlantic & Western—Jonesboro to Broadway..... 7.00
Bee Tree—Swannanoa to Craggy Mountain..... 5.00
Caldwell & Northern—Collettsville to Edgemont..... 14.00
Durham & South Carolina—Durham southwest..... 30.00
Durham & Southern—Apex to Durham..... 21.00
Raleigh & Pamlico Sound—Raleigh east towards Wilson..... 12.50
Raleigh & Southport—Lillington south toward Fayetteville..... 6.00
Wellington & Powellsville—Windsor to Plymouth..... 29.00
124.50

NORTH DAKOTA.

Farmers' Grain & Shipping Company—Starkweather to Hansboro... 42.00
Great Northern—York branch, York to Thorne, 34.35 miles; Towner branch, Towner to Maxbass, 45.89 miles; Bottineau branch of the Minot division, Westhope west to Antler, 12.75 miles; Lakota branch, Munich to Sarles, 20.53 miles; Davenport to Chaffee, 7.00 miles; total..... 120.52
Minneapolis, St. Paul & Sault Ste. Marie—Red River west to Kenmare, 251.00 miles; Egeland to Armourdale, 20.00 miles; Underwood to Garrison, 19.50 miles; total..... 290.50
Northern Pacific—Denhoff to Turtle Lake, 27.85 miles; Edgeley to Streeter, 39.88 miles; total..... 67.73
520.75

OHIO.

Baltimore & Ohio—Haselton to Niles, 8.52 miles; Niles to Cuyahoga Falls, 41.50 miles; total..... 50.02
Cincinnati, Georgetown & Portsmouth—Georgetown to Russellville, 7.00 miles; Cincinnati to Coney Island, 3.50 miles; total..... 10.50
Toledo & Indiana—Wauseon to Bryan, 22.33 miles; Wauseon to sidings, 1.21 miles; total..... 23.54
84.06

OKLAHOMA TERRITORY.

Denver, Enid & Gulf—Coldwater via Cherokee to Oklahoma-Kansas State line..... 46.40
Kansas City, Mexico & Orient—Fairview to Custer City..... 50.00
Midland Valley—Skiatook to Foraker..... 58.00
154.40

OREGON.

Columbia River & Oregon (O. R. R. & N.)—Arlington to Condon.. 45.00
Louisiana & Pine Bluff—Not specified..... 3.00
Oregon & Eureka—Luffenholtz to Camp 13, 1.20 miles; on extension from Eureka toward Arcata, 2.50 miles; total..... 3.70
Oregon State Portage—Cello to Big Eddy..... 8.50
Sumpter Valley—Tipton to Austen..... 8.22
68.42

PENNSYLVANIA.

Buffalo & Susquehanna—Juneau to Sagamore..... 20.00
Buffalo, Rochester & Pittsburg—Rockton to coal mines..... 3.00
East Broad Top—Rocky Ridge to Evanston..... 5.00
Lancaster, Oxford & Southern—Fairmount to Quarryville..... 7.00
Northampton & Bath—Northampton to Bath..... 21.00
Pennsylvania—Cambria & Clearfield division, Possom Glory Junction to Clymer..... 4.00
Pittsburg, Summerville & Clarion—Waterson west thorough Bush Run 2.00
Western Allegheny (B. & L. E.)—Queen Junction to Rose Point... 14.70
76.70

RHODE ISLAND.

Newport & Wickford—Wickford Landing to Wickford Junction..... 3.50

SOUTH CAROLINA.

Conway Coast & Western—Conway to Cool Spring..... 12.00
Union & Glenn Springs—Prides to Union..... 16.00
28.00

SOUTH DAKOTA.

Chicago, Milwaukee & St. Paul—Armour to Stickney, 20 miles; Madison to Saranac, 11 miles; total..... 31.00
Missouri River & Northwestern—Rapid City west towards Mystic... 20.00

South Dakota Central—Colton to Wentworth..... 25.00
White River Valley (C., M. & St. P.)—Chamberlain to Presho..... 40.00
116.00

TENNESSEE.

*Atlanta, Knoxville & Northern (L. & N.)—Knoxville to Etowah.. 59.00
Atlanta, Knoxville & Northern (L. & N.)—Etowah to Tennessee-Georgia State line toward Cartersville, Ga..... 16.00
Cincinnati, New Orleans & Texas Pacific—Cardiff to Tennessee river 5.50
Little River—Not specified..... 18.00
*Louisville & Nashville—Henderson division, Goodlets to Greenbrier 8.70
Louisville & Nashville—Knoxville division, Byington to Wind Rock. 26.00
Tennessee—Jakes branch to Buffalo Creek..... 8.00
Virginia & Southwestern—Taylor Mines branch, Rexford to Baldeen 10.00
151.20

TEXAS.

Beaumont & Great Northern—Trinity east..... 4.00
Houston & Texas Central—Mexia south..... 1.00
Jasper & Eastern (A., T. & S. F.)—Kirbyville to Sabine River..... 17.50
Kansas City, Mexico & Orient—Between Sweetwater and Knox City.. 75.00
Northeast Texas—Red Water to Daingerfield..... 14.00
Orange & Northwestern—Buna to Newton..... 31.00
St. Louis, Brownsville & Mexico—From a point 3.50 miles north of Robstown to Bay City, 139.00 miles; Algoa to Brazoria, 32.00 miles; total..... 171.00
Texas & Gulf—Timpson to Watterman..... 16.00
Texas Southeastern—Diboll to Naches river..... 9.00
338.50

UTAH.

Malad Valley (O. S. L.)—Garland to Idaho State line..... 18.30
Oregon Short Line—Logan branch, Logan Sugar Works to Wellsville 8.40
Rio Grande Western—Roy to Hooper, 4.05 miles; Bingham branch, Garfield Junction to Garfield, 16.20 miles; total..... 20.25
Salt Lake & Ogden—Lagoon to Kaysville, 3.75 miles; Kaysville to Layton, 2.25 miles; total..... 6.00
*San Pedro, Los Angeles & Salt Lake—Modena to Morton, 10.74 miles; at Goss, 2.33 miles; total..... 13.07
66.02

VERMONT.

Bethel Granite—Bethel to quarries..... 5.00

VIRGINIA.

Norfolk & Western—Big Creek branch, from above Richlands to coal fields in Tazewell County, 5.96 miles; Speedwell extension from Cripple Creek, 1.00 mile; total..... 6.96
Tidewater—Algren to Suffolk..... 7.00
13.96

WASHINGTON.

Columbia & Puget Sound—Walsh to Rock Creek..... 2.75
Northern Pacific—Main line junction switch to Granger..... 2.75
Spokane Falls & Northern (Gt. Nor.)—International boundary line near Midway, B. C., west to 5.00 miles south of recrossing into British Columbia..... 44.00
49.50

WEST VIRGINIA.

Chesapeake & Ohio—Leewood to Coal River extension of Cabin Creek branch, 12.00 miles; Station 664 on Rainey Creek branch, 3.00 miles; Bartow to Winterburn, 3.00 miles; total..... 18.00
Coal & Coke—Adrian to Gassaway..... 50.20
Coal River—Holleyhurst to Bull Creek..... 5.00
Deepwater—Blake to Fetzer..... 43.00
Iager & Southern (N. & W.)—Ritter up Dry Fork of Tug River to Berwind-White coal fields..... 20.00
Meadville & Somerville—From Strange creek..... 10.00
Norfolk & Western—Clear Fork branch from Gordon..... 10.43
Western Maryland—Between short arms of Potomac River..... 8.60
165.23

WISCONSIN.

Chicago & North-Western—From a point six miles north of Laona to Wisconsin-Minnesota State line, 28.62 miles; Mercer to Fosterville, 20.49 miles; total..... 49.11
Chicago, St. Paul, Minneapolis & Omaha (C. & N.-W.)—Winter to Draper..... 10.00
La Crosse & Southeastern—Stoddard to La Crosse..... 11.80
Manitowoc, Green Bay & North-Western (C. & N.-W.)—Manitowoc north..... 16.74
Milwaukee & State Line (C. & N.-W.)—Between Wisconsin-Illinois State line and St. Francis, north and south of Bain..... 6.25
Owen & Northern (Wis. Cent.)—Owen to Ladysmith..... 42.50
Stanley, Merrill & Phillips—Jump river to Lynch..... 6.25
142.65

WYOMING.

Chicago, Burlington & Quincy—Spur track from Junction one-half mile east of Guernsey station..... 8.85
Wyoming & North-Western (C. & N.-W.)—Casper west..... 32.00
40.85

CANADA.

Algoma Central & Hudson Bay—Mile-post 66 to Mile-post 69.25..... 3.25
Brandon, Saskatchewan & Hudson Bay—Not specified..... 7.00
Canadian Northern—Arizona Junction, Man., to Carberry Junction, Man., 74 00 miles; main line, Kamsack, Assin., west via Humboldt and Battleford, Sask., to Edmonton, Alberta, 527.00 miles; total..... 601.00
Canadian Pacific—Linton to end of track, 65.00 miles; Wetaskiwin to Daysland, 50.00 miles; Lacombe to end of track, 50.00 miles; Brookdale to Varcoe, 18.00 miles; Darlingford to Kaleida, 6.00 miles; Reston to Wawota, 60.00 miles; Lander to Broomhill, 20.00 miles; Yahk to international boundary, 8.00 miles; total.. 277.00
Great Northern of Canada—St. Jacques Junction to St. Jacques.. 7.20
Halifax & Southwestern—Halifax to Liverpool, Nova Scotia..... 112.00
Klondike Mines—Dawson City to Grand Forks..... 13.00
Quebec & Lake St. John—Valcartier west, 3.00 miles; La Tuque Junction west, 12.00 miles; total..... 15.00
Quebec Bridge & Railway Company—Quebec across the St. Lawrence River to a point on the Intercolonial (except bridge)..... 9.41
Spokane Falls & Northern (Great Northern)—Grand Forks, B. C., to Phoenix..... 23.00
Temiskaming & Northern Ontario—North Bay, Ont., to Liskeard... 113.00
1,180.86

MEXICO.

Chihuahua & Pacific—La Junta to Temosachic..... 55.00
Inter California (So. Pac.)—Calexico south..... 14.27
Kansas City, Mexico & Orient—Chihuahua division, Las Trancas to San Sostenes, 41.00 miles; between the Guerrero River and Bocoyna, 50.00 miles; Pacific Coast division, between Fuerte and Las Hornillos, 10.00 miles; total..... 101.00
Linares & Gulf—Linares toward San Jose..... 6.00
Pan-American—Tonala, State of Chiapas, to Ocapa..... 62.15
238.42

*Change in location of old main line.

Proposed Increase in the Variation in the Height of Couplers.

At the October meeting of the Western Railway Club, Mr. J. J. Hennessey, of the Chicago, Milwaukee & St. Paul, introduced a topical discussion in which it was proposed to increase the variation allowed in the height of couplers. The present variation of 3 in. between the maximum and minimum height of M. C. B. couplers from top of rail does not seem to be sufficient. The standard height of 33 in. was established back in the 70's. At that time the railroads had their cars equipped with link and pin drawbars. Some of the wrought iron and Safford drawbars and others had very small openings in the mouth and it was very difficult to couple one car to the other by switchmen stepping in between the cars and attempting to enter the link of one drawbar, into the mouth of the opposite drawbar with safety to themselves, when the variation in height of the two drawbars was more than 3 in. That was the reason the M. C. B. Association established a variation of 3 in. between the maximum and minimum height of center line of drawbars from top of rail.

A few years afterward the vertical plane coupler, or what is commonly called the Master Car Builders' coupler, was adopted. At that time the knuckles had a wearing surface on the face of about 8 in., some less, some a little more, with an opening of about 2 in. in the center. The Master Car Builders' Association and railroad men generally discussed the advisability of allowing more variation between the maximum and minimum height of cars, but the objections were that in the majority of cases the lower lug of the knuckle was not over 2¾ in. wide, and they felt that with a greater variation, the tendency would be toward having all the pulling and buffing done on either the upper or the lower lug when a high car and a low car came together in switching, and thereby cause either lug to break off, and cause serious delays. But since that time things have changed. All railroads to-day are buying the solid knuckle with a 9-in. wearing face, while some of the larger roads are using knuckles having a wearing surface of 10 in., and the knuckle is solid, consequently the danger of breaking off the upper or lower lugs is no longer present.

At interchange points there is great delay in cars being sent back, especially by the belt lines which do the bulk of passing cars from one road to another, on account of the cars being higher or lower than the present prescribed limits. This is expensive to the railroads; while on the repair tracks it will be found that car repairers are continually raising old cars.

It is quite true that there is a law prescribing the 3-in. limit but the railroad companies and the Master Car Builders' Association are responsible for the law, for it was upon their recommendation that it was passed.

Viewing the matter from a practical standpoint, some figures are presented showing the actual settlement of cars. Wear on journal bearings, ⅜ in.; wear on journals, ¼ in.; wear on wheels, ¼ in.; wear on carry iron and bottom of M. C. B. coupler, ½ in. (that is, ¼ in. each); settlement of arch bars, ¼ in. It is well known that there are very few cars in service to-day that were built five or six years ago under which the arch bars do not have a tendency to bend up, and this ¼ in. is quite insufficient to represent it. Permanent set of springs was ¼ in. to ⅜ in. Difference of springs between empty and loaded cars, 1½ in. Set of overhang of car, ⅜ in.; that is, from the bolster to the end of the car. This is taken at ⅜ in. though in many old cars it amounts to as much as 1 in.; while some weak flat cars bend up an inch. The total according to these figures is 4⅛ in. There is nothing overdrawn in this; in fact, it is not sufficient, as it is not as much as really takes place in service.

Observations on one of the worst divisions of the Chicago, Milwaukee & St. Paul showed that the up and down movement of the couplers was not more than 2 in. though, of course, there is a greater variation in yards. But with the knuckle from 9 in. to 10 in. wide at least 1 in. more of variation can safely be recommended between the maximum and minimum heights. That would make it possible to build new cars 35 in. high, and the car would not be condemned or refused until it had dropped below 31 in. The settlement of new cars is sometimes great, and often amounts to as much as 1 in. after the first thousand miles.

The total allowable variation to-day under the present Master Car Builders' rules and under the Interstate Commerce Rules is 3 in., and when there is a settlement of 2 in. when a car is loaded there is but 1 in. of variation left. In short this is accountable for much more expense in the way of car repairs than many are aware of.

In the course of the discussion following the opening remarks, it was urged that 4 in. was not enough; it should be 5 in., for the reason that with a knuckle with a 10-in. face there would still be 5 in. of knuckle surface to pull on. Regarding this latter recommendation there was some variation of opinion, though it was well agreed that there should be an increase in the amount now allowed. The discussion closed with the adoption of a resolution urging the Master Car Builders' Association to consider the matter with a view of allowing greater variation than at present.

A New Oil Pumping Process.

The Southern Pacific is soon to make a test of a new pipe line pumping process for crude oil, which is expected to greatly reduce the cost and difficulty of pumping long distances. A special 8-in. pipe line 31 miles long has been laid from Volcan Siding in the Kern river oil fields to Delano, Cal., and a pumping plant consisting of three 200-h.p. boilers and a Dow compound duplex steam pump with a capacity of 1,000 gallons of oil a minute, has been installed at Volcan.

The pipe line is laid with 8-in. standard pipe made by the National Tube Co., corrugated on the inside with six grooves, each 3/64 in. deep and ½ in. wide, each groove making two complete turns in a 20-ft. length of pipe. The pipe is corrugated by a special process developed by Mr. J. D. Isaacs, Asst. Eng. Maintenance of Way, Southern Pacific. A plant for corrugating the pipe has been built near Bakersfield, Cal., on the side of a hill, and the pipe is rolled by gravity through the various processes from the time it is unloaded from the cars until it is loaded on cars again. The corrugating machine makes the pipes somewhat polygonal in shape and careful tests are made to discover any defects. Each length of pipe is tested with 1,200 lbs. of water pressure, both before and after corrugating. This testing is done by the Pittsburg Testing Laboratory and Robert W. Hunt & Co., and only selected lengths are used. Each length is weighed and measured and a separate record is kept of it.

In operation water is pumped into the pipe with the oil in sufficient quantities to form a shell around the oil which does not come in contact with the surface of the pipe. The grooves cause the water and oil to advance through the pipe with a rotary motion, and it is claimed that with this process oil can be pumped as easily as water. At the outlet a centrifugal separator removes the water from the oil. The pipe line is laid with depressions or traps every 400 ft. These traps prevent the pipe from running entirely dry in case the pumping stops and assist in getting the stream of oil surrounded with water under way again. If the tests to be made prove the new system to be successful it will probably be adopted on a large scale on the Coast.

Recent Heavy Locomotive Equipment of the Great Central Railway of England.

Within the last few years the Great Central has become one of the most active and progressive lines in England operating at the present time about 600 miles in the manufacturing country north of London and reaching Leicester, Nottingham, Sheffield and Manchester. About five years ago an entrance into London was obtained over the tracks of the Metropolitan between Quainton Road and Finchley. This stretch of track, however, was full of curves and the traffic over it was badly congested so that the line was unsuited for the operation of heavy and fast express trains. Shortly after the trackage rights were secured from the Metropolitan, the Great Central and the Great Western acting together obtained the necessary parliamentary sanction for the construction of a new line with favorable grades and few curves from Grendon Underwood to Neasden, 46 miles, which gives to both roads a fine entrance into London. Work was begun on the new line two years ago and it was thrown open for goods traffic early in November. It is expected to have the line in shape for the operation of passenger trains by March, 1906.

A considerable freight and suburban passenger business is expected over the new line as well as fast express service to the northern cities, and in anticipation of this the motive power department of the Great Central has designed and had built a number of locomotives for each of these classes of service.

The Atlantic (4-4-2) type engines were built by the North British Locomotive Company, Ltd., of Glasgow, and will be put in service on the most important express trains out of London. The cylinders, which are placed outside the frames in accordance with American practice, are 19½ in. x 26 in., and are inclined downward 1 in 48. The driving wheels are 81 in. in diameter with cast-steel centers. The trailing wheels are quite large, 51 in. in diameter, as are also the tender wheels. The forward truck wheels are 42 in. in diameter. The boiler has a Belpaire firebox, and both the shell and firebox are formed of steel plates. A working pressure of 200 lbs. is employed and the boiler has 1,931.3 sq. ft. of heating, of which 1,777.9 sq. ft. is contained in the 221 tubes, 2 in. in diameter and 15 ft. long. The firebox contains 153.4 sq. ft. of heating surface and has a grate area of 26 sq. ft. The frames are steel plate 1¼ in. thick and are bent in at the forward end to provide room for the cylinders and forward truck. In the front-end an inside stack and petticoat pipe are provided and the blast pipe

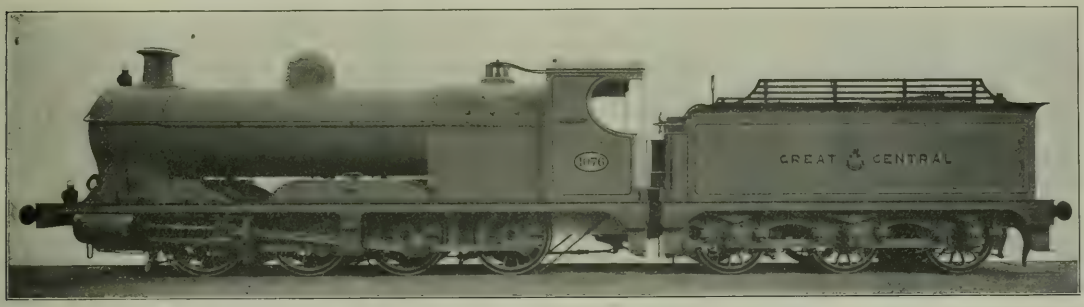
Atlantic (4-4-2) Type Express Locomotive—Great Central Railway of England.

supports a perforated dished plate spark arrester and perforated plate deflector. The forward truck has 1¼ in. of side play in the bolster controlled by heavy laminated springs, and the trailing truck has boxes of the Cartazzi type. The valves are of the balanced slide valve type with Stephenson link motion. The tender has a capacity of 4,000 gallons of water and 6½ tons of coal. A novel form of water scoop for taking water from track tanks is used, the scoop being raised and lowered with a steam cylinder moving a lifting screw.

The heavy freight locomotives which will be put in service between London, Sheffield and Manchester and Grimsby Docks are of the 0-8-0 type, and were built by Kitson & Co., Ltd., of Leeds. The cylinders are mounted outside of the frames and have a diameter of 19½ in. with 26-in. stroke. The eight wheels are 55 in. in diameter and the engine has a rigid wheel base of 17 ft. 1 in. The boiler is of the Belpaire type, 15 ft. long over tube sheets and 4 ft. 9 in. diameter, outside, with its center line 8 ft. 3 in. above the rails. It contains 1,764.9 sq. ft. of heating surface, of which 1,625 sq. ft. is in the tubes 202 in number and 2 in. in diameter. The firebox contains 139.9 sq. ft. of heating surface and has a grate area of 23.6 sq. ft. In working order the engines weigh 142,800 lbs., all on drivers, and the tender when loaded weighs 95,536 lbs., giving a total weight of engine and tender of 238,333 lbs. The engines are equipped with automatic vacuum brake apparatus.

For heavy suburban service the tank locomotives shown in the illustration have been designed and a number of these have been built by the Vulcan Foundry, Ltd., Newton-le-Willows, Lancashire. These engines have inside cylinders 18 in. x 26 in., driving two pairs of coupled wheels 67 in. in diameter. The boiler is designed for a working steam pressure of 160 lbs. and contains 1,065 sq. ft. of heating surface. Of this amount, 955 sq. ft. are in the tubes and 110 sq. ft. in the firebox, which has a grate area 19.85 sq. ft. The total wheelbase of the engines is 29 ft. 10½ in., and their length over buffers is 40 ft. 9½ in. The side tanks have a capacity of 1,450 gallons of water. At 90 per cent. of the boiler pressure the engines have a tractive effort of 18,107 lbs. Their weight in working order is 151,760 lbs.

These engines were all built from the designs of Mr. John G. Robinson, M. Inst. M. E., Chief Mechanical and Marine Superintendent of the Great Central, to whom we are indebted for the illustrations and description.



Heavy Freight Locomotive for the Great Central Railway of England.

Tank Locomotive for Suburban Service—Great Central Railway of England.

Important Changes in Railroad Officers During 1905.

The following list of official changes during the past year is not intended to be complete, but to show the more important executive appointments. The record reflects, as well, many of the most striking happenings in the railroad history of the year.

Atchison, Topeka & Santa Fe.
April—H. U. Mudge, General Manager, resigned. (See Chicago, Rock Island & Pacific.)
—J. E. Hurley, General Superintendent of the Eastern grand division, appointed General Manager.
November—E. D. Kenna, First Vice-President, resigned.

Atlantic Coast Line.
March—W. N. Royall, General Superintendent, appointed General Manager.
November—R. G. Erwin, President, resigned.
—T. M. Emerson, Third Vice-President, elected President.
December—J. R. Kenly, Fourth Vice-President, elected Third Vice-President.

Baltimore & Ohio.
February—C. S. Sims, General Manager, resigned.
—T. Fitzgerald, General Superintendent, appointed General Manager.

Central of Georgia.
January—T. S. Moise, General Superintendent, appointed General Manager.

Central Vermont.
January—E. H. Fitzhugh, Vice-President and General Manager, resigned. (See Grand Trunk.)
—G. C. Jones, Superintendent of the Middle division of the Grand Trunk, appointed General Manager.

Chicago & Eastern Illinois.
February—R. R. Hammond, Second Vice-President and General Manager, resigned.
—H. I. Miller, General Manager of the Chicago, Rock Island & Pacific, elected Second Vice-President and General Manager.

Chicago, Burlington & Quincy.
January—J. M. Gruber, General Superintendent of the Union Pacific, appointed General Manager of the lines east of the Missouri river.

Chicago Great Western.
September—S. C. Stickney, General Manager, elected also Second Vice-President.
—L. S. Cass, Assistant to the General Manager, elected Third Vice-President.

Chicago, Milwaukee & St. Paul.
September—E. W. McKenna, Assistant to the President, elected Second Vice-President.
October—H. R. Williams, General Manager, resigned. (See Pacific Railroad.)
November—W. J. Underwood, Assistant General Manager, appointed General Manager.

Chicago, Rock Island & Pacific.
February—W. B. Biddle, Freight Traffic Manager of the Atchison, Topeka & Santa Fe, elected Third Vice-President.
—H. I. Miller, General Manager, resigned. (See Chicago & Eastern Illinois.)
April—J. F. Stevens, Second Vice-President, resigned. Appointed, in July, Chief Engineer of the Panama Canal.
—H. U. Mudge, General Manager of the Atchison, Topeka & Santa Fe, elected Second Vice-President.
June—F. O. Melcher, General Superintendent of the Choctaw district, appointed General Manager of the Central and Northern districts.
—D. E. Cain, General Superintendent of the Eastern grand division of the A., T. & S. F., appointed General Manager of the Southwestern and Choctaw districts.

Cincinnati, Hamilton & Dayton.
May—J. A. Edson, General Manager, resigned. (See Kansas City Southern.)
—R. H. Bowron, Superintendent of the North and South divisions, appointed General Manager of the C., H. & D. and Chicago, Cincinnati & Louisville.
September—Eugene Zimmerman, President, resigned. (See Detroit, Toledo & Ironton.)
October—F. D. Underwood, President of the Erie, elected also President of the C., H. & D., Pere Marquette and C., C. & L.
November—Authority of the Vice-Presidents of the Erie extended over the C., H. & D., Pere Marquette and C., C. & L.
December—Judson Harmon appointed Receiver of the C., H. & D. and the Pere Marquette.

Cleveland, Akron & Columbus.
February—J. F. Miller, Vice-President, retired on a pension.

Cleveland, Cincinnati, Chicago & St. Louis.
January—M. E. Ingalls, President, elected Chairman of the Board.
—W. H. Newman, President of the N. Y. C. & H. R., elected President.
—E. V. W. Rossiter, W. C. Brown, John Carstensen and G. J. Grammer elected Vice-Presidents.

Colorado & Southern.
October—A. D. Parker, General Auditor, elected Vice-President.
December—J. M. Herbert, Vice-President and General Manager, elected First Vice-President.
—A. D. Parker, Vice-President, elected Second Vice-President, in charge of operating, traffic and accounting departments.
—J. H. Young, General Superintendent, appointed General Manager.

Cumberland Valley.
September—A. J. Cassatt, President of the Pennsylvania, elected President, succeeding T. B. Kennedy, deceased.

Denver & Rio Grande.
March—A. C. Ridgway, General Manager of the Denver, Northwestern & Pacific, appointed General Manager.

Detroit, Toledo & Ironton.
June—G. M. Cumming elected President, succeeding Samuel Hunt, deceased.
—R. K. Smith, Superintendent on the St. Louis, Iron Mountain & Southern, appointed General Manager.
July—F. A. Durban elected President.
—B. S. Warren elected Vice-President.
September—F. A. Durban, President, elected also President of the Ann Arbor, succeeding Joseph Ramsey, Jr., resigned.
November—Eugene Zimmerman elected President, succeeding F. A. Durban, resigned.
December—F. A. Durban elected Vice-President.

El Paso & Southwestern System.
May—H. J. Simmons, General Superintendent and Traffic Manager, appointed General Manager.
July—James Douglas elected President.
—A. C. James elected Vice-President.

Erie.
October—Russell Harding, First Vice-President of the C., H. & D., elected Vice-President of the Erie.
November—Russell Harding, Vice-President, resigned.

Georgia, Southern & Florida.
June—S. F. Parrott, Chairman of the Southeastern Freight Association, elected Vice-President and General Manager.

Grand Trunk.
January—E. H. Fitzhugh, Vice-President and General Manager of the Central Vermont, elected Third Vice-President, succeeding F. W. Morse, resigned. (See Grand Trunk Pacific.)
—F. H. McGuigan, Manager, elected Fourth Vice-President.

Grand Trunk Pacific.
January—F. W. Morse, Third Vice-President of the Grand Trunk, elected Vice-President and General Manager.

Harriman Lines.
May—W. B. Scott, General Superintendent of the Houston & Texas Central, appointed Assistant Director of Maintenance and Operation, succeeding B. A. Worthington. (See Oregon Railroad & Navigation.)

Illinois Central.
February—W. J. Harahan, General Manager, elected Fourth Vice-President.
—I. G. Rawn, Assistant General Manager, appointed General Manager.

Kansas City Southern.
May—J. A. Edson, General Manager of the C., H. & D., elected President.
June—William Coughlin, General Superintendent of the Denver & Rio Grande, appointed General Manager.
July—H. R. Duval elected Vice-President.

Lake Shore & Michigan Southern.
February—G. J. Grammer, General Traffic Manager, elected Vice-President in charge of traffic of New York Central Lines west of Buffalo.

Lehigh Valley.
September—J. W. Platten, Second Vice-President, resigned.

Long Island.
January—W. F. Potter, Vice-President and General Manager, elected President, succeeding W. H. Baldwin, Jr., deceased.
April—Ralph Peters, General Superintendent of the Southwest

system of the Pennsylvania Lines West, elected President, succeeding W. F. Potter, deceased.

Louisville & Nashville.
February—W. L. Mapother, Assistant to the President, elected First Vice-President.
June—W. J. Dickinson, Third Vice-President, resigned.
July—A. R. Smith, General Freight and Passenger Agent of the Atlanta & West Point, elected Third Vice-President.

Mexican Central.
June—C. R. Hudson, President of the San Antonio & Aransas Pass, elected Vice-President.

Michigan Central.
January—H. B. Ledyard, President, appointed Chairman of the Board, succeeding C. M. Depew.
—W. H. Newman, President, and W. C. Brown, John Carstensen and C. J. Grammer, Vice-Presidents of the N. Y. C. & H. R., elected to the same positions on the Michigan Central.

Minneapolis, St. Paul & Sault Ste. Marie.
August—E. Pennington, Second Vice-President, elected First Vice-President, succeeding John Hamilton, deceased.
—W. L. Martin, Freight Traffic Manager, elected Second Vice-President.

Mobile, Jackson & Kansas City.
May—F. E. Dewey, Vice-President and General Manager, resigned.
—A. McDonald elected Vice-President.
—T. P. Whittelsey appointed General Manager.
September—A. McDonald, Vice-President, resigned.
—G. J. Kobush elected Vice-President.

National of Mexico.
April—J. G. Metcalfe, First Vice-President, resigned.
—J. S. MacKie, Second Vice-President, resigned.
—D. P. Bennett, Assistant to the President, elected Vice-President, with duties of former Vice-Presidencies.

New York Central & Hudson River.
February—N. Guilford, Traffic Manager, elected Vice-President in charge of traffic of New York Central Lines east of Buffalo.

Norfolk & Western.
February—W. G. Macdowell, Treasurer, elected Vice-President.

Northern Pacific.
June—C. M. Levey, Assistant to the President, elected Third Vice-President.
August—J. N. Hill elected Vice-President, succeeding D. S. Lamont, deceased.

Oregon Railroad & Navigation.
February—B. A. Worthington, Assistant Director of Maintenance and Operation of the Harriman Lines, appointed General Manager of the O. R. R. & N. and Southern Pacific lines in Oregon, succeeding E. E. Calvin. (See Southern Pacific.)
April—B. A. Worthington, General Manager, elected also Vice-President.
May—B. A. Worthington, Vice-President, resigned. (See Wabash-Pittsburg Terminal.)
June—J. P. O'Brien, General Superintendent, appointed General Manager of the O. R. R. & N. and Southern Pacific lines in Oregon, Washington and Idaho.
July—J. P. O'Brien elected also Vice-President.

Pacific Railroad.
October—H. R. Williams, General Manager of the Chicago, Milwaukee & St. Paul, elected President.

Panama.
April—T. P. Shonts, President and General Manager of the Toledo, St. Louis & Western, elected also President.
—J. F. Wallace elected Vice-President and General Manager.
July—J. F. Stevens appointed General Manager, succeeding J. F. Wallace, resigned.

Pennsylvania.
October—Samuel Rea, Fourth Vice-President, elected Third Vice-President, succeeding S. M. Prevost, deceased.
—J. B. Thayer, Fifth Vice-President elected Fourth Vice-President.
—H. Tatnall, Sixth Vice-President, elected Fifth Vice-President.

Richmond, Fredericksburg & Potomac.
May—W. J. Leake elected President, succeeding E. T. D. Myers, deceased.

San Antonio & Aransas Pass.
June—C. R. Hudson, President, resigned. (See Mexican Central.)

San Pedro, Los Angeles & Salt Lake.
March—R. C. Kerens, First Vice-President, resigned.
—W. H. Bancroft, Vice-President and General Manager of the Oregon Short Line, elected also First Vice-President of the S. P., L. A. & S. L.

Southern.
March—C. H. Ackert, General Manager, elected Fourth Vice-President.
—T. C. Powell, Freight Traffic Manager, elected Fifth Vice-President.
—H. B. Spencer, General Manager of the St. Louis-Louisville lines, appointed General Manager.

Southern Pacific.
February—E. E. Calvin, Vice-President and General Manager of the Oregon Railroad & Navigation, elected Vice-President and General Manager.

Tidewater.
May—R. Du Puy, Vice-President and General Manager of the St. Joseph & Grand Island, appointed General Manager.

Toledo, St. Louis & Western.
March—G. H. Ross, General Traffic Manager, elected Second Vice-President.

Union Pacific.
April—A. L. Mohler, General Manager of the Lines East of Green River, elected Vice-President.

Wabash.
April—F. A. Delano, late General Manager of the Burlington lines east of the Missouri river, elected First Vice-President.
—Henry Miller, General Superintendent of the Chicago, Burlington & Quincy, appointed General Manager.
October—F. A. Delano, First Vice-President, elected President, succeeding Joseph Ramsey, Jr.
—A. C. Bird, Vice-President, resigned.
—E. B. Pryor, Assistant to the President, elected Fourth Vice-President.

Wabash-Pittsburg Terminal and *Wheeling & Lake Erie.*
April—Joseph Ramsey, Jr., President, resigned.
—F. A. Delano elected President.
May—B. A. Worthington, Vice-President and General Manager of the O. R. R. & N., elected Vice-President, succeeding J. W. Patterson, resigned.
September—R. Blickensderfer, General Manager, resigned.
October—B. A. Worthington, Vice-President, also appointed General Manager.

Western Maryland.—
November—A. Robertson, General Manager of the Terminal Railroad Association of St. Louis, appointed General Manager of the W. M. and the West Virginia Central & Pittsburg.

Western Pacific.
June—W. J. Barnett, President, resigned.
—E. T. Jeffery, President of the Denver & Rio Grande, elected also President of the Western Pacific.
—W. J. Barnett, J. White and V. G. Bogue elected Vice-Presidents.

Washington Correspondence.

WASHINGTON, Dec. 26.—When Congress reassembles next week it is expected that there will be important developments in both houses in connection with proposed railroad legislation. Representative Hepburn, Chairman of the House Committee on Interstate and Foreign Commerce, is at work on a bill which will probably be introduced soon after the recess and will be made the basis of the measure that is to be reported from his committee. Mr. Hepburn has had little to say about his bill, but it is expected that it will follow the recommendation of the President as to giving the Interstate Commerce Commission authority to prescribe maximum rates. There is some curiosity to know just what provisions for judicial review Mr. Hepburn will incorporate in his bill, for he has always held that there should be opportunity for review prior to a rate fixed by the Commission being put into effect. His bill of the last session provided for such judicial review, and it was with great reluctance that he agreed to the Esch-Townsend bill. He did so and reported that bill to the House only when it became apparent that he would be outvoted in the committee if he insisted on forcing a vote on his own bill. It is probable that the bill he will introduce will provide for the rate fixed by the Commission going into effect prior to review, as, in view of the President's position on that point, it is not probable that a bill providing for prior review can be reported from the House Committee.

When the Senate Committee meets again efforts will be made to expedite an agreement on a report to the Senate. The fact that the resolution under which the Senate Committee sat during the recess provided that it should report to the Senate within 10 days after the beginning of the session has been generally lost sight of. More than 10 days had expired before the beginning of the

recess, but the committee had made no serious effort to agree upon a report. It would have been impossible for the committee to have agreed within the time fixed by the resolution, for there are scarcely two members of the committee who would agree upon all the details of a bill. There are so many differences of opinion that it will doubtless take several weeks and a series of compromises to secure the support of a majority of the committee for any bill, and when a majority report has been agreed upon it is probable that there will be at least two minority reports.

One of the difficulties in the way of an early report from the Senate Committee will be encountered in the effort that the Republican members of the committee will make to secure enough votes on their own side of the committee to report a bill. It is apparent that it will be very difficult, for instance, for Senator Foraker and Senator Dolliver to find any common ground on which both can stand. It is possible that, rather than form a combination with the Democratic members of the committee, the Republican advocates of giving the Commission authority to fix rates may ultimately unite on the Elkins proposition, but Senator Foraker and possibly one or two others may be expected to stand out against this compromise as long as there is any hope of defeating it without hopelessly dividing the party. It is even possible that Senator Foraker might go so far as to stand out against all of the other Republican members of the committee, for he believes that the proposition to give this power to the Commission is nothing short of revolutionary.

No positive predictions as to how the Democratic members of the committee will vote can yet be made. Senator McLaurin, of Mississippi, for instance, is reluctant to give the executive department of the government the power over transportation and commerce proposed by the advocates of commission-made rates, but there are one or two rate situations in Mississippi that seem to him to involve undue discriminations against certain localities, and he is disposed to give to the Commission the power to fix rates if he can be satisfied that it would lead to the correction of what he believes to be discrimination against non-competitive points. Senator Foster, of Louisiana, is another uncertain quantity on the Democratic side. Many of the business men of New Orleans are of the opinion that their city could not hope to fare so well under commission made rates as it does with the railroads free to make import and export rates through their port so as to attract trade to it that might go to the Atlantic ports under a system of rate-making by the Commission that would be based largely on considerations of distance, and these men have not hesitated to impress their views on Senator Foster. Senator Carmack, of Tennessee, is generally counted among the advocates of giving the Commission authority to make rates, but he is receiving many protests against this legislation from his home city of Memphis and from other points in Tennessee. Senator Tillman, of South Carolina, has already defined his position by introducing a bill proposing to empower the Commission to make maximum rates. Senator Newlands, of Nevada, the remaining Democrat, has a scheme of his own for the national incorporation of railroads and their management under governmental control, and he may decide not to support any plan advocated by other members of the committee and submit a minority report to the Senate advocating his own bill. Whatever may be the final result, the present outlook is for divisions on both sides of the committee.

Winnipeg Shops of the Canadian Pacific.

Within the last three years the Canadian Pacific has built two large and modern car and locomotive repair shops, the Angus shops at Montreal and the Winnipeg shops at Winnipeg, Manitoba. The Montreal shops take care of the heavy repair work on the eastern divisions and some locomotive and car building is done there. The Winnipeg shops are for repair work only and handle the motive power and rolling stock on the western lines. The shop tract includes about 160 acres and is 2½ miles west of the passenger station on the main line. A complete local fire alarm system connects with the power house and the city fire alarm system. There are about 12 miles of tracks, four miles of water pipes and about two miles of drains in and around the buildings, the egg-shaped main drain being of concrete, 3 ft. 6 in. by 2 ft. 4 in. All the shop buildings are laid out with a view to future extensions without disturbing the existing plant.

The buildings are of native brick on concrete foundations. They are of "mill construction," and are equipped with fire sprinklers throughout. They are heated with the Sturtevant hot blast system, by exhaust steam from the power house. All the shops have outside lean-to buildings for lavatories and fan-houses.

Water for power and shop purposes is pumped from the Red river, about three miles east of the shops, through an 8-in. pipe, into a 500,000-gallon reservoir, and from there into an elevated 125,000-gallon tank, 130 ft. high. Drinking water is pumped from a 5-in. artesian well, near the power house, into an elevated 10,000-gallon tank.

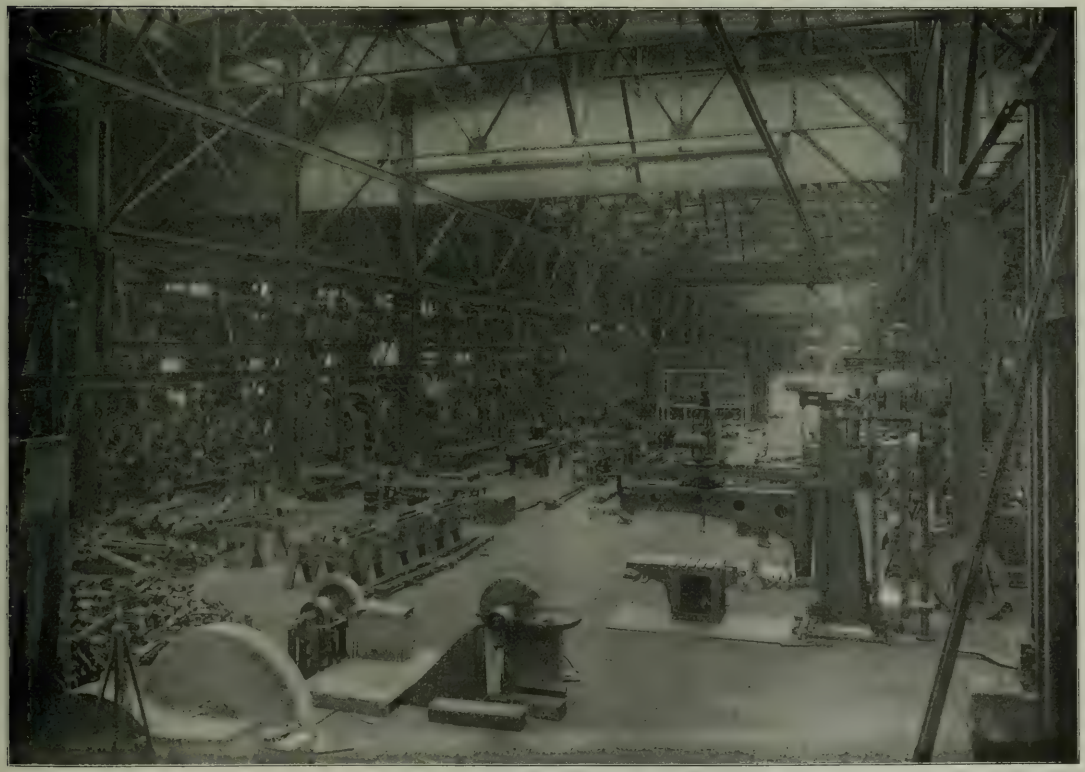
Power House.—The power house is 125 ft. by 101 ft., and is equipped with five 250-h.p. Babcock & Wilcox boilers, two fire pumps, and two pumps for power and shop purposes of a capacity of 1,000 gallons per minute each, two 500-k.w. units driven by simple, non-condensing, open type engines, and a 50-k.w. unit for night service. The exhaust steam from the engines is used for heating the shops, in connection with the Sturtevant system, at 5 lbs. pressure, the condensed water being pumped back to the boiler feed hot well. The engine room has a 15-ton, hand-power, chain sprocket, traveling crane of 46-ft. span and 25-ft. lift.

South Side of Machine and Erecting Shop and Store House—Winnipeg Shops of the Canadian Pacific.

Locomotive and Machine Shop.—This building is 164 ft. by 792 ft. and has a capacity for making general repairs to 25 locomotives a month. It is completely equipped with modern machinery for general repair work. A rivetting tower at one end has a 20-ton rivetting crane and 5-ton auxiliary hoist. There are two 7½-ton and one 20-ton, three-motor electric traveling cranes, each of 56-ft. span and 27-ft. lift, traveling the whole length of the shop over the middle bay. Two 50-ton trolleys are used for stripping the locomotives. A transfer table 52 ft. wide and 440 ft. long in the center bay of the shop is used for placing locomotives on the pits. A 70-ft. turntable is placed just outside the main shop entrance. Eight longitudinal tracks at the east end are used for light repairs to locomotives, six of the tracks having pits connecting with a drop pit. All machines are motor-driven, the large machines individually, and the small ones with group drive. All the machines are served by narrow gage tracks in conjunction with jib cranes which are provided for all machines handling work requiring heavy lifting. Tender and boiler work is done on the north side of the locomotive shop; the erecting pits are on the south side and across the east end.

Blacksmith Shop.—The blacksmith shop is 216 ft. by 100 ft.

Planing Mill and Car Shop—Winnipeg Shops of the Canadian Pacific.



West End of Machine Shop—Winnipeg Shops of the Canadian Pacific.

It has 32 fires and 14 oil furnaces, and is equipped with 11 jib cranes with a capacity of from one to three tons each, one 1,200-lb. single frame hammer, one 700-lb. single frame hammer, one 3,000-lb. double frame hammer, and one 3,300-lb. single frame hammer, and several 150-lb. and 250-lb. automatic hammers. This shop also has cold sawing machines, punches, shears and bull-dozers, all motor driven and served by narrow gage tracks. All forges are fitted with the Sturtevant blast system and a separate system for exhaust.

Foundry.—The foundry is 120 ft. by 90 ft. and has a capacity of 12 tons of castings per day. It is equipped with a three-motor, 7½-ton traveling crane of 38-ft. span and 20-ft. lift; a 5-ton jib crane with a 5-h.p. motor and controller, a 40-in. cupola with a No. 8 Sturtevant pressure blower run by a 30-h.p. A. C. motor, and one two and one five-ton spur geared crane ladles. There are two core ovens, one 9 ft. by 16 ft. and the other 7 ft. 6 in. by 9 ft., and one grinder and two tumblers run by a 10-h.p. motor. The brass foundry is equipped with a one-ton traveling crane, four furnaces, one tumbler and grinder. A two-ton pneumatic elevator, 16-ft. lift, runs from the ground to the charging floor of the cupola. Provision is also made in the foundry for a second cupola which is to be removed from the old shops.

Passenger Car Shop.—This shop is 240 ft. by 100 ft. and has a capacity, for general repairs, of about 25 cars a month. The upholstering work is done on the gallery on the east side of the shop. An outside transfer table 70 ft. wide and 450 ft. long serves this shop and the freight car shop.

Freight Car Shop.—This building is 312 ft. by 100 ft. and has a capacity, for general repairs (including rebuilding) of about 70 cars per month. The repair yards, at the east end of the shops, have a capacity, for light repairs, of 150 cars a day.

Dry Kiln.—This building is a Morton moist air down draft kiln. It has two compartments, each 85 ft. by 19 ft., and has a capacity of four cars of lumber.

Planing Mill.—The mill building is 216 ft. by 100 ft., and is equipped with machinery for manufacturing all material for repairs to freight and passenger cars on the divisions between Fort William and Calgary. All the machines are individually driven by motors. The machines are equipped with a shaving exhaust system, which carries all shavings from each machine to a tower near the power house, and from there direct to the boilers, where they are burned.

General Stores and Offices.—This building is 252 ft. by 85 ft., two stories high. The general offices for the shops are at the west end of the building, and are three stories high. The stores building is fitted with suitable shelving, cupboards and bins sufficient for storing all supplies for the western lines, from Fort William to Vancouver, including branches. It is also provided with a two-ton hydro-pneumatic elevator, and a narrow gage system of tracks connects the building with all shops. A platform 4 ft. high runs all around the building, 10 ft. wide on the north and south sides, 70 ft. wide on the west end, and 200 ft. at the east end for receiving, storing and shipping supplies.

An English Engineer's Opinion on the Panama Canal.

Mr. L. F. Vernon-Harcourt, a well-known English engineer, who has had much professional experience in work on the Mississippi river, has made a statement of his views on the kind of canal which should be built at Panama. This expression of opinion, however, is made subject to more complete information of the circumstances of the case, known as yet only to those acquainted with the findings of the Advisory Board of Engineers.

Mr. Vernon-Harcourt's statement, quoted from the European edition of the *New York Herald*, is as follows:

"It is obvious that a canal with locks as proposed by the Isthmian Canal Commission of 1889-1901, could be completed much sooner and at considerably smaller cost than a sea level canal, on account of the excavation for a lock canal being much less in the deep Culebra cut and also along the whole length of the proposed summit level, and particularly in view of the difficulty of obtaining adequate and efficient labor at the isthmus. In the circumstances, however, that the United States government has undertaken the construction of the canal these considerations are of much less importance than for a private company, in which case early completion and moderate capital expenditure are most essential, provided permanent advantages are secured fairly commensurate with the delay in completion, and the enhanced expenditure in a tide level canal.

"It appears to me, so far as the information at my disposal goes, that the choice between a lock canal and a sea level canal, with a tidal lock at Miraflores, which is essential, depends upon the possibility of constructing a dam at Bohio in a sound foundation, as proposed by the Canal Commission of 1899-1901, so as to obtain lake navigation for a considerable portion of the summit reach of the canal, and to the extent to which the Chagres river might prove a permanent menace to the security of the sea level canal, with the greater speed practicable along Bohio Lake compensating in a great measure for the delay at locks. With more complete security against the incursion of the floods of the Chagres river, a canal with locks would seem preferable to a sea level canal, especially as any future enlargements and deepening for the increased dimensions of vessels would involve much less excavation with a lock canal than with a sea level canal. On the contrary, if the Bohio dam is impracticable at any reasonable cost, owing to the great depth to which the foundation would have to be carried to reach a sufficiently sound stratum, as has been recently stated, and if the floods of the Chagres river cannot be perfectly controlled by a dam at Gamboa at a reasonable cost, then a sea level canal should have the preference on account of the greater facility it would afford for the passage of vessels across the isthmus.

"M. Bunau-Varilla's alternative scheme does not appear to be acceptable, for these reasons: It is quite true that dredging soft soil and transporting soft soil or blasted rock by water is cheaper than excavating soft soil and land transport, and a good deal of the original excavation for the Suez Canal was effected in hollows flooded by water from a fresh water canal, the water being gradually lowered as the dredging proceeded. It remains, however, to be proved that breaking up rock by Lobnitza rock cutting saws is cheaper than ordinary blasting of rock out of water, and it is far more troublesome to complete the enlargement of the waterway after it is opened without impeding traffic than by straightforward dredging for forming a canal, while the modification proposed in the water level of the existing waterway forming such a great highway for shipping would be attended by very great difficulty. A fatal objection, moreover, to the economy and rapidity of execution of M. Bunau-Varilla's scheme is that he could not in future enlarge the upper part of the deep cutting by dredging which would be required for a sea level canal, and if the work is to be done by dredging it would be necessary to carry out the upper part of the cutting to the full width at once. Clearly, to attempt the execution of M. Bunau-Varilla's project is not to be recommended, and the choice lies between a canal with locks, if the Bohio dam is feasible—and there is not any doubt as to preventing with certainty the incursion of the Chagres floods into a low level canal—and a sea level canal with a tidal lock on the Panama site."

Report of New South Wales Delegates.

An elaborate and interesting report has been submitted to the New South Wales Government Railway Commissioners by James Fraser, M. J. C. E., Engineer-in-Chief, and H. McLachlan, Secretary to the Commissioners, regarding their recent visit to the United States as delegates to the Railway Congress. Part of this report is printed herewith.

As regards electric traction, the report says: "On the Baltimore & Ohio lines at Baltimore the motors for hauling passenger trains (with the locomotive dead) weigh 95 tons on four axles, or 23¾ tons per axle, all traction weight, and those for freight work each 80 tons on four axles. Two of these latter can, however, be coupled together and work as one unit, with an adhesive weight of 160 tons. These two motors working coupled lift a load of 2,000 tons gross on a grade of 1½ per cent., or 1 in 66, and are in respect of load hauled the most powerful engines at present existing.

"It is not claimed that the work is done economically; in fact, the reverse is the case, as the General Superintendent of Motive Power of the company informed us that the cost per ton-mile is more than twice as great as with steam power. However, very heavy loads are taken through the center of the city without smoke, and through long tunnels where only small loads would be possible owing to the fumes were steam locomotives used."

After going into some details regarding the New York Central electrification project, the report says: "Apart from the American systems described, which were or are about to be installed on account of exceptional circumstances and not as a means of economical working, the modification of the Liverpool & Southport in England is perhaps the most important, and we might mention as a preface to our remarks on this system, that in conversation with Mr. Aspinall, General Manager of the Lancashire & Yorkshire Company, of whose system the section mentioned forms part, he expressed himself as unfavorable to the modification, stating that working cost was very greatly increased and the only material advantage is the slight addition that can be made to the number of trains worked, and on that account an increase in receipts. During 12 months working it was shown that, while receipts increased, electric operation was more expensive than steam, the principal increase being in coal consumption. The cost of electric installation was £20,000 per mile, equal to about three and a half times the installation of a steam locomotive service. The Liverpool & Southport line is operated by direct current.

"The present adoption by our state of any system of electrical working of railroads does not appear desirable. First cost and operation of direct current through a third rail both being high, and as there is practical certainty of successful operation of the single-phase alternating current, we should, we think, wait the

result of further experiments and experience in older countries in this system before making any movement of our own."

On the rail motor question the New South Wales engineers say: "On the London & Southwestern (England), the latest form of motor car embraces the ordinary type of railroad locomotive boiler and engine on a small scale, and it is contended it gives better results than the vertical form. In regard to the cost of working the figures given struck us as abnormally low, coming down on a month's average (Bishop Waltham branch) to as little as 3 pence per mile (locomotive service), covering driver, cleaner, coal, oil and water; and the Great Western Railway, which has a large number of motors, about 70—rail and road—at work, gives the average cost of working, including interest and depreciation at 7⅛ pence per car mile (rail motors). This figure supports the view that the locomotive type boiler is the more economical. It is claimed by those who have had to operate them that the success of the cars has demonstrated their utility in enabling increased facility for travel and stimulating business. We suggest that they are well worthy of being considered in connection with a number of services on our line. There appears to be a future before the 'rail motor,' and both at the Congress and in England we were impressed with the attention which is being given to the matter and the number of vehicles which are being put into service. In some cases, on branch lines with limited traffic, they are doing the whole of the passenger business, and their low cost of running enables services to be given to the convenience of local residents, which would not be economically possible with the ordinary locomotive. In connection with the Great Western, which had carried 3,000,000 passengers in 18 months, it is claimed that their operation has been profitable—cost 7.35 pence, earnings 9.91 pence per car mile."

Regarding the Mallet articulated locomotive at work on the B. & O. heavy gradients, the report says: "This locomotive lifts in a grade of 1 in 100 a train of a gross weight of 2,200 tons. The following data was obtained by us as to coal consumption: Length of heavy section operated, 14.8 miles; grade 1-100, 6.5 miles; grade 1-200 to 1-500, 8.3 miles; maximum curvature, 9 deg.; average atmospheric temperature, 17 deg.; average feed water temperature, 35 deg.; pounds of coal consumed per square foot of grate used per hour, 66; pounds of coal consumed per mile run, 584; pounds of coal consumed per 1,000 ton-miles, 308.5; average boiler pressure, 218; pounds of water evaporated per pound of coal, 5.4. The engine was operated by one engineer and one fireman on this work, and judging from the results obtained it would seem a desirable type of engine to employ on our heavy gradients, where, on account of tunnel or other causes, an assistant engineer cannot at present be used; in fact, engines of this type might probably be used with advantage on all heavy sections, as the axle-load could be greater than with existing heavy engines, while the division of the engine into two sets of drivers would enable it to take our sharp curves easily, as on the 9 deg. curve the flange wear has been trivial, but that may to some extent be due to the elastic bar frames used."

Continuing the report says: "The permanent-way accessories, switches, crossings, etc., are in many cases bad on American and Canadian roads, as in both stub switches are largely used, but the best American switches and crossings leave little room for improvement. These latter are very similar to what we have used during the past ten years, except that in the case of switches, the 4-ft. rods are stiffer and riveted to the switch instead of passing through the webs, as is done in our state. The American practice is in this respect the better, and they have made larger use of 'spring-frogs' and switches in lieu of crossings than has been done in any other country. We have done something in this respect, but might with advantage follow more extensively American practice. We saw nowhere any improved tools for permanent-way or bridge work, but Fairbanks, Morse & Company had at Washington a good exhibit of motor trolleys, the use of which might, by moving men speedily from place to place, permit of some reduction of the maintenance gangs on some sections of our system.

"Of machines for ways and works we saw some, the introduction of which should prove of advantage, and of new machines special mention might be made of the high-speed sensitive drills exhibited by Hill, Clarke & Company, at Washington, one of which we purchased while in America. These machines run at practically the same speed as wood tools; and we have since learned that many machines of a similar type are in use in Germany, where punched and reamed work in bridge construction has been abandoned for all drilled, and high-speed machines doing the work in less time than when two operations were made. These machines should be serviceable for much of the work done in our permanent-way shops. Of air tools there were very good exhibits at Washington, but that placed by the Rand Drill Company was distinctly the best. No special improvement has been made in pneumatic drills or hammers, but two good types of hoists were shown—one by the Rand Drill & Pneumatic Tool Company and the other by the General Electric Company. The former a pneumatic machine, with a small cylinder and spiral barrel to carry an endless wire rope, similar in design to a small steam hoist, was compact, and a more serviceable machine in many ways than the straight air hoists which we have now in use. The latter are very similar, made by the Sprague Company, and are worked electrically.

"Of tools for the manufacture of switches and crossings we saw nothing novel except those in use in planing machines in the Ramapo Iron Works at Niagara Falls. The planing machines carry double tool boxes, but the tools themselves, made from self-hardening steel, have broad, chisel-shaped cutting edges, and the top, bottom and sides are taken off practically to full depth or width. This form of tool will be adopted with much advantage in our own shops, as the work can be done much more speedily and cheaply.

"Of bridge shops we inspected only one, viz., that operated by the King Bridge Company at Cleveland. The material is delivered in a yard at one end of the shop, carried forward into covered shops by means of pneumatic hoists; and all work in the shops is done by means of air tools, to which material is delivered by straight air-hoists on single-joint runways. At this establishment, too, we saw some very large turntables being made. For roundhouses in America it is now usual to erect turntables 80 ft. to 100 ft. in diameter, and it is essential that these should run lightly. An improvement in the old type cone-bearings has been made by the King Bridge Company. The cones are about 9 in. in length and travel on the ordinary beveled path, but are provided with pintles (at both ends), which are run in ball-bearings. These centers run with an absolute minimum friction, and should we require to erect heavier turntables than are now in use, this bearing is what we should adopt.

"Of systems for locomotive coal-handling, we, unfortunately, saw few, but that of the Pennsylvania Railroad Company at Altoona was the best. In connection with locomotive coal handling, we might mention that the Brown Hoist Machinery Company and the Wellman-Seaver-Morgan Company, of Cleveland, are making clam-shell dredges for coal and ore handling, and that such a device would be of service at our larger locomotive depots for handling coal which for convenient storage is stacked on the ground."

Referring to American coal shipping methods, the report says in part: "At Baltimore the simplest of all systems is adopted, viz., to run the wagons on an elevated stage over bins which are of sufficient height above wharf level to permit of their complete discharge in vessels lying alongside. In this case, too, the feeder tracks, etc., are excellently arranged, each car, after being tipped, passing by gravity to an inside falling track which leads to the reception sidings for empties."

Commenting on American methods for handling freight and passenger traffic Messrs. McLachlan and Fraser state in part: "The country generally is more favorable to big hauls than is the case with us, and it has enabled the American companies to quote lower rates for freight than (with perhaps the exception of India) any railroad company or administration anywhere. It would appear that our practice in regard to capacity of cars, having in view our local conditions, was more satisfactory for our requirements, although with our extensive stock traffic it would seem to be wise to follow the American practice and to adopt more extensively bogie trucks with large capacity for live stock. In connection with traffic manipulation, we think it desirable to refer to the later systems of marshalling freight by gravity. Of these systems we saw two, both excellent. First, we visited that of the Pennsylvania Railroad Company at Juniata, near Altoona, where for inbound and outbound traffic siding accommodation, 20 tracks for each give a total capacity of over 3,000 50-ton cars. The system involves the construction of a hump approached on an easy grade, so that a heavy train may easily be propelled to the summit. The second system we visited was at the Lake Shore, Michigan & Southern Railroad at Collingwood, near Cleveland. Here the switches are operated by hand instead of power, as is the case at Altoona. At Collingwood we saw a train of 60 cars broken up into 24 sections and delivered and at rest in their proper sidings in eight minutes."

Another A. C. Interurban Line.

Announcement is made that the Toledo & Chicago Interurban Railway, which will extend, when completed, from Goshen, Ind., to Alvordton, Ohio, with a branch south to Fort Wayne, will be equipped with the General Electric Company's single phase alternating current system. At present 50 miles of the road, constituting the branch from the proposed east and west main line to Fort Wayne, Ind., is completed and about ready to start operation. The company owns private right-of-way alongside the highways, and has franchises which permit it to run cars on the main streets of the cities and towns traversed. It expects to carry express and freight, as well as passengers.

It will be recollected that the first regular single phase line in this country of any considerable length was opened just about a year ago—the Indianapolis-Rushville section, 40 miles long, of the

Indianapolis & Cincinnati Traction Company. This road was built under the direction of Sargent & Lundy, consulting engineers, and equipped by the Westinghouse Electric & Manufacturing Company. The Toledo & Chicago company is now preparing to put 50 miles in operation, as stated above, so that it will have the longest single phase line at present in existence in this country. F. E. Seagrave, Toledo, is President, and F. B. Perkins is General Manager and Electrical Engineer.

Tramway Bridge of Reinforced Concrete.

BY W. B. PALEY.

The corporation of Bournemouth, England, recently extended its system of tramways to the town of Christchurch. The extension, some 3½ miles long, a single track line of 3 ft. 6 in. gage, includes an interesting specimen of reinforced concrete construction in a bridge over the river Stour. It has been erected by the Yorkshire Hennebique Contracting Company, of Leeds, in the short space of four months. As the river is tidal a pre-existing bridge had to be removed, one side of it being kept up to maintain the communication till the new work was ready, the difficulty of the undertaking was considerable. There are 48 piers, each containing four round steel rods, which are carried over in the arches, of which there are four in each span. These arches are of 25 ft. 6 in. span, except one over the deepest part of the stream, which is 41 ft. There is also a half-arch at each side, making 14 openings in all, of a total length of 347 ft. A footpath on each side, 6 ft. wide, is supported on corbels of concrete, reinforced with steel rods. The actual width of the bridge proper is 17 ft. 6 in., not reckoning the footpaths. It carries a double line of electric tramway, worked on the usual overhead or

A Tramway Bridge of Reinforced Concrete.

trolley system. Trials were made on October 14, a few days before the opening for traffic, with three 12-ton tram-cars, each loaded up to 16 tons. Bags of cement were also piled on the bridge, to the extent of 210 lbs. per square foot, to represent additional traffic. The cars were run together over each line, in both directions, two being made finally to pass each other at full speed on the 41 ft. span, with the result that a deflection of only ⅛ in. was shown by the "amplificator." The rigidity of the bridge, as observed from a car, is certainly most noticeable, quite equal to anything that could be attained by a brick or stone structure, whilst both the cost and the length of time occupied in erection have been less. Time was of importance, besides the ordinary reasons, as a few days rain causes the river to overflow the low-lying land on the Christchurch side, where it was necessary to prepare part of the materials. A short wooden stage was built on each bank, carrying a traveling crane with a jib long enough to reach the center of the bridge. By these cranes, of course, the concrete, ready for use, was swung out in large buckets wherever it was wanted.

The photograph shows the work whilst half of the old bridge was still in use, its light iron piers being plainly visible, as well as the temporary hand railing of wood separating it from the new work. Iron hand-rails have, of course, now been added on each side. The amount of the contract is understood to have been about £4,000, with £500 additional for the abutments. The bridge, the general effect of which is very good, is the largest construction in this material yet erected in the south of England; in fact, very few works of any magnitude have so far been attempted in this country in reinforced concrete.

Exact measurements of the Simplon tunnel made recently show the variations from the calculated measurements. The actual length of the tunnel is 31 in. less than was found from the trigonometrical survey before it was built. The axis of the tunnel from the north portal deviated to the east; that from the south portal to the west, so that in the middle of the tunnel they were 8 in. apart horizontally and 3½ in. vertically. These variations, be it remembered, are in a tunnel 12 miles, 1,452 ft. 4 in. long, and a fraction over.

Care, Use and Design of Locomotive Boilers.

At the November meeting of the Pacific Railroad Club at San Francisco papers were presented by Geo. Austin and J. J. Malone on the care, use and design of locomotive boilers. The location of the club apparently had something to do with the character of the presentation, for the value of blowing off and the reasons for the practice were brought prominently to the front. Blowing off is used as a means of reducing the accumulation of sludge and of lowering the concentration of foaming matter. The first requires that boilers be blown out at frequent intervals with small quantities at each blowing. On divisions where the water contains considerable impurities, not necessarily foaming matter, blow-off cocks should be located at the lower parts, such as the front and back legs of firebox, and should only be operated when steam is not being used, a few moments after the throttle has been closed; this allows the sediment to settle.

For this it is not necessary that large quantities of water be blown out, since it will run clear after the first few seconds. The largest deposits of sludge will be found at the mud ring, where they will be found to vary from 1 to 9 in. in front, and from 3 in. to 18 in. at the back. The heaviest deposits are always found in the water space on the mud-ring between the door sheet and back head. The reason for this is clear when the circulation of the water is considered from the boiler checks to its final ascension, since it moves from the checks towards the back part of the boiler, and the sediment is slowly carried to that point and deposited.

Blowing out to prevent foaming is an entirely different proposition, for the reason that the water in a boiler that is charged with alkali is charged about equally throughout the boiler; consequently, blowing out from any part of the boiler at any time, either while working steam or not, is good practice to anticipate and prevent foaming.

It must not be thought, however, that foaming will cease the moment the blow-off cock is opened. Blowing off does not decrease the amount of concentration; it merely lessens the amount of water, so that by adding more the concentration may be lowered, and when this has been done, not before, the foaming will cease. In alkali districts a concentration of about 200 grains to the gallon will be needed before foaming will really begin. But this will be preceded by a sort of surface foaming. That is to say, the engine will work wet steam for a considerable length of time previous to showing by the water filling up the glass that the boiler is priming or foaming. This working wet steam condition probably precedes the actual foaming condition by several miles; and suggests about the proper time when the blow-off cocks should be liberally used and the concentration as to the foaming matter per gallon be reduced in the boiler by refilling with clean water.

The excuse that is sometimes made, that the blow-off cock is not opened for fear of losing water, is not a valid one, because the practice will actually effect a saving. Working wet steam previous to actual foaming, and working water while foaming will use up a far greater quantity than if the blow-off cock has been used and water kept below the foaming point, entirely apart from consideration of the saving to the machinery.

There is one other reason for the failure of the engineman to use his blow-off cocks, and that is the inconvenient places in which they are frequently located. It is sometimes even necessary for the enginemen to crawl out on the running board in order to use them, and when this is the case, or when other similar inconveniences exist, they are sure to be neglected.

Further, care should be taken in blowing out boilers not to have the injectors working at the same time the blow-off cock is open. It is a much better plan to fill up the boilers and then blow them down. The ideal way to handle the feed water in locomotive boilers, especially in alkali districts, is to always put in the boiler a little more water than is being used, and blow the surplus water out; this preserves the boiler in fair condition for a longer period to do business without foaming, and it reduces the necessity of blowing out large quantities of water frequently, besides preventing the unequal temperatures caused by blowing out large quantities and refilling.

The best time to blow-off will be found to be before foaming commences, when the concentration is about 175 grains to the gallon. This will prevent foaming. Don't wait until foaming begins, or an engine failure will result, for then it will be impossible for the engine to work until the water has been purified. That takes time, and lost time is engine failure. In the cooling of the boiler the utmost care should be exercised. There are three methods in use, that may be described as follows:

First.—Open the blow-off cock, blow out all water and steam

at the same time, and then fill up with cold water to cool.

Second.—Set the engine in the house with water-glass full. Close all ash-pan openings and door. Cover the smokestack and allow the boiler to cool down until the water in the boiler is at a temperature of 70 or 80 deg.

Third.—Where practicable, place engine in roundhouse with fire in, and leave fire, where coal is used, until it dies out. Where oil is used, cut the feed of oil down for a half hour before shutting down entirely. Let the boiler cool down gradually, closing all dampers, until water in the boiler is at a temperature of 70 or 80 deg.

The first method is the worst that possibly could be used. If one were hunting for a method that would do the most damage, it would be hard to improve on this one. When one considers that some things similar to this method are quite the regular practice, is it any wonder that 50 per cent. of the engine delays and failures are from boiler troubles? The second and third methods cannot be followed in practice at all times. What is advocated is that they be adhered to as closely as possible and that the first be avoided.

When a boiler needs washing, it should be cooled carefully and washed thoroughly. Every wash-out plug in the boiler should come out. It is very bad practice to wash the belly of the boiler one time, the crown-sheet another time, and so on. Cooling a boiler is a serious matter, and when it is cool the washing should be thorough. It will run enough longer the next time to pay for it. Careful cooling means giving a boiler all the chance possible to cool. If time will not permit cooling the boiler as mentioned above, it is suggested that at least one and a half hours be spent in working the steam down uniformly to no pressure. It should never be blown out through the relief valve holes in 10 or 12 minutes. In all cases of reducing steam, water should be above the crown-sheet at all times.

If the firebox has an arch or fire-brick work, water should not be drawn below crown-sheet in less than three or four hours after the fire is removed. This includes the time used in reducing the steam and cooling. When the boiler is cool, remove all mud-ring plugs, and let out water. The crown-sheet can be washed as soon as the water leaves it. The belly plugs in the bottom of the barrel of the boiler should not be removed until all the water is out of the mud-ring. By removing them after this, one can tell if there is a bank in the belly of the boiler. If there is, water will run from these holes after plugs are removed. The belly should be well washed, and lastly the mud-ring. The following are places to wash carefully for mud and scale banking: Over fire-doors, on belly and flue-sheet braces, just above front mud ring, and from there forward about one-third the length of the barrel; also on the crown-sheets of engines having crown-bars. Boiler washers should inspect boilers with a torch, through plug-holes, to see if they are clean, and also to familiarize themselves with the internal construction, so that they can wash to better advantage. In washing through all plug-holes, the nozzle should be turned so as to wash down all sediment that may have collected between tubes, braces and staybolts. Wash-out plugs should always have mixed oil and graphite put on them before screwing in. Then screw in with the fingers as far as they will go, and they should go within a very few turns of being tight. This practice will insure not getting the threads crossed. They should not be screwed in with a long wrench and as hard as a man can pull. A 16-in. wrench, used with one hand, makes them tight enough. The plug will last longer, will not leak, and will come out so much easier the next time. A shoulder is put on many plugs by being pulled in too tight. Then time is lost in getting them out. About every two months, in bad-water districts, boilers with radial stays in crown-sheet should have dome-cap taken off and stand-pipe taken out of dome, in order that a man may get in and scale the crown-sheet, stay-bolts and radial stays, then wash the crown-sheet and side-sheets on the inside of the boiler. Be careful and wash as long as anything can be removed.

Good boiler washing requires at least 100 lbs. pressure. The practice of using hot water for washing boilers cuts but very little figure; it is destructive to hose, and presents no feature that would make it enough desirable over the cold water system to warrant its adoption. This, of course, applies to points where water is plentiful; where water is scarce, it would pay to conserve it and use it over again for washing out purposes.

The method of handling feed-water by enginemen is a very large factor in causing firebox leaks. It has been thoroughly demonstrated within the last six years that these variations and inequalities in temperature play a most prominent part, not only in causing leaks, but also in causing damage and actual destruction to certain parts of locomotive boilers. Actual tests have demonstrated the fact that a piece of iron or steel can be heated or cooled any number of times without decreasing its strength. Therefore, the simple heating and cooling of a boiler will not cause the metal in it to deteriorate or become weaker, if it is always cooled and heated uniformly.

A boiler being made up of many pieces of iron securely riveted together, it would follow that to cool any one portion and not to cool the rest would mean that incalculable strains would be put on the boiler seams and plates. The strains (that is, the steam pressure) that boilers are built to stand are small, indeed, as compared with the strains put on them on account of inequalities of temperature. And these are the agencies that really disturb the joints and cause leaks.

The value of feed water purification is shown by a comparison of the results obtained on two divisions of the Atchison, Topeka & Santa Fe. One of them, the Eastern Grand division, has 34 treating plants in operation; the other, the New Mexico division, has none. On the Eastern Grand division, with 450 engines in service, during the month of June last there were but 11 failures on account of flue leaks, while on the New Mexico division for the same month there were 73 failures from flue leaks. In the first case, with 11 failures, the mileage per failure on account of leaky flues was 113,500, and the other, with the 73 failures, the mileage per failure was 4,200 miles. There were not as many failures on account of foaming on the water-treated division as there were on the untreated division.

It is not contended that water treating reduces the number of washouts, but the condition is that, with the water treating, washing out is done to remove sludge, which is a very simple process, while with the untreated water washing out is done to get rid of scale, which is frequently an impossible proposition, as the scale adheres tightly, and it is an impossibility to get sufficient water pressure to remove it.

It seems certain that the admission of cold air into the firebox, or large quantities of cold water going into the boilers through the injectors when the boiler is hot, are what we may call adverse or secondary causes of firebox leaks. It is undoubtedly true that the primary cause is overheating. This is caused by the accumulation of scale or waters heavily charged with sediment, which is frequently the case. How heavily charged, cannot be stated. It probably is not an exaggerated statement to say that, in some cases, it ranges from water at the top with a little sediment in it to sediment at the bottom with a little water in it.

The scale forms in the angles where the stays or flues penetrate the sheets, and gradually extends, until sometimes it reaches from one bolt to the other, completely covering the sheet, but being heaviest at the stay-bolt, and stays there until the overheating occurs and the leak begins. This formation will start on flues in some cases, especially in seasons of muddy weather, in a hundred miles service, probably less than that, and in those seasons it does not get hard, but is a putty-like substance, really more difficult to dislodge than a harder scale. The formation of hard scale is one of the reasons why the sectional expander gives better service as a tool for running repairs on flues than the roller expander. The sectional expander jars away this scale and removes the cause, and does it without thinning the flue or making the hole taper.

Leaky flues can be considered along with the subject of corrugated and cracked fire-sheets, as the same causes that govern one govern the other. At a master mechanics' meeting held about two years ago the reported life of tubes ranged from 30,000 miles in Texas to more than 200,000 miles in Wisconsin, and all agreed that cold air was a very bad thing for flues and one of the principal causes of flue leaks. A prominent writer on boiler troubles tells us that it is cold water that is a paramount cause of flue leaks, as it is of corrugated and cracked fire-sheets. It would seem reasonable that if cold water and cold air are so very injurious, that flues should give better service in Texas than they do in Wisconsin, because of the relative climatic conditions in the two localities.

The fact is, these conditions are, as previously stated, secondary, and we must look for the trouble in some other direction. There can be no leaking in ordinary boiler work unless overheating takes place. The assertion is made with the understanding that allowance is made for the natural wear of material, and also for the unequal strains produced by unequal temperatures. These certainly do develop leaks, but the frequency of leaks due to this cause are so few that they are scarcely worthy of being taken into consideration alongside of the actual cause of leaks.

In the design of boilers it is no longer a question of the efficiency or strength of a boiler to care for 200 or 225 lbs. pressure to the square inch. All modern locomotive boiler builders meet this requirement. Whenever feed-water is such that the life of a firebox runs along from 12 to 15 years, it makes but very little difference what the construction of the boiler is, that is to say, whether it is of the wide or narrow firebox type. Since fireboxes will last for 12 or 15 years, it is proof positive that they are not cooling down the boiler and bringing it from one extreme to the other.

With good water, such as may be expected where a boiler lasts 12 or 15 years, it may be desirable and economical to have a wide firebox, as there is no question that wide fireboxes will burn certain kinds of coal with greater economy than narrow fireboxes do.

That being the case, about the only thing to consider for a locality that has good water is a strong and well-supported crown, no matter whether the boiler is of the wide or narrow type. In bad-water districts the conditions are different; consequently, to recommend a certain type of boiler, you must know the locality, and water supply procurable in that locality. Where bad water is the rule, the smaller the stayed surfaces, the less it will cost to maintain the boiler.

It is recommended that a water space commencing with 6 in. at the mud ring, and tapering up to a crown-sheet to a distance of 10 in. from side-sheets, be used. This not only improves the circulation but gives a greater length of stay-bolt to care for the continuous movement of contraction and expansion. It is best also to have the crown-sheets in one continuous sheet for both the inside and outside.

On the Southern Pacific the water is such that flexible bolts cannot be used satisfactorily on crown-sheets, and for top rows on side-sheets, back-heads, and throat-heads, as the water forms a scale in such short time that these bolts would not do the work they were intended for. The reason for flat crown-sheets inside and out is that when the boiler is first fired up and cooled down the outside crown-sheet will expand simultaneously with the inside.

The semi-circular outside crown-sheet on a firebox with radial stays did not meet with the approval of Mr. Malone because when the boiler is first fired up, the outside sheet being cool, and in the form of a semi-circle, there is no give to it until steam is raised on the boiler. This is a hard strain on the threads of the sheets and bolts. The boilers in bad-water districts have to be cooled off and washed out at each end of the division, so that it makes a hard strain on these bolts, both in firing up and cooling down, as it has to be done so often. Of course, this style of box, once the steam is raised, is all right. On boilers which are only washed out or the fire drawn out of firebox every two or three months, as they are on some roads, it does not make so much difference about using this type of box and stay.

The author also objected to the use of tees on the inside of the outside crown-sheet, and the use of tee iron for crown-bars, as it leaves no room for proper bracing of the boiler and cleaning of the crown-sheet; as when the boiler is first put into service, the thimble itself around crown-bolt acts as the same thickness of scale to begin with. Where water is so bad that the scale forms around the outside of the thimble, it will be only a short time before these bolts will leak, requiring a removal of the same and application of new bolts.

As these boilers have so little room between the top and bottom tee irons, and have eight sling braces on each bar, it would be a very expensive job to renew bolts as often as they are required, and replace them in the way they are now; that is, the bolt being screwed in the crown-sheet and not on the top of tee crown-bar; if the bolt is applied this way it is necessary to take out the sling stays on the crown-sheet to get in to put the nut on. It is not generally done in that way: They drill the bolts out of crown-sheet and back it up and tap a hole through crown-bar and crown-sheet, and screw up the stay-bolt. This saves taking off the dome-cap and taking out the stand-pipe to get into the boiler to remove sling-stays to put nuts on. There is no necessity of using a thimble when bolt is replaced in this way, as the threads on the sheet holds it the same distance from crown-bar; this is the general way in which these boilers are repaired, but this is not the way that bolts are applied when first built, as they screw in the sheet and use a thimble and nut on top of crown-bar.

The Trinity River Plant of the North Mountain Power Company.

Among the power transmission systems of the Pacific Coast, one of the most interesting is that of the Trinity river plant of the North Mountain Power Company. This plant is located in the central part of Trinity County, California, two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity river. The nearest railroad point is Redding, on the "Shasta Route" of the Southern Pacific. Humboldt Bay, on the Pacific Ocean, with Eureka, the chief coast city of northern California, lies almost due west, distant 59 miles in a straight line. The altitude of the plant is about 1,480 ft. All material, cement and machinery were hauled in over 60 miles of the severest mountain roads, across three distinct divides or summits. It required 18 to 20 horses to pull each of the larger pieces, weighing 18,000 lbs., up the grades, and when mud was encountered it was necessary to hitch the 18 horses to the fall of a block and tackle fitted with steel cables. Despite these difficulties, however, no mishap occurred to any of the machinery.

The water used at the plant is diverted from Canon Creek, which has a drainage area of 52 sq. miles above the diverting dam. The upper part of the basin is a rugged, glaciated granite country, extending up to an altitude of from 9,000 to 10,000 ft. above sea level. The dam is small, and serves merely for diverting the water. It is of the usual rock-filled crib form. Part of the ditch is cut in solid rock, but the most of it is dug in the side-hill soil. The flumes are 19 in number and vary in length from 30 ft. to 1,200 ft. The total length of the ditch, flumes and tunnel is 7¼ miles. The average grade of all is about 9.73 ft. per mile. The penstocks are each 1,165 ft. long. Under a total head of 604 ft. there is an effective head of 600 ft., or a working pressure of 260 lbs. per sq. in.

An 18-Horse Team Hauling the Lower Half of the Stator of a 750 k.w. Bullock Alternator Over 60 Miles of Mountain Road from the Nearest Railroad Station, to the Plant of the North Mountain Power Company.

The plant proper consists of the power house, two transformer houses and three high-tension switch houses. Each of the two hydraulic units consists of a pair of 44-in. Pelton wheels under one sheet steel housing, provided with ring-oiling, self-aligning bearings, coupled to the generator through flexible leather link couplings. The nozzles are of the deflecting type. With the largest tips in service the wheels are capable of driving the generators at 25 per cent. overload.

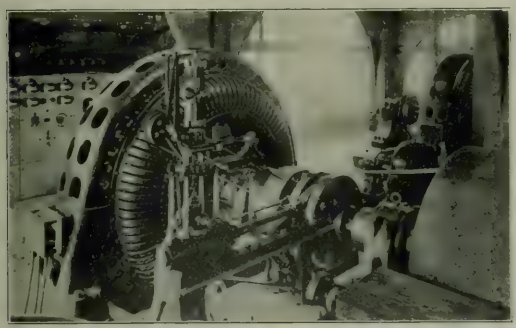
The wheels are controlled by Type "F" Lombard governors using oil. The pressure and vacuum are maintained by oil pumps belt-driven from the wheel shafts. The governors are not fitted with any form of switchboard speed control, but a single operator has no difficulty in synchronizing a generator under the load conditions which exist in the plant. The tail race is 6½ ft. wide and excavated for 280 ft. through bed rock to the Trinity river. The generators, two in number, are of the Bullock type, furnished by Allis-Chalmers Company, of Milwaukee, being three-phase, 750 k.w., 500 r.p.m., 2,200 volts, 25 cycles, rev. field, six-pole. Two Bullock exciters, 125 volts, 45 k.w., 900 r.p.m., are driven by belts from the generators. The switchboards are of marble and have Wagner instruments. The power house, 36 x 51 ft., is built of concrete made up with sand and gravel, taken from the river bars a few rods from the site of the plant, and with imported Portland cement. A special bay or alcove has been provided to give ample space behind the switchboard. The roof is of corrugated iron supported on steel trusses. A "Cyclops" hand-operated crane spans the main part of the building and is fitted with a one-ton "Triplex" block. This easily handles the heaviest piece of machinery.

The leads between the generators, exciters and switchboard are lead-covered cables laid in conduits within the concrete and cement

floor. The transformer house is 13 ft. x 51 ft. 6 in., and is also of concrete. It contains seven step-up transformers., viz., two banks of three each and one in reserve. They are of Bullock make, 300 k.v.a. water cooled, oil insulated, 2,200/19,050 volts, 25 cycle.

The high-tension switch house is a frame structure covered with corrugated iron. In it are two banks of "M-T" single throw air-brake switches, and G.E. alternating current multiplex lightning arresters, connected up for the three-phase circuit. The pole line extends almost due west from the plant to the sub-station in Eureka. The length is 65 miles. Of this 55 miles are over a severely rugged mountainous country; the altitude of the plant is only 1,480 ft. and Eureka is at sea-level, but the line passes over several summits ranging from 4,500 to 5,500 ft. in altitude. Fifty miles of its length lie in a heavily timbered country, requiring a tremendous amount of clearing, the trees ranging from 2 ft. to 4 ft. in diameter. It was necessary to construct a trail nearly the entire length of the line. The route deviates from a straight line only slightly and only where the topography made it unavoidable. It is a "thorough" transmission, so to speak, there being no taps on the line anywhere between the plant and the sub-station at Eureka. The line is a single circuit, three-phase, averaging 35 poles to the mile. The spread of wires on the standard length spans is 40 in.; the wire is No. 4 copper, except on some long spans where stranded cable is used. The potential at present used on line is 30,000 volts.

The sub-station at Eureka includes an auxiliary steam plant consisting of two Babcock & Wilcox water tube boilers fitted with Peabody patent oil burning furnaces duplicate oil pumping system; Goudert auxiliary feed water heater; Wheeler "Admiralty" surface condenser with self-contained steam-driven air and circulating pumps, the cooling water being taken from Humboldt Bay, and a McIntosh and Seymour tandem compound engine of nominal rating of 700 h.p. A jackshaft running at 500 r.p.m. is connected to engine by a rope-drive.



View in Power House, Showing 750 k.w. Bullock Alternator and Lombard Waterwheel Governor.

A Bullock rotary converter, 500 k.w., 500 r.p.m., six-pole, 25-cycle, 550-volt, is arranged for direct connection to this jackshaft by a jaw clutch and so driven by the engine. This permits of carrying the load by steam when necessary to shut down the transmission line for repairs. The engine is fitted with a switchboard speed control device. The clutch has a synchronism indicator in the nature of a lamp, so that the engine may be connected to the rotary while it is running at full speed on the power transmitted from the Trinity river plant. For the rotary converter there are three Bullock transformers, 190 k.w. water-cooled, 25-cycle, 30,000/352 volts. For stepping down for the local distributing system are three General Electric Company's 400 k.w. water-cooled transformers.

For furnishing power to the 60-cycle incandescent and arc lighting circuits of the city of Eureka, a three-phase, 60-cycle generator is driven by the rotary acting as a synchronous motor. The sub-station is fitted with switchboards and H. T. switches suitable for handling the equipment. A fuel oil tank 54 ft. in diameter by 25 ft. deep, holding 10,000 barrels, has been built near the sub-station, and is connected to a dock on Humboldt Bay by a pipe-line.

The load at present consists chiefly of lights in the city of Eureka. Some motors are already connected to the circuits, and the motor load is being rapidly developed.

Foreign Railroad Notes.

Last October a Prussian freight engine changed enginemen as usual at a water-tank near the Russian border. The new engineman, instead of backing to the yard where his cars stood and in spite of signals against him, drove his engine directly down the main track and head on into a passenger train. It turned out that the engineman was drunk. As he was killed proceedings could not be taken against him; but it having been learned that the fireman knew he was drunk, the state's attorney has prosecuted him for not reporting the engineman's condition, which the regulations require him to do; and the railroad authorities have improved the occasion to issue orders intended to make more certain the early removal of trainmen who fall into drinking habits.

The management of the Prussian State Railroads has prepared to let contracts thus early for locomotives to be delivered in the next fiscal year, which begins with April. At this time specifications have been made for 427, of different kinds, and of these no less than 162 are to use superheated steam, while 97 are to be compound engines.

The private railroads in Russia in 1903, the complete figures for which have only recently been reported, had a very favorable season, their gross earnings being then 11 per cent. greater than in 1902, while their expenses were 3 per cent. less, resulting in an increase of no less than 21 per cent. in their net earnings. The government had to pay on account of guarantees of dividends and interest $5,778,553 in 1901 and $4,215,292 in 1902, but only $865,121 in 1903.

On the Prussian State Railroads it is ordered that sleeping and dining-cars carry a green flag, which shall be notice to be very cautious in switching lest the slumber of the passenger be interrupted or a connection be hindered between his cup and his lip.

The True Perspective of the Supply Department.*

BY GEO. G. YEOMANS.†

Touching, first, the least important feature, I rather like the title of supply agent, which has been adopted by some roads to designate the head of this department. To my mind, it means more, and it is intended to mean more, than the title of storekeeper or general storekeeper. We have a general freight agent, a general passenger agent, a purchasing agent and a real estate agent in charge of their respective departments; why not a supply agent, in charge of all the supplies belonging to the company, whether they are in a storehouse or not? Further, it better indicates his true rank as the equal of these other officials, and his right to occupy his proper place on the personal staff of the general manager. It also signifies, to some extent, his emancipation from the direct control of the division superintendent, the master mechanic or the superintendent of bridges and buildings. The storekeepers should report to him but he should also be responsible for and have control over all material of any nature that is not in actual use, regardless of its location.

I have said that his proper place is on the staff of the general manager. I am aware that this is a much discussed and still unsettled question, but if approached by the process of elimination, we may, perhaps, reach a logical conclusion. Should he report to any local or division official? No, because his jurisdiction should extend over all divisions in order to secure the most economical distribution of his supplies; and a divided responsibility is the death warrant of efficient service. Should he report to the head of the mechanical department? Obviously not, because the mechanical department uses only about 30 per cent. of the material which he is called upon to provide and distribute. The same objection applies to the maintenance of way or bridge and building departments. Should he be on the staff of the general superintendent? Again, no. The general superintendent is, strictly speaking, an operating and not a managing official. His division superintendents are his chief lieutenants, and are, and should be, supreme on their respective divisions. The general superintendent would naturally delegate authority over supply matters to them, and they, in turn, to their division master mechanics or roadmasters, and we speedily arrive at the point from which we started with such tremendous effort only a few years ago.

Should he report to the purchasing agent? A great deal has been said and written on this question and opinions differ widely. On a small railroad, where the duties of the purchasing agent are necessarily light, and where the expense of the two separate organizations is an item of importance, it might be admissable; but on any railroad of what we have grown to consider modern magnitude, the answer is just as obviously, no. (1) Because the purchasing agent of a large railroad has his time and attention entirely monopolized in seeing that the funds placed at his disposal are wisely and economically disbursed. If he is studying his profession properly and keeping in close personal touch with the actual needs of the property, the physical conditions surrounding his local sources of supply and the market conditions which must primarily form the basis of sound judgment in his conduct of the business, he could not devote enough time or attention to the supply department to render his supervision other than nominal and perfunctory. (2) Because it is a bad policy, theoretically at least,

*Read at the December meeting of the Western Railway Club.
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to have the receipt and inspection of material in charge of the same person who buys it.

The supply agent should be independent to the extent that he furnishes a complete check on the purchasing agent as to the quantity and quality of the material for which the company's money is expended. This he could not be if his tenure of office depended on the latter. In reaching this conclusion, we are casting no slight upon the members of the purchasing fraternity. We are discussing the organization, not the man; and it must be admitted that any organization which depends wholly on the man is faulty.

By this process of elimination, then, we arrive at the general manager. Who so proper to have the general supervision of this important department as the one man, above all others, to whom the management looks for results? Who so capable of directing the whole policy of a supply department in the production of these results, through his personal representative at its head? Who so able to decide impartially all questions concerning supplies which involve expense of operation to such a marked degree? Every analysis of the subject points unerringly in the one direction. The true importance and the relative rank of the head of the supply department places him upon the personal staff of the general manager.

The relations of the supply department to all of the other departments are so vital, and their mutual interests so closely interwoven, that it is almost a pity that a separate organization should be a necessity; yet, on the other hand, the good that can be accomplished by a well organized and independent supply department, acting as a constant check upon the wasteful or unnecessary use of material, is only just beginning to be realized.

We have heard so much about the desirability of co-operation and harmony between the various branches of the service that the expression has become trite and hackneyed. If one-tenth of the platitudes which have been uttered on this theme had been reduced to practice, there would be little left to talk about in connection with it. The two words are, in a sense, synonymous, the one being the active and the other the passive expression of the idea. You cannot have co-operation without activity as well as harmony, and hence I prefer to use that word. Co-operation means to act jointly with others to the same end; to work or labor with mutual efforts to promote the same object. You will note that one man, or one department, cannot co-operate. It takes at least two. Ask a storekeeper if he is co-operating with a master mechanic. If he is trying his best to work in harmony with him and to render efficient service, he may honestly answer yes; but is he? You can never know until you ascertain whether or not the master mechanic is actively working with him.

Co-operation cannot be one-sided—it cannot be active on the one part and inert or resistant on the other. It is collective work that counts. In this respect, the supply department is the most dependent branch of the service. It must always be fully equipped and yet it is wholly without initiative. In its present shape, it is of comparatively recent origin. It is still, to a certain extent, on probation. We hear a good deal about its co-operating with the older departments, but not much about the other departments working with it. The tendency seems to be for them to sit quietly by and watch the supply department work out its own salvation; "to damn it with faint praise" where there is no fault to find, and with ingenious energy when there is; to feel that they have done their full duty when they have cast no obstacles in its pathway. Such an attitude, such a lack of co-operation in the true sense of the word, not only prevents the supply department from rendering the most efficient service it is capable of, but is reflected in the less efficient work of the other departments themselves.

What I want to impress upon you is the real necessity for more active assistance from the heads of those other departments in order to secure the best results and the best service from the supply department. Let us drop the habitual use of the time worn and overworked excuse of "no material," and devote a little of our spare time and surplus energy to helping the storekeeper out with a few timely suggestions, or a little advance information of expected requirements. Let the general manager recognize more fully the true importance of his supply agent as a valuable member of his staff; include him in all of his inspection trips and so keep him in close touch with physical conditions and contemplated work for which he will be expected to furnish the material; call him in when he is consulting with his general superintendent about a proposed extension, or with his chief engineer regarding the replacing of a bridge or the erection of a building.

Let the division superintendent and master mechanic make it a point to keep their storekeeper fully advised of probable requirements as far in advance as possible. Tell him when this sidetrack is to be put in; that stock yard built; or the other water tank erected. Tell him how many locomotives are expected to be shopped next month and the general nature of the repairs; what the prospects are of the number of bad order cars increasing or diminishing in the near future. In a word, co-operate with him to that extent in getting required material on the ground before the men are waiting for it.

Don't let's expect the supply agent to be a clairvoyant or expect the material to be forthcoming if he doesn't know it is wanted; and don't let's expect him to dig out for himself the information that we might so easily give. If the exact material required is not in stock, let us aid the storekeeper by suggesting and accepting reasonable substitutes. Let us see that our requisitions are so clearly and explicitly worded that they cannot easily be misunderstood, even by one who is unfamiliar with the local conditions or shop methods. Don't let us be afraid to say *why* we want, as well as *what* we want. A knowledge of the purpose for which material is required is a great aid to its intelligent selection. When a question is asked by a storekeeper, don't let us attribute it to idle curiosity and reply by saying it's "none of his business." Don't think because we know it all, that it is necessary to keep the other fellow in ignorance, but let us disseminate a little of our knowledge among those who are not so fortunate, and thereby add to the intelligent conduct of the less enlightened branches of the service.

When the heads of all the various departments once fully realize how essential their own active and intelligent efforts are to the success of the supply department and through it to the efficiency of the whole operating organism, the true perspective will have been established and the true capabilities of the department will have been made available.

The Pedrick & Smith Pipe Bending Machine.

The accompanying illustration shows a machine made by Pedrick & Smith, Germantown, Philadelphia, Pa., for bending pipe cold. Piping of steel, iron, brass, copper or other material can be bent cold up to and including 2 in. in diameter. The machine is also adaptable by means of special formers, for bending light angles, flats and tee bars. The gearing is compound, with a ratio of 25 to 1, thus giving the machine powerful leverage, and enables a bend to be made in a 2 in. pipe with but little effort. It is operated by a hand wheel consisting of four handles, which by means of the compound gearing engages the face plate, to which are attached the bending quadrants. The pipe is held in the quadrant at

The Pedrick & Smith Pipe Bending Machine.

one end by a steel plate, while the resistance stud on the movable arm engages the other end. The various curvatures are obtained by adjusting the arm, which has a swing of three-quarters of a circle supplemented by the movement of the resistance stud in the "T" slot on the arm. The machine is mounted on a telescopic stand which can be raised or lowered to any suitable height; when the base is fastened the upper part swivels. A universal arm or section for the stand is furnished so that if desired the face plate may be placed in a horizontal position at any height from the floor. Quadrants are furnished with the machine for 1-in. pipe with a radius of 6 in.; for 1¼-in. pipe with a radius of 9 in.; for 1½-in. pipe with a radius of 12 in., and for 2-in. pipe with a radius of 14 in. While only four quadrants are furnished with the machine it has been demonstrated that smaller size pipe can be bent in the larger size quadrants very satisfactorily. In fact, workmen will not take the time to change the quadrants unless they desire a shorter radius than the larger quadrant will give them.

GENERAL NEWS SECTION

NOTES.

The Railway Commission of Canada has appointed two inspectors to examine into the conduct of the railroads generally and to make weekly reports; the principal object being, according to the reports, "to secure compliance with those provisions of the railroad law designed to insure safety."

A Massachusetts manufacturer in a complaint to the Springfield *Republican* says that the tipping or bribing evil now makes trouble in the freight department. When two shippers send freight to New York (by boat) or to points beyond New York, if the boys at the dock have been "fixed" the goods arrive in 24 hours; if not, maybe in ten days.

A correspondent in central Illinois who appears to be somewhat startled by the strenuousness now visible in certain departments of the Wabash, summarizes his observations as follows: "The new general manager of the Wabash, in his policy of retrenchment has since the middle of June abolished all train collectors; consolidated the road's six divisions into three; consolidated under one head the locomotive, car and machinery departments; taken off half the through and many accommodation trains; consolidated maintenance of way departments of the Springfield and Middle, and Detroit and Eastern, divisions; abolished pay cars, paying employees by checks sent to heads of departments and agents; and reorganized the purchasing department, creating a general head for all Wabash properties."

In the complaint of Wylie against the Northern Pacific, the Interstate Commerce Commission, in an opinion by Chairman Knapp, decides that the Northern Pacific has no right to make through passenger rates with stage lines to the Yellowstone Park which discriminate in favor of a certain stage line and a certain hotel company. The complainant runs a stage line in opposition to the one favored by the railroad. The road had sold through tickets on which it received less than its established rate to the nearest railroad station. The railroad company controls the policy and operations of these stage and hotel companies which it favors. The commission holds that the stage company is not competent in law to be a party to through routes and joint rates, as contemplated by the Interstate Commerce law.

At Kansas City, July 1, papers were filed in the United States District Court in the suit of the Government to punish the Atchison, Topeka & Santa Fe for contempt of court in giving secret reduced rates to the Colorado Fuel & Iron Company. This suit is based on the evidence taken by the Interstate Commerce Commission and published in the decision of that body several months ago. The special counsel engaged by the department of justice to decide what action should be taken by the Government in this matter recommended that officers of the road be charged with contempt and be called to answer; but President Roosevelt decided that only the company should be prosecuted; that to prosecute the officers, one of whom was Paul Morton, Vice-President of the company at the time the offences were committed and since then Secretary of the Navy, would be unjust, because in dealing with other corporate offenders against the laws—notably the Harvester Company at Chicago—the Government had not prosecuted individuals.

The Secretary of Agriculture is preparing 1,200 suits against railroads for violation of the law limiting the time which animals may be confined in cars in transportation. It is said at the Department that the law has heretofore been a dead letter because the railroads which have been prosecuted have simply paid their fines and gone on with the violations as before; but evidence has now been secured under which very many flagrant violations can be punished. Since the department began its inquiries a number of railroads have taken action to comply with the law. The Missouri Pacific has quickened the time of one run from 47 hours to 27. The Chicago & North-Western proposes to use stable cars (exclusively?), and if the animals are made comfortable in these cars the Government will not prosecute. The Illinois Central has established extensive feed and rest yards at Freeport. It is said that the railroads will try next winter to induce Congress to repeal the law or to allow animals to be confined more than 28 hours.

A Transatlantic Tow.

The Standard Oil Company has for some time brought much of its crude oil from the Texas fields to the New York refineries in steel barges, towed by steamers specially built for this work. The newer barges carry 50,000 bbls. (say 8,000 tons) of oil, and the steamer carries 30,000 to 40,000 bbls. additional. The refined oil shipped to European ports has never been carried in barges, however, but in tank steamers with a capacity of from 40,000 to 70,000 bbls. Announcement has just been made that the towing steamer Col. E. L. Drake has started across the ocean to London with barge 95. Although this is the first transatlantic tow of oil, it is not the record haul, for the S. O. steamer Atlas took a barge from New York to San Francisco, last winter, covering 13,090 miles in 72 days.

Michigan Refrigeration Cases.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision concerning refrigeration of fruit on the Pere Marquette and Michigan Central roads. It is held that railroad companies are required at common law to furnish suitable transportation facilities, and it follows that the railroad companies in this case, holding themselves out as common carriers of perishable fruit, must provide the necessary refrigerator cars for the traffic; that during the performance of the transportation the car is the car of the railroad company using it, and its measure of responsibility as to the sufficiency of the car is the same, whether it obtains the car by purchase or lease; that a railroad company holding itself out as a carrier of a commodity which can only move under refrigeration is ordinarily in duty bound to furnish that refrigeration, for the icing is not a mere incident of the transportation service but is a part of the service itself; that refrigeration, being incumbent upon the carrier as a part of the transportation, the charge for that service stands like any other charge for transportation, and it is the duty of the carrier to publish, file with the Commission, and observe its refrigeration charges, over which the Commission has the same jurisdiction as of any other charge for transportation; that it is not within the province of the Commission to prescribe the method or kind of refrigeration charges which shall be adopted by the carrier. The Commission finds that a reasonable refrigeration charge based upon the cost of the ice actually used would be $2.50 per ton. The Michigan Central has established for the present season the reasonable charge of $2.50 per ton for ice actually used, and that company should be dismissed. The Pere Marquette, while under contract to continue its use of Armour cars during the present season, has made reductions in its refrigeration charges amounting to from 15 to 30 per cent. to apply during the present season, and has filed a statement with the Commission that it intends for the season of 1906 to purchase or lease its own equipment and also furnish refrigeration at $2.50 per ton for the ice actually used in transit. For various reasons stated by the Commission, including the consideration that the Commission is without authority to fix rates for the future, no order is issued at this time.

Grab Irons in Texas.

The General Managers' Association of Texas has given notice of a resolution recently adopted that after June 1, 1906, the lines in the Association will not accept cars for transportation or switching purposes, owned by other railroad companies, private car lines or individuals, with hand-holds and foot-holds secured by lag screws, except with the understanding that if any such car is received the lag screws will be replaced by bolts, at the expense of the owner. Cars will only be acceptable, in this respect, after the substitution of bolts for lag screws, when hand-holds and foot-holds are secured by bolts nutted, with ends of same upset to keep the nut from turning off or being screwed off. C. Hamilton, of Waco, is President of the Association.

Differential Fares by the Michigan Central.

The Michigan Central recently asked the authority of the Central Passenger Association to sell tickets at the differential rate ($2 less than standard) from Chicago to the seaboard. The matter was referred to three arbitrators, and they decided that the privilege should be granted. When it was found that the Michigan Central interpreted this decision as allowing it to sell at the differential rate over the New York Central, a standard line, the other roads objected. In view of this objection, the arbitrators have issued a supplementary opinion stating that the decision was understood to apply to the New York Central as well as to any connection on which differential fares are accepted. There has been strenuous objection made by the Grand Trunk to the granting of this privilege to the Michigan Central, and the Grand Trunk has declared that it will reduce its rates so as to preserve its differential under the Michigan Central's rate. The Pennsylvania offers a similar dif-

ferential rate by the Pittsburg, Cincinnati, Chicago & St. Louis, whose passengers go over the standard Pennsylvania line east of Pittsburg.

Safety on the Lake Shore.

The Lake Shore & Michigan Southern has ordered the removal within ten days of all facing point switches on the main line between Chicago and Buffalo; or, where removal is impossible, the protection of such switches by distant signals. According to a press despatch, special watchmen have been stationed to see that unprotected switches are right before the arrival of the 18-hour express trains, the watchmen to remain at the switches until the train passes.

New Zealand Railroads.

The railroads of New Zealand, with the exception of one private line 84 miles long, all belong to the state. There are about 2,374 miles in operation on a 3-ft. 6-in. gage. Including the steamer service on Lake Wakatipu, they represent a capital expenditure of about $100,000,000. A few years ago, a number of American locomotives and cars were imported by the government; but, on account of local criticism of the policy of importing from abroad, the government workshops have recently been largely employed in building additional rolling stock to meet the rapid increases in traffic. During the year ended March 31, 1904, there was an increase of five locomotives, 58 passenger cars, 18 brake vans, and 423 freight cars in the equipment. At the same time, there were being built 21 locomotives, 11 of them in government workshops. The total rolling stock in use at the end of the year was 377 locomotives, with an average tractive power of 9,476 lbs.; 809 passenger cars, with an average seating capacity of 39½ persons, and 13,132 freight cars, with an average capacity of seven tons. At the best equipped shops in the colony, where about 450 men are employed, an engine has been turned out in five weeks. Within the last few years, Westinghouse air-brakes and Pintsch gas have been very largely introduced, as well as the interlocking system, and the electric-tablet system of train signaling, which are in use over a considerable mileage and are being rapidly extended. During the year under review, 58 miles of track were relaid with 70-lb. rails, and it was proposed to relay at least 100 miles more during the year ended March 31, 1905.—*London Times.*

Duff Roller Bearing Screw Jacks.

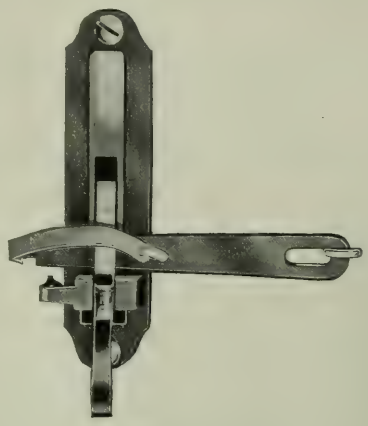
The Duff Manufacturing Company, Pittsburg, Pa., has placed on the market a new line of roller bearing screw jacks in 25 or more different sizes. These jacks have been put to abnormal tests in order to prove their efficiency for heavy work, and have demonstrated a considerable saving in operating expenses and in time and labor. The makers claim that the same load can be raised about 15 per cent. easier with the "Duff" jack than with any other anti-friction screw jack.

The "Duff" jack contains two roller bearings—one large or main bearing at the head of the jack, and another bearing to take the thrust on the bevel pinion. The main feature of any anti-friction jack, however, is the bearing itself. The roller bearing used is a patented bearing consisting of two hardened ground tool steel plates with a cage between them carrying the hardened ground rolls. A cut of the two bearings employed is shown herewith. It is claimed that this form of bearing will stand heavier loads, and will wear better than ball-bearings, and that the rolls will not crush or flatten and will not wear grooves in the hardened plates after continuous service, as is often found in other types of anti-friction bearings. When the bearings are removed from the jack frame, they remain intact and do not separate and become hard to handle.

The ratchet on the "Duff" jacks is of special construction, and with it the jack may be reversed with ease and quickness. The "Duff" roller bearing jacks cover a wide field in the handling of railway equipment, in bridge work and in the way of wrecking purposes. They are made in all sizes with capacity from 15 tons to 70 tons. Cone bearing and roller bearing journal jacks with capacities of 10, 15 and 25 tons are also made by this company.

The Preston Seal-Lock.

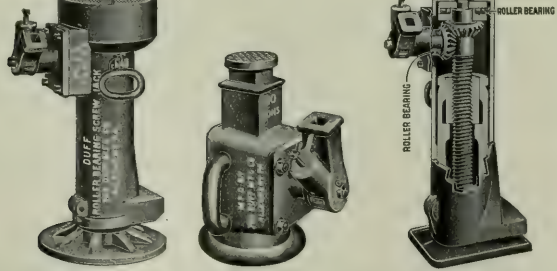
The accompanying illustration shows the Preston seal-lock. The patents are owned by Crago & Bohrnstedt, Cadott, Wis., who describe the device as follows: The seal is made of very thin tin with a hole in each end. No leading of any kind is necessary, which reduces the cost of seals very materially. The locking device is secured by a retaining guide in the form of a lug having forwardly projecting flanges, and through the medium of a dog engaging one of a series of serrations. The hasp is provided with a diamond point and a knife hook, which hold the seal in position and help to mutilate it when the locking device is forced upward. The locking device is also provided with a sharp edge which cuts the seal in two pieces when the lock is opened. No sealing punch is required to close the seal, and the latter is destroyed when the lock is opened, making it impossible to use it a second time. The lock is easily opened with the hand and is operated quickly. It is also provided with openings which will admit of the use of any seal now on the market. The lock was on exhibition at the International Railway Congress at Washington in May.



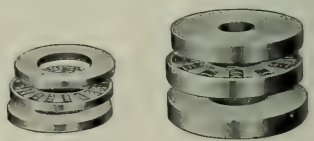
Preston Seal-Lock.

Suez Canal Traffic.

The net tonnage through the Suez Canal in 1904 shows an increase of 1,494,547 tons compared with that of 1903, the increase being due to heavy shipments of wheat from India to Europe, and to the large quantities of coal consigned to the East. The latter exceeded the shipments of 1903 by about 500,000 tons. During the year 4,237 vessels passed through the canal, of which 2,679 were British. There was an increase in 1904 of 1,430,376 tons in the tonnage of British vessels as compared with 1903. The figures were 7,403,553 tons in 1903 and 8,833,829 tons in 1904. The tonnage of German vessels increased from 1,773,265 tons in 1903 to 1,969,561 tons in 1904. In the year 1870, when the canal was opened, 26,758 civil and military passengers were carried through the canal; in 1904 the number was 210,849.—*Consular Report.*



Types of the "Duff" Roller Bearing Jack and Sectional View of the Same.



Roller Bearings Used in the "Duff" Screw Jacks.

The Milan Exhibition of 1906.

To celebrate the inauguration of the Simplon tunnel, an exhibition is to be held at Milan, in 1906, under the patronage of the King of Italy. It is known as the International Exhibition of Public Hygiene and Hygiene and Sanitary Assistance in Transports, and the programme indicates that special attention will be paid to the hygiene of railroad buildings and rolling stock, organization of railroad emergency services, etc.

Engineering Societies of the World.

The following statistics of the principal engineering societies were recently given by John W. Leib, Jr., in his presidential address before the American Institute of Electrical Engineers:

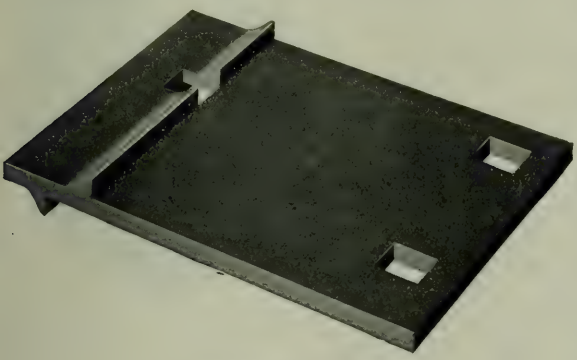
Name and date of organization.	Date of report.	Honorary members.	Full members.	Associate members.	Associates.	Junior members.	Total.
Am. Society of Civil Engineers, 1852..	1905	9	1,795	903	127	367[1]	3,203
Am. Inst. of Mining Engineers, 1871..	1905	7	3,483	....	190	....	3,680
Am. Society of Mech. Engineers, 1880.	1905	19	1,915	....	237	609	2,780
Am. Inst. of Electrical Engineers,1884	1905	2	481	2,851	....	....	3,334

Name and date of organization.	Date of report.	Honorary members.	Full members.	Associate members.	Associates.	Total.
Instn. Civil Engrs.(Great Britain), 1818	1905	19	2,191	4,110	271	6,597[2]
Instn. of Mechanical Engineers, 1847..	1905	9	2,351	1,454	72	3,977[3]
Iron and Steel Inst., 1869.....	1905	11	1,898	.....	.....	1,909
[4]Instn. of Electrical Engineers, 1889..	1904	6	1,101[5]	1,435	1,761	4,303[6]
Verein Deutscher Ingenieure, 1891....	1903	6	17,543	.....	.....	17,549
Societé des Ingénieurs Civil de France, 1848	1901	..	.....	.....	.....	3,691

[1]Includes 27 Fellows.
[2]Includes 136 Foreign Members.
[3]Not including 1,144 students or graduates.
[4]Originally organized as the Society of Telegraph Engineers and Electricians in 1871.
[5]Not including 450 students or graduates.
[6]Not including 1,107 students or graduates.

"Combination" Tie Plate.

The tie plate shown herewith is a new one, recently added to the line of the Railroad Supply Co., Chicago, and called the "Combination." It has a rib on each side. One acts as a shoulder to prevent lateral movement of the rail. The lower rib enters the tie



Combination Tie Plate.

to prevent displacement of the plate by the downward and outward thrust of the rail. It is called a "combination" tie plate because it can be used either under a rail joint or at intermediate points simply by reversing it, the shoulder in either case supporting the rail.

Additional Panama Steamer.

The Panama Railroad Steamship Line has chartered the Savannah Line steamer "City of Savannah" for a term of three months, with an option for renewal or of purchasing the boat if she proves satisfactory. The "City of Savannah" was built in 1896 by the Newport News Shipbuilding & Dry Dock Company for the Plant Steamship Company, and was originally named "La Grande Duchesse," until purchased by the Savannah Line. She is a twin screw boat, 380 ft. long, 47 ft. beam and 28 ft. deep and of 5,017 tons gross register. Her engines are of 6,500 i.h.p. Built for a 16½ knot ship, her record has been unsatisfactory, in speed performance and coal consumption, and she has a comparatively small cargo space.

The German Technolexicon.

Dr. Hubert Jansen, editor-in-chief of *The Technolexicon*, which is being published by the Society of German Engineers, announces that in the compilation of this universal technical dictionary for translation purposes—which is being prepared in English, German and French, and was commenced in 1901—about 2,000 firms and individual collaborators are at present assisting. At the present time 2,700,000 word cards have been collected. For further particulars Dr. Jansen may be addressed at 49 Dorotheenstrasse, Berlin.

The Acrobat versus the Street Car.

At a recent meeting of insurance men with a view to starting a campaign against hired witnesses, shyster lawyers, ambulance chasers and professional accident claimants, Theodore Waters showed a photograph of an acrobat who had evolved a somewhat hazardous method of making a living. "This man," said Mr. Waters, "didn't mind letting street cars bump him all over the street. He would be picked up by a confederate and carried to a furnished room. Then the confederate would be bandaged up and the acrobat would go out again to get bumped. Again a confederate would go to bed with the injuries the acrobat was supposed to have received. Getting witnesses was easy. The gang had little trouble in collecting damages. Finally they were caught and punished."

Dominion Mail Subsidies.

The State Department has made public the information that in the fiscal year ended June 30, 1904, the Canadian Government paid $851,748 in mail subsidies to steamship lines. The largest amount, $175,000, was paid to lines running from Canada to Great Britain; $146,000 was paid to the Canada-South African lines, and $116,800 to the Australian lines.

Manufacturing and Business.

The Railway Steel-Spring Co., it is said, will enlarge its car-wheel shops at Hudson, N. Y.

The Buda Foundry & Manufacturing Co., Chicago, has shipped 98 push cars to Panama, this being part of a large order for various track construction supplies received recently.

According to reports from Philadelphia, the Philadelphia & Western has decided to use the third-rail system, and a contract is to be given at once for building an electric generating plant.

The Philadelphia & Reading has given a contract to Robert Palmer & Sons Shipbuilding Co., of Noank, Conn., for building six coal barges, each of which will have a capacity of 1,200 tons, to be completed during the coming fall and winter.

W. A. Stadelman, eastern agent of the Wellman-Seaver-Morgan Company, and who has been in charge of the eastern office at 42 Broadway, New York, has been appointed general sales agent of the same company, with headquarters at Cleveland, Ohio, taking effect July 1. Fred Stadelman has been appointed assistant manager of the New York office.

The Isthmian Canal Commission have ordered 3,000 squares of Paroid roofing and a similar amount of Neponset black building paper and Neponset insulating paper from F. W. Bird & Son, East Walpole, Mass. The above company state that the Government has used many carloads of Paroid in the Philippines, Cuba, and on work in this country.

The Toledo-Massillon Bridge Co., recently formed by the reorganization of the Massillon Bridge Co., has selected a site for its new works at Toledo. Plans now being made call for a main building 100 x 400 ft. of brick construction, to contain traveling electric cranes and a large amount of machinery. There will also be five smaller buildings, and it is expected to have the works in operation by the first of next month.

J. G. White & Co., of New York, announce the appointment of Mr. Harold U. Wallace, the son of John F. Wallace, as Third Vice-President of their company. Mr. Wallace was Chief Engineer of the Illinois Central up to March of this year. He has been connected with the Illinois Central since 1894, having been Chief Engineer since 1902. The lake front improvement work of the road in Chicago, which included the depression and reconstruction of 20 miles of yard and main tracks, was carried out under the supervision of Mr. Wallace.

Iron and Steel.

The Tennessee Coal, Iron & Railroad Co. has recently received an order for about 55,000 tons of rails for 1906 delivery.

Bids will soon be asked for about 55,000 tons of steel to be used in building the new Manhattan bridge over the East river, New York.

The Pittsburg Steel Co. has given an order to the United States Steel Corporation for 1,000,000 tons of steel billets for delivery within the next five years.

The American Bridge Co. and Riter-Conley Manufacturing Co., of Pittsburg, have the contract for the 10,500 tons of structural steel to be used in the new buildings at the West Allis plant of the Allis-Chalmers Co.

The Lake Shore & Michigan Southern has given a contract for about 15,000 tons of bridge material to be used in building small

structures along the line of its road and the Atchison, Topeka & Santa Fe has given an additional order for 3,000 tons.

Orders have recently been given by the Vanderbilt roads for 25,000 tons of rails; by the Wabash, 5,000 tons; Toledo & Chicago Interurban, 5,500; Long Island, 2,500; electric roads in the neighborhood of Cleveland, 5,000; electric lines in the east, 10,000 tons.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

National Railroad Master Blacksmiths' Association.

The next meeting of this association is to be held August 15, 16 and 17 at Cleveland, with headquarters at the Forest City House (rate $2 a day). The following committee reports will be presented: "Forging Machine Formers, Bulldozers, Etc.," D. H. Edwards, Chairman; "Spring Making, Repairing and Tempering," Jas. Fenwick, Chairman; "Oil Furnaces," John McNally, Chairman; "Manipulating Tool Steel, Including High Speed Varieties," R. A. Mould, Chairman; "Tools and Formers for Steam Hammers," D. Fitzgerald, Chairman; "Best Material and Methods of Forging Motion Work," J. B. Anderson, Chairman; "Ideal Blacksmith Shop," H. G. Price, Chairman; "Best Methods of Repairing Locomotive Frames, Both Iron and Steel," W. Smith, Chairman; "Best Methods of Testing Materials and Selecting Same for Uses Intended," L. J. Brunner, Chairman.

PERSONAL.

—Mr. J. L. Campbell, who has been appointed Engineer of Maintenance of Way on the El Paso & Southwestern and the El Paso-Northeastern System, was born in 1863 and began railroad work in 1894 as Resident Engineer of Construction on the Rio Grande Northern Railroad of Texas. From 1895 to 1898 he was Locating Engineer for the Rio Grande, Sierra Madre & Pacific. In 1897 he was made Chief Engineer of Location and Construction on the El Paso-Northeastern, and subsequently served on the Atchison, the Arizona & New Mexico, part of the Southern Pacific, and the St. Louis, Kansas City & Colorado. He next entered the service of Phelps, Dodge & Co. and was appointed Engineer of Maintenance of Way of the El Paso & Southwestern and the recently acquired El Paso-Northeastern. For the four years before he began railroad work Mr. Campbell was Chief Engineer of the City of El Paso, Texas. He was in May, 1901, elected a member of the American Society of Civil Engineers.

—Honorable S. Parent, formerly Premier of the Province of Quebec, will, it is reported, be appointed to the Railroad Commission of the Privy Counsel, to succeed the Honorable F. B. Wade, deceased.

—Mr. Charles A. Dunham, who has been appointed Signal Engineer of the Great Northern, entered railroad service in 1884 on the Chicago, Burlington & Quincy as a helper in the mechanical department. In 1887 he went to the bridge department of the New York, Chicago & St. Louis. For some time he worked for Grant Brothers, railroad contractors in California, and in March, 1890, he re-entered the service of the Burlington as a locomotive fireman. In 1892 he left the Burlington to go to the Union Switch & Signal Company, for which company and the National Switch & Signal Company he worked until February, 1896, when he was appointed Inspector of Signals on the Illinois Central. He was soon made Supervisor of Signals, and on March 1, 1901, was promoted to be Signal Engineer.

—Hon. Fletcher Bath Wade, K. C., M. P., late Chairman of the Commissioners of the (Canadian) Trans-Continental Railway, who died on May 23, was born Sept. 9, 1852, at Granville, N. S. After studying for three years in a lawyer's office he was admitted to the bar at Halifax, N. S., in 1875. Mr. Wade was connected with many railroad, steamship, mining and other companies. In 1878 he was appointed Solicitor of the Nova Scotia, Nictaux & Atlantic Railroad. In 1888 he was in charge of financing the completion of the Nova Scotia Central and later was appointed Receiver and Manager, which position he held for six years. He was a promoter of the Halifax & South Western and the Middleton & Victoria Beach railroads, which have since been sold to the McKenzie & Mann interests. Mr. Wade has been an active supporter of the Liberal party since 1878.

—Mr. A. T. Hardin, who has just been appointed Assistant to the General Manager of the New York Central & Hudson River, was born in 1868 and entered railroad service at the age of 14 as an operator on the Richmond & Danville. After working for seven years as operator, agent and stenographer, he went to the University of South Carolina, where he graduated in 1894 in the civil engineering course. In that year, he entered the Maintenance of Way department of the Southern. In 1898 he came to the New York Central as supervisor, since which time he has been Division Engineer of the Eastern division, Engineer of Track and Engineer of Maintenance of Way. This last position he leaves to become Assistant to the General Manager.

—Mr. John Marcus Davis, who has been appointed Assistant General Superintendent of the new Central district of the Great Northern, was born in 1871. His first railroad work was in 1889 as a brakeman on the San Antonio & Aransas Pass. From this he went into office work and served on the Gulf, Colorado & Santa Fe, the Mexican Central, and the Great Northern. In 1898 he was appointed Assistant Superintendent of the Fergus division of the G. N. He was transferred to the Montana division, and then back to the Breckenridge division. In 1900 he left the Great Northern to go to the Erie & Wyoming Valley; and thence went to the Erie as Superintendent of the Wyoming and Jefferson divisions. In 1902 he was transferred to the Allegheny division, and in 1903 returned to the Great Northern as Superintendent of the Eastern division. In 1904 he went to the Dakota division, and this year was appointed Superintendent of the new Minot division, which position he held until July 1, when he was appointed Assistant General Superintendent.

—Mr. Herbert T. Herr, who has been appointed Acting General Superintendent of the Denver & Rio Grande, was born in Denver in 1876. After graduating at the East Denver high school in 1895, he entered the shops of the Chicago & North-Western as an apprentice. After a year of this work, he went to Yale and graduated in 1899 from the Sheffield Scientific School. During two of the summer vacations while he was in college, Mr. Herr worked as apprentice on the Denver & Rio Grande. In 1899 he was appointed Division Master Mechanic of the Southwest division of the Chicago Great Western, and in December of the same year Mechanical Engineer. In April, 1902, he went to the Atchison, Topeka & Santa Fe as Master Mechanic at Fort Madison, Iowa. He next went to the Norfolk & Western as Master Mechanic of the Eastern division, with headquarters at Roanoke, Va. This position he held until September, 1904, when he was made Assistant to the Vice-President on the Denver & Rio

Grande, from which he is promoted to be Acting General Superintendent.

—Mr. Warren S. Palmer, who has been appointed General Superintendent of the Northern district of the Southern Pacific, comprising the Coast, Western, Sacramento and Carson & Colorado divisions of the Pacific system, is a native of San Francisco. He graduated in 1876 in the civil engineering course of the University of California. After his graduation, he served as carpenter and draftsman apprentice in the bridge and buildings department of the Central Pacific. In 1881 he was transferred to the engineering department, where he spent five years in location and construction work. In 1886 he left the railroad business to become a member of the firm of Palmer & Storey, engineers and contractors, during which time that firm built the Colusa & Lake, the Yreka and the Pajaro Valley railroads in California. In 1890 he returned to railroad service as Resident Engineer of the First district of the Southern Pacific, and in 1898 he was appointed Assistant Superintendent of the Western division. In 1901 he was appointed Superintendent of the Sacramento division, and a year later was transferred to the Western division. From this position he was recently promoted to be General Superintendent of the Northern district.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—F. C. Fox, General Superintendent of the Western Grand Division, has been appointed General Superintendent of the Eastern Grand Division, with headquarters at Topeka, Kan., succeeding D. E. Cain, resigned. R. J. Parker, Superintendent of the Missouri division, has been appointed General Superintendent of the Western Grand Division, with headquarters at La Junta, Colo., succeeding Mr. Fox.

Chicago, Burlington & Quincy.—The Chicago division now includes the terminals and the main line to Clyde, Ill., seven miles. The Aurora division extends from Clyde to Galesburg, Ill., including the branch lines, except the line from Sterling to Deep Rock, which has been made part of the Galesburg division. The Galesburg division consists of the Quincy, Peoria, Galva, Keithsburg, Rushville, Tri-City and Savannah branches and the Galesburg yards. The Ottumwa division includes the main line from the West Galesburg yard to Creston, Iowa. The Burlington division is made up of the branch lines running into that city. It will also include the branch from Quincy, Ill., to Louisiana, Mo., which has been part of the Galesburg division. The St. Louis division extends from Rio, Ill., to St. Louis, including the branch from Concord via Jacksonville to Centralia.

L. N. Hopkins, Supply Agent of the lines East of the Missouri River, has been appointed Purchasing Agent of the Chicago, Burlington & Quincy, succeeding George G. Yeomans, resigned.

T. J. Frier, Assistant Supply Agent, has been appointed Supply Agent of the lines East of the Missouri river, with headquarters at Chicago, succeeding L. N. Hopkins, promoted.

Chicago, Rock Island & Pacific.—A. G. Merrill, Superintendent of of the Panhandle division, has been appointed Superintendent of the Arkansas division with headquarters at Little Rock. H. M. Hallock, Superintendent of the Oklahoma division, has been appointed to succeed Mr. Merrill, with headquarters at Oklahoma City, O. T.

Cincinnati, New Orleans & Texas Pacific.—D. M. Case has been appointed Superintendent of Signals of the Cincinnati, New Orleans & Texas Pacific, succeeding W. A. D. Short, who has resigned to become Signal Engineer of the Illinois Central.

C. E. Rickey has been appointed Superintendent of Car Service of the Cincinnati, New Orleans & Texas Pacific and Alabama Great Southern, succeeding I. F. Hall, assigned to other duties.

R. D. Lankford, Assistant Secretary, has been appointed Secretary of the Cincinnati, New Orleans & Texas Pacific, with headquarters at New York, succeeding W. A. Shoemaker, resigned. J. W. Hood has been appointed Assistant Secretary, with headquarters at Cincinnati, succeeding Mr. Lankford.

Delaware & Hudson.—George A Keller, Superintendent of Car Service, has been appointed Car Accountant, with headquarters at Albany, N. Y. He is succeeded by Thomas O. Cole, also with headquarters at Albany.

F. B. Lincoln, Superintendent of the Susquehanna division, with headquarters at Oneonta, N. Y., has resigned. The jurisdiction of A. T. Benjamin, Superintendent of the Saratoga division, with headquarters at Albany, has been extended over the Susquehanna division.

Denver & Rio Grande.—A. H. Calef, J. F. Vaile and W. H. Taylor have been elected directors. They succeed Edward O. Wolcott, deceased, and E. H. Harriman and Edwin Gould.

El Paso-Northeastern System.—Dennis Sullivan, General Superintendent, has resigned.

A. R. Oster has been appointed General Superintendent, with headquarters at Alamogordo, N. M., succeeding D. Sullivan, resigned.

Erie.—E. H. Harriman and George F. Baker, directors, have been elected to the executive committee.

Great Northern.—George S. Stewart, Assistant Superintendent of the Breckenridge division, has been appointed Superintendent of the Minot division, succeeding J. M. Davis, recently appointed Assistant General Superintendent.

R. D. Hawkins has been appointed General Master Mechanic of the Central district, with headquarters at Minot, N. Dak. The Central district, of which J. M. Davis was recently appointed Assistant General Superintendent, is a new general district and includes the Dakota, Minot and Montana divisions and the Montana Central Railway. The jurisdiction of the Assistant General Superintendent of the Eastern district has been extended to include the Willmar, Breckenridge, Fergus Falls and Northern divisions and the Willmar & Sioux Falls Railway. The jurisdiction of the Assistant General Superintendent of the Western district will include the Kalispell, Spokane and Cascade divisions and the Spokane Falls & Northern Railway.

Illinois Central.—T. J. Hudson, Traffic Manager, has been appointed General Traffic Manager; F. B. Bowes, Assistant Traffic Manager, has been appointed Freight Traffic Manager; A. H. Hanson, General Passenger Agent, has been appointed Passenger Traffic Manager, and S. G. Hatch, Assistant General Passenger Agent, has been appointed General Passenger Agent, succeeding Mr. Hanson. The offices of Traffic Manager and Assistant Traffic Manager have been abolished. The same appointments have been made for the Yazoo & Mississippi Valley.

Interborough Rapid Transit (New York).—George H. Pegram has been appointed Chief Engineer of the Interborough Rapid Transit Company and of the Rapid Transit Subway Construction Company, succeeding S. L. F. Deyo, Chief Engineer of the latter company and of the Subway division of the Interborough.

Kansas City Southern.—H. Visscher has been appointed Treasurer, succeeding F. V. S. Crosby, and R. J. McCarty, Auditor and Assistant Secretary, succeeding H. B. Johnson, resigned. Both will have headquarters at Kansas City.

New York Central & Hudson River.—A. T. Hardin, Engineer of Maintenance of Way, has been appointed Assistant to the General Manager.

George W. Vaughan, Division Engineer, has been transferred from Buffalo to the office of the Chief Engineer in New York in connection with terminal improvement work.

Newton & Northwestern.—Homer Loring, Treasurer, has been elected President, succeeding Hamilton Browne.

Pacific & Idaho Northern.—A. R. Randolph, Chief Claim Clerk of the Oregon Short Line, has been appointed General Superintendent, with headquarters at Weiser, Idaho.

Panama.—John F. Stevens has been appointed General Manager, succeeding John F. Wallace.

Peoria & Pekin Terminal.—George F. Newman has been appointed General Freight Agent.

St. Louis & San Francisco.—J. G. Taylor, Division Engineer of the Western division, has been appointed Resident Engineer of the Eastern, Central and Southwestern divisions with headquarters at Springfield, Mo. C. B. Spencer, Division Engineer of the Northern division, has been appointed Resident Engineer of the Northern and Western divisions with headquarters at Joplin, Mo. N. B. Hanna has been appointed Resident Engineer of the Southern division and of the Kansas City, Memphis & Birmingham, with headquarters at Memphis, Tenn. H. Hall, Assistant Division Engineer, has been appointed Assistant Resident Engineer of the River and Cape divisions, with headquarters at Cape Girardeau, Mo. All of the resident engineers will report to the Engineer of Maintenance of Way.

Southern.—Charles Hoffman, who has been Road Foreman of the locomotive department of the Chicago, Burlington & Quincy, has been appointed Master Mechanic of the St. Louis-Louisville Lines, with headquarters at Princeton, Ind.

Trinity & Brazos Valley.—Michael Sweeney is Vice-President as well as General Manager. R. H. Baker, who has been Vice-President and General Manager, continues as Vice-President.

Wabash.—James K. Howard, Engineer of Maintenance of Way of the Western division, with headquarters at Peru, Ind., and Guy Courter, Assistant Engineer of Maintenance of Way of the Springfield division, with headquarters at Springfield, Ill., have resigned, the latter to go into private business. E. K. Woodward, Engineer of Maintenance of Way at Detroit, has been appointed to succeed Mr. Howard. A. G. Trippeer, Engineer of Maintenance of Way of the St. Louis division, with headquarters at Moberly, Mo., has been transferred to the Detroit division, succeeding Mr. Woodward. E. M. Merriweather, Engineer of Maintenance of Way at Springfield, Ill., has been transferred to succeed Mr. Trippeer as Engineer of Maintenance of Way of the Western division, with authority over the St. Louis division and headquarters at Moberly, Mo. The jurisdiction of Edward Shelah, Engineer of Maintenance of Way of the Middle division, with headquarters at Decatur, Ill., has been extended to include the Springfield division. Mr. Shelah thus succeeds Mr. Merriweather and Mr. Courter.

George G. Yeomans, heretofore Purchasing Agent of the Chicago, Burlington & Quincy, has been appointed Assistant to the First Vice-President. In this position, he will have charge of the purchasing and fuel departments of the entire system, including the Wabash-Pittsburg Terminal and Wheeling & Lake Erie.

The authority of J. B. Barnes, Superintendent of Motive Power and Machinery has been extended over the car department and the position of Master Car Builder has been abolished.

Wheeling & Lake Erie.—H. T. Douglas, Jr., Chief Engineer of the West Side Belt, has been appointed Consulting Engineer of the Wabash Lines east of Toledo. Mr. Douglas' duties as Chief Engineer of the West Side Belt will be taken over by George T. Barnsley, Chief Engineer of the Wabash lines east.

Yazoo & Mississippi Valley.—See Illinois Central.

LOCOMOTIVE BUILDING.

The Buenos Ayres & Rosario has ordered 22 compound six-wheel (2-4-0) passenger locomotives from Robert Stevenson & Co., of Darlington, England.

The Missouri, Kansas & Texas has ordered 14 simple mogul (2-6-0) locomotives, eight simple 10-wheel (4-6-0) locomotives and two balanced compound 10-wheel (4-6-0) locomotives from the Baldwin Locomotive Works, for September and October delivery, instead of 30 locomotives, as reported in our issue of June 23. The mogul locomotives will weigh 155,000 lbs., with 133,100 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 63 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,268 sq. ft.; 298 charcoal iron tubes, 2 in. in diameter and 12 ft. 8 in. long; Otis steel firebox, 101 in. x 60 in.; grate area, 46.2 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 28,000 lbs. The simple 10-wheel locomotives will weigh 145,000 lbs., with 105,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 68 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,372 sq. ft.; 295 iron tubes, 2 in. in diameter and 14 ft. 3 in. long; Otis steel firebox, 100⅛ in. x 41¼ in.; grate area, 29.1 sq. ft.; tank capacity, 6,500 gallons, and coal capacity, 12 tons. The compound 10-wheel locomotives will weigh 157,800 lbs., with 116,500 lbs. on the drivers; cylinders, 15 and 25 in. x 26 in.; diameter of drivers, 68 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,650 sq. ft.; 294 iron tubes, 2 in. in diameter and 16 ft. long; Otis steel firebox, 108⅛ in. x 41¼ in.; grate area, 31 sq. ft.; tank capacity, 6,500 gallons, and coal capacity, 12 tons. The special equipment for all will include: Westinghouse-American air-brakes, "Simplicity" bell ringer, National-Hollow brake-beams, Diamond "S" and steel insert brake-shoes, Buckeye tender couplers and Leeds reversible pilot couplers, Pyle-National electric headlights, Monitor injectors, U. S. metallic piston and valve rod packings, Coale safety valves, Leach pneumatic sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Standard Steel Works driving and truck wheel tires, and Safety Car Heating & Lighting Co.'s steam heat equipment for 10-wheel locomotives.

CAR BUILDING.

The Chicago & Eastern Illinois has ordered 26 cabooses from the Mt. Vernon Car Manufacturing Co.

The Chicago, Rock Island & Pacific has ordered 25 cabooses from the Mt. Vernon Car Manufacturing Co.

The Missouri, Oklahoma & Gulf has ordered 50 gondola cars of 60,000 lbs. capacity from the American Car & Foundry Co., for September delivery.

The El Paso & Southwestern has ordered 500 side steel dump coke cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for December delivery. These cars will weigh approximately 45,000 lbs., and measure 40 ft. long and 9 ft. 8¼ in. wide, both inside measurements. The special equipment includes: Westinghouse air-brakes, Climax steel couplers, Miner tandem draft rigging, Harrison dust guards and McCord journal boxes.

The Chicago & North-Western, as reported in our issue of June 23, has ordered 500 refrigerator cars of 60,000 lbs. capacity from the Chicago Works of the American Car & Foundry Co. for August delivery. These cars are to measure 40 ft. long and 9 ft. wide over sills and 7 ft. 5 in. high from sill to plate, with wooden frames and underframes. The special equipment will include: Steel axles, Williamson & Priese bolsters, metallic brake-beams, Congdon brake-shoes, Westinghouse air-brakes, Chicago & North-Western standard brasses, draft rigging, roofs and trucks, Chicago steel couplers and cast-iron journal boxes and wheels.

The United Railroads of San Francisco, as reported in our issue of June 16, have ordered 50 California type combination cars from the St. Louis Car Co., for September 15 delivery. These cars will weigh 14,700 lbs. and have a seating capacity for 42 persons. They will measure 13 ft. 2 in. long, and 8 ft. 2 in. wide, inside measurements; 4 ft. 6 in. long, and 9 ft. 7 in. wide, over all, and 11 ft. 7 in. high from rail, with wooden frames and wood and steel underframes. The special equipment includes: Jones & Laughlin axles; United Railroads of San Francisco standard bolsters, hand wheel and track brakes and couplers; Peckham brake-beams, brake-shoes, brasses, journal boxes, springs and trucks; National Electric Co.'s air-brakes, Pantasote curtain material, St. Louis Car Co.'s door fastenings and doors, incandescent lights, Felton-Sibley Co.'s Tuscan red paint, Monitor canvas roofs and Griffin Wheel Co.'s wheels.

BRIDGE BUILDING.

Bedford, N. S.—Bids, it is said, will soon be asked by the Intercolonial for building a railroad bridge to carry double track at this place, to cost about $50,000.

Bloomsburg, Pa.—The viewers on the proposed State bridge at Mifflinville have decided to report favorably on an overgrade crossing of the tracks of the Pennsylvania Railroad. The bridge will be 1,421 ft. long, 125 ft. of which is made necessary by the overgrade crossing. It will have a 24-ft. roadway, and 6-ft. walk.

Bracebridge, Ont.—Bids are wanted by Alex. C. Salmon, town clerk, for building a steel bridge 190 ft. long, with 20-ft. roadway and 6-ft. walk on cement abutments. Plans at the office of the Engineer, Public Works Department, Toronto, Ont.

Decatur, Ill.—The Highway Commissioners have under consideration the question of replacing the old wooden bridge over the Sagamon river at this place with a steel structure to cost about $15,000.

Falls City, Neb.—Bids are wanted July 14 by J. C. Tanner, County Clerk, for some bridge work in Richardson County.

Greensburg, Pa.—The county commissioners have given a contract for the new bridge over the Youghiogheny River at West Newton to the Pope Bridge Co., of Beaver Falls, at $67,885.

Haverhill, Mass.—The bids recently opened at the office of the County Commissioners at Salem for the new bridge at Haverhill varied from that of the American Bridge Co.'s bid of $177,950 (the lowest bidder) to $204,000.

Lancaster, Pa.—The Lancaster & Eastern, which is building an electric line from Lancaster to Christiania, via Gap, will build bridges over Conestoga creek near Witmer's, and just east of Leaman Place.

Lyme, Conn.—The plans for the new bridge of the New York, New Haven & Hartford over the Connecticut river have been approved by the Federal authorities, and it is reported that the bridge will be built in one year.

Manitowoc, Wis.—A bridge may be built at Tenth street at a cost of $50,000 by the Fox River Valley Railway Co.

St. Louis, Mo.—An ordinance is being prepared authorizing a vote to be taken on the question of appropriating about $5,000,000 for building a free municipal bridge over the Mississippi river.

Sandusky, Ohio.—Bids are wanted July 10 by the Board of County Commissioners for building a steel and concrete arch in Oxford township, Erie County. Charles Kubach is Auditor.

Sherman, Tex.—The Houston & Texas Central, it is said, is

planning to replace many of its old bridges along the line of its road between this place and Dallas with new structures.

WAYNESBORO, PA.—The Western Maryland has given the Pennsylvania Steel Co. a contract for the reconstruction of four bridges on the main line and two on the West Virginia Central, as follows: Main Line—Over Marsh Run, near Hagerstown, to be of 43½ deck-plate girder spans; over Antietam Creek, east of Hagerstown, to have two 75-ft. deck plate girder spans; over Coconocheague Creek, near Williamsport, to have four 80-ft. 6-in. deck-plate girder spans; over Little Conococheague Creek, West Virginia Central-Gerstell Bridge, to have two 120 ft. through riveted truss spans and two 32-ft. 10-in. deck-plate girder spans; Dawson Bridge, to have one 120-ft. through riveted truss span and two 54-ft. 4-in. deck-plate girder spans. All the work to be finished by December 1.

WEBSTER SPRINGS, W. VA.—Bids are wanted July 13 by P. M. McElwain, Clerk of the County Court, for building an iron bridge 100 ft. long over the Elk river in Webster County.

YORK, PA.—The York Street Railway Co. will build a subway 360 ft. long, 30 ft. wide, and 13 ft. high, under the Northern Central tracks at Richland avenue.

Other Structures.

CHAMPAIGN, ILL.—The Cleveland, Cincinnati, Chicago & St. Louis, it is said, is planning to put up a new passenger station at this place, to cost about $25,000; also a new freight house.

CHICAGO, ILL.—The Chicago & Western Indiana, it is said, will build a new station at 47th street, to cost about $50,000; also one at 55th street.

EL PASO, TEX.—Plans are being made for new shops for the joint use of the El Paso & Southwestern and the El Paso-Northeastern, to consist of brick and steel structures and a machine shop, 127 x 323 ft., repair shop 110 x 300 ft., blacksmith shop 80 x 100 ft., power house 50 x 100 ft., a mill 100 x 200 ft., a 20-stall roundhouse and some other buildings.

EVERETT, WASH.—The Great Northern, it is said, is planning to put up a brick passenger station here.

HILLYARD, WASH.—The Great Northern, it is reported, will spend about $300,000 in improvements at this place, to include a new freight house and improvements to its roundhouse and yards.

JOHNSON CITY, TENN.—The Southern, it is reported, has plans ready for putting up a new passenger station at this place.

MONROE, N. C.—The Seaboard Air Line is planning to put up a new passenger station and freight house to cost about $60,000.

NEW YORK, N. Y.—Plans have been made by Bridge Commissioner Best and submitted to the Board of Estimate for building a new terminal at the Manhattan end of the Brooklyn Bridge, to double its present capacity, at a cost of about $5,000,000.

PORT RICHMOND, N. Y.—The Philadelphia & Reading has given a contract to the Millard & McGraw Construction Co. for putting up a brick office building two stories high.

VANCOUVER, B. C.—A large terminal depot, it is reported, will be built by the Great Northern at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

APALACHICOLA NORTHERN.—A contract has been given by this company to the Morey Engineering & Construction Co., of St. Louis, Mo., to build its road from St. Joseph Bay, Fla., east to Apalachicola, and thence north to River Junction, a distance of about 80 miles.

BLUFFTON & FORT WAYNE (ELECTRIC).—Bonds have recently been issued by this company, the proceeds of which are to be used to extend the Muncie, Hartford & Fort Wayne from Bluffton north to Fort Wayne, Ind., a distance of 25 miles.

BRONX, YONKERS & WHITE PLAINS.—Application has been made by a company under this name in New York for a franchise to build an electric road from the Borough of the Bronx, New York City, north to White Plains, about 15 miles.

BROOKVILLE & MAHONING (PITTSBURG, SHAWMUT & NORTHERN).—This company has begun the construction of its road from Hyde, in Elk County, Pa., at which point connection will be made with the Pittsburg, Shawmut & Northern, southwest through Brookville to Freeport, on the Pennsylvania, a distance of about 103 miles. W. P. Mulhern, George S. Ramsey, E. B. Tilden and others, of St. Mary's, are interested.

BUFFALO, LAKE ERIE & NIAGARA.—A charter has been granted this company in New York, with a capital of $4,000,000, to build a railroad around Buffalo, from a point on the shore of Lake Erie southwest of Buffalo through the towns of Hamburg, West Seneca and Amherst to the Niagara river at Tonawanda, and thence to the International bridge at Buffalo. The directors include: C. N. Bushnell, J. H. Metcalf and H. W. Putnam, of Buffalo.

CARLINVILLE, ALTON & ST. LOUIS.—Incorporation has been asked by this company in Illinois with headquarters in Jerseyville to build a railroad from Carlinville southwest to Jerseyville, and thence south to Alton, about 50 miles. The incorporators and first board of directors include: Andrew J. Gross, J. M. Page, J. W. Becker, J. C. McGrath, all of Jerseyville; A. L. Austen, of Chicago; Robert Curdie and J. M. Rhoades, of Alton, Ill.

CHICAGO & NORTH-WESTERN.—A contract has been given by this company to Kilpatrick Bros. & Collins at about $750,000 to build an extension of its road from Casper, Wyo., west to the edge of the Shoshone reservation, a distance of about 135 miles. (See Construction Record.)

COLORADO, TEXAS & MEXICO.—The stockholders of this company will vote on July 10 on issuing bonds, in conformity with the ruling of the Texas Railroad Commission, to build 400 miles of road from Wilbarger County, Tex., to a connection with the San Antonio & Aransas Pass, near Comfort; also to build a line from Washburn, Tex., connecting with the Fort Worth & Denver City, the Atchison and the Rock Island, to San Antonio.

GREAT NORTHERN.—Contracts have been given by this company to Owens & Loveland, of Omaha, Neb., for the first 10 miles of its extension north from Ashland, Neb. Callahan Bros. and Phelan & Shirley, of Omaha, have the contract for building 50 miles near Yutan and in the Winnebago reservation. Work is to be begun at once at Sioux City, Freemont, and Ashland, and the contracts call for the completion of the work before November 1. Contracts for the balance of the extension, which is to be 105 miles long, it is said, have been given to St. Paul contractors.

KANSAS, OKMULGEE & GULF.—This company, which has a capital of $2,500,000, recently filed a mortgage for $3,000,000 to raise funds to build its projected road from Kansas City south through the Cherokee, Creek and Choctaw nations, to a point on the Red river near the 96th meridian. A branch line is also to be built from Okmulgee, Ind. T., northeast to Joplin, Mo., a total distance of about 560 miles. F. H. Smith, of Okmulgee, Ind. T., is President.

MEXICAN CENTRAL.—This company is reported to have let the contract to Hampson & Smith, of the City of Mexico, for building the extension of its branch which terminates at Tuxpan to the port of Manzanillo, on the Pacific coast. As reported in last week's issue of the *Railroad Gazette*, the Mexican Central has an option until September 6 on the Mexican National Construction Co.'s line, which runs from Colima to Manzanillo, 89 miles. If the option is exercised and this road taken over, there will be about 40 miles of line from Tuxpan to Colima to be built to complete the line to Manzanillo. On the other hand, a new line from Tuxpan to Manzanillo would be about 125 miles long.

MISSISSIPPI VALLEY & GULF.—Incorporation has been granted a company under this name in Oklahoma, with a capital of $50,000,000. Its headquarters are at Guthrie, Okla. T., and at Chicago, Ill. It is proposed to build a railroad from Keokuk, Iowa, southwest through Missouri to a point on the Arkansas river in Arkansas. The incorporators include: E. L. Cochanour and S. S. Cochanour, of Keokuk; G. P. Dalton, of Muscatine; G. A. Mason and T. Rockenfeller, of Chicago, and H. W. Pentecost and I. M. Louden, of Guthrie.

NATIONAL OF MEXICO.—The new line of this company from Monterey, Mex., east to Matamoras, which was operated as far as Los Aldamas, about 83 miles, last year, has been completed to Metamoras, a total distance of 205 miles.

NORTHERN PACIFIC.—A contract has been let by this company to Donald Grant, of Faribault, for building the first 15 miles of its proposed extension from Denhoff, N. Dak., west to Coalharbor, in McLean County, a distance of 54 miles.

OKLAHOMA INTERURBAN (ELECTRIC).—An officer writes that this company is in the market for material for building about three miles of electric railway, and also that the company is planning to continue its line to Lexington, a distance of 40 miles. C. V. Eggleston, Oklahoma City, Okla. T., is President and General Manager.

OPELOUSAS, GULF & NORTHEASTERN.—An officer writes that the chances are good for building this road from Melville, La., to Opelousas, and that contracts may be let for the work in about 60 days. There will be only one steel bridge. T. H. Lewis is President and Ira W. Sylvester is Chief Engineer, both of Opelousas.

PENNSYLVANIA.—A contract has been given by this company to the Millard & McGraw Construction Co., of Philadelphia, for double tracking and straightening the tracks of its Princeton branch, on which work is to begin at once. This branch, which is about three miles long, is to be made double-track throughout.

Surveys, it is reported, are being made by this company for building a new freight line around Baltimore. The new line is to be about 10 miles long, and will be a surface road the entire dis-

tance, leaving the main line of the Philadelphia, Baltimore & Washington at Stemmer's Run. A connection is to be made with the Frederick Road extension on the south side of Baltimore.

Public Service Corporation.—This company is said to be planning to build a high-speed electric road from Newark, N. J., to New York City.

Rockland, Jasper & North-Western.—A charter has been granted this company in Texas, with a capital of $100,000 to build a railroad from Rockland, in Tyler County, Tex., east to Jasper, in Jasper County, approximately 25 miles. The incorporators include: W. W. Kyle, S. K. Stone, W. W. Cunningham and others, of Beaumont.

St. Paul & Des Moines.—This company has been organized in Iowa with a capital of $1,000,000, to build a railroad from Iowa Falls to the Minnesota state line, with certain branches. The headquarters of the company will be at Iowa Falls. This is to be the construction company for the proposed extension of the Des Moines, Iowa Falls & Northern from Iowa Falls to Mason City, or Charles City, Iowa, a distance of about 110 miles. The incorporators are: E. S. Ellsworth, William Welden, W. J. Souder, of Iowa Falls, and W. H. Tylee and W. A. W. Dodge, of Boston, Mass. (See Construction Record.)

Spokane International.—An officer writes that contracts have been let for building this proposed road from Spokane to the international boundary line, where connection will be made with the Canadian Pacific. The work includes some heavy sections, and it is not yet known just what bridges will be put up or tunnels pierced. C. W. Chapin, of New York, is President, and E. G. Tabor, Chief Engineer.

Trinity & Brazos Valley.—An amendment to its charter has been filed by this company, which was recently bought by the Colorado & Southern, contemplating the building of an extension from the northern terminus at Cleburne, in Johnson County, north to Forth Worth, and thence east to Dallas, about 65 miles; also for a line from a point near Maxia north to Dallas, approximately 80 miles, and for an extension from the southern terminus at Maxia to Galveston, via Houston, about 200 miles, with an extension eastward towards Louisiana, passing through Beaumont to Orange, on the state line, about 110 miles.

Vinita & Western.—A charter has been granted this company in Oklahoma Territory to build a railroad from Vinita, Ind. T., northwest through the Cherokee nation, and through the counties of Montgomery, Chautauqua and Cowley in Kansas; a distance of about 140 miles; also to build two branches, one 20 miles and the other 85 miles. The incorporators include: F. R. Pierce, of St. Louis; C. C. Nelson, of Fort Scott; G. F. Badgett, of Tonopah, Nev.; L. F. Parker, Jr., of Vinita; J. S. Mabon, of Guthrie; M. P. Libby and A. Schoenhart, of El Reno.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—The Staten Island Rapid Transit Railroad Co., which is controlled by the Baltimore & Ohio, has been authorized by the New York State Railroad Commission to issue $5,000,000 in new bonds. Of this amount, $3,500,000 is to be used to refund $1,000,000 first-mortgage 6 per cent. bonds of the old S. I. R. T. R. R. Co., due 1913, and $2,500,000 second-mortgage 4 per cent. bonds due July 1, 1904.

Central of New Jersey.—This company is reported to have bought control of the New Jersey & Pennsylvania, which runs from Whitehouse, N. J., on the Central of New Jersey, north to Morristown, 27 miles. Up to a few months ago the name of the road was the Rockaway Valley.

Chicago & Alton.—The Chicago & Alton Railroad Co. has sold to Kuhn, Loeb & Co., $5,000,000 3 per cent. fifty-year refunding bonds. These are issued for betterments and are part of an authorized issue of $45,350,000, of which $37,388,000 have already been issued. The authorized issue was increased from $40,000,000 in September, 1904. The Chicago & Alton Railway Co. owns more than 98 per cent. of the stock of the Chicago & Alton Railroad Co.

Chicago & Eastern Illinois.—The stockholders of this company have ratified the proposed issue of $55,000,000 fifty-year 4 per cent. bonds, redeemable at 102½. Of these bonds $34,626,000 will be used for refunding purposes.

Chicago & North-Western.—Permission has been given by the New York Stock Exchange to list $10,609,200 additional common stock from time to time on official notification that it has been issued and paid in full. This will make the total amount issued $59,949,900.

Chicago Terminal Transfer.—This company has again defaulted on its 4 per cent. bonds. The previous default was in January. Under the mortgage, the holders of 50 per cent. of the bonds may now foreclose on account of the January default. It has been stated that the road will be sold to one of several different railroads entering Chicago, but there appears to be no authoritative information at present as to which of these will get the property.

Cleveland, Cincinnati, Chicago & St. Louis.—Gross earnings for the quarter ended June 30 were $5,225,900, a decrease of $226,300 from 1904. Operating expenses were $3,928,600, and net earnings, $1,297,300, a decrease of $227,800 from 1904. For the six months ended June 30, gross earnings were $10,154,800, an increase of $155,000, and net earnings, $2,210,000, a decrease of $16,900. All earnings for 1905 are partly estimated.

Consolidated Railway (N. Y., N. H. & H.).—The Consolidated Railway has bought the Branford Light & Water Co.'s trolley line, five miles long, from East Haven, Conn., to Branford. The Branford Company has an authorized capital stock of $600,000, only half of which has been issued. The road has been operated by the Fairhaven & Westville, one of the Consolidated properties. The price paid is said to have been about $80 per $100 share for the $300,000 stock, and the payment to have been made in 4 per cent. Consolidated Railway debentures.

East Tennessee & Western North Carolina.—The stockholders have authorized a new issue of $500,000 in bonds to pay the present bonded indebtedness and to buy four miles of railroad in Mitchell County, N. C.

Green Bay & Western.—A committee representing a considerable amount of the "B" debentures is asking, by advertisement, deposits of these securities for the purpose of obtaining income alleged to belong to the owners of these obligations and securing their interests on any transfer of the property. The advertisement states that the net earnings are sufficient to pay a substantial percentage on the "B" debentures after full payments on all prior claims. When the road was reorganized at foreclosure sale in 1895, its securities were exchanged for "A" and "B" debentures and stock. After 2½ per cent. has been paid each on the "As" and the stock, and the two have in addition shared equally in the surplus up to 5 per cent. each, all surplus earnings are according to the reorganization plan to go to holders of the "Bs."

Long Island.—Application has been made to the New York Stock Exchange to list $5,691,000 additional refunding mortgage 4 per cent. bonds of 1949. This will make the total amount listed $17,891,000.

New York Central & Hudson River.—The lease of the Beech Creek Extension Railroad to the New York Central is reported to provide that the Central shall pay 3½ per cent. interest on the outstanding $3,500,000 bonds issued in 1901 and 4 per cent. on an issue limited to $20,000,000 of consolidated mortgage bonds which is to be made. The Beech Creek Extension is a recent consolidation of the Beech Creek Extension, Curwensville & Bower, Pittsburg & Eastern, and Clearfield Southern, all controlled by the New York Central.

New York, Ontario & Western.—A new mortgage to secure $12,000,000 4 per cent. fifty-year gold bonds has been made by this company to the New York Trust Company, trustee.

Philadelphia & Reading.—Gross earnings of the Philadelphia & Reading for May were $3,550,477, against $2,956,570 in 1904. Net earnings were $1,522,398, against $1,109,284 in 1904. Dividend payments are now at the rate of 4 per cent. a year.

Raleigh & Southport.—This company, formerly the Raleigh & Cape Fear, whose road runs from Raleigh, N. C., southeast to Lillington, 35 miles, has made a mortgage to the Knickerbocker Trust Co., of New York, as trustee, to secure $2,000,000 5 per cent. bonds. An extension to Fayetteville, 50 miles, and probably to Southport, 90 miles further, is to be built.

St. Louis & San Francisco.—The Beaumont, Sour Lake & Western, a road 22 miles long, which runs from Brownsville to Sour Lake, in Texas, has been sold to the St. Louis & San Francisco, or to the Yoakum interests. Colonel R. C. Duff, of Beaumont, Tex., will, it is reported, be elected President of the road. G. W. Meeker, who is now President, has stated that all the stock of the road and the majority of the bonds have changed hands, and that the new owners will soon assume charge of the property.

Western Pacific.—A meeting of the stockholders has been called for August 23 to vote on a proposition to increase the capital stock of the company from $50,000,000 to $75,000,000. This increase, it is said, is to reimburse the Denver & Rio Grande for advances which it may be called upon to make for building branch lines in California for the Western Pacific. By the terms of the issue of $50,000,000 first-mortgage bonds, if the proceeds of that issue are not sufficient to pay all the cost of construction, including branch lines, the necessary funds are to be provided by the issue of junior securities.

GENERAL NEWS SECTION

NOTES.

The Pennsylvania Railroad is establishing the block system on the Philadelphia & Erie division.

The Boston & Maine is to use the electric train staff on a short piece of temporary single track at Haverhill, Mass.

On Tuesday, July 4, the number of fares collected on the cars of the Brooklyn Rapid Transit Company, Brooklyn, N. Y., operating the elevated and street surface railroads in that city, was 1,600,000.

The United States Bureau of Forestry is now officially known as the Forest Service. The control and administration of the national forest reserves, formerly under the Land Office of the Department of the Interior, is now in the hands of the Forest Service.

It is said that the New York, New Haven & Hartford has revised its notice refusing to continue through rates on all-rail coal to New England, and has limited it to shipments going to points west of the Connecticut river and south of the Highland division.

The Wabash Railroad has dismissed the superintendent and 132 men of the Secret Service department of the road. Interviews with officers of the road seem to indicate that the detective service is not to be entirely abandoned but that each superintendent is to take charge of the department on his own division.

On the Boston Elevated Railroad, the cars of which have one large door in each side at the middle, the side doors are now regularly used at all times, compressed-air opening-and-closing devices having been applied. With this apparatus all of the doors are opened and closed by the guard at the end of the car.

A Philadelphia paper announces that the Pennsylvania Railroad is to begin at once, and continue as fast as possible, the application of air-brake apparatus to the 10,000 or 15,000 freight cars belonging to the company which are not yet equipped. The same paper says that the Philadelphia & Reading has had all of its cars air-braked for two years.

Mr. G. S. Hobbs, of the Maine Central, speaking at the recent convention of accounting officers, in New York City, said that the uncoupling of cars in trains for the purpose of weighing them was unnecessary. He made experiments with 40 cars and found that the weights of the cars when coupled to others did not differ materially from their weights when detached.

The Grand Trunk and the Erie are determined that their passenger rates between Chicago and New York shall be two dollars lower than those of the Michigan Central, and the action of the M. C. in reducing its eastbound fare two dollars (to $18), in accordance with the decision of the recent Aribitration Board, has been followed by reduction to $16 (first-class) by the G. T. and the Erie.

Officers of the Interborough Rapid Transit Company, New York City, report that for the six months ending June 30 the traffic on the elevated lines was fully equal to that in the corresponding period of last year. This indicates that whatever traffic the subway lines have taken from the elevated has been fully made up by the increase in traffic which is caused by the increase in population of the city.

The Interstate Commerce Commission has revised its decision by which was established the differential on ex-lake grain from Lake Erie to Baltimore and Philadelphia. The differential prescribed—3 mills a bushel below the rate to New York—was intended to be equal to 5 mills per 100 lbs.; but the lighter weight of oats and barley was not thought of, and now the differential on these lighter grains is made 1⅔ mills.

The Legislature of Ohio has passed a law requiring that all mail cranes shall clear the widest locomotives 18 inches, and, according to an Ohio paper, every crane in that state on the Baltimore & Ohio and the Pittsburg, Cincinnati, Chicago & St. Louis will have to be moved away to a point farther from the track. To secure the uniformity which is necessary for convenience, it is said that the P., C., C. & St. L. will have to move the cranes throughout its lines, both in Ohio and in other states.

The *Poughkeepsie Press*, of Poughkeepsie, N. Y., says that after September 1 the Poughkeepsie Bridge route of the New York, New Haven & Hartford is to have 300 cars of freight a day from the Lackawanna road, the increase being due to an arrangement by which perishable freight now going by way of New York City is to be delivered to the New Haven road at Maybrook, N. Y. It is said that this will make the freight movement over the bridge, eastbound and westbound, about 1,500 cars a day.

The Atchison, Topeka & Santa Fe has established five experimental farms along its line at Matagorda, Alvin, Sealy, Kopperl and Gainesville, all in Texas. These farms will be developed by experienced farmers, who will go from farm to farm and who will have a car fully equipped for experimental agriculture, as well as for housing the men in charge. The plan of the railroad company is not to force remarkable crops by artificial means of any sort, but simply to prove to prospective settlers what is possible with modern agricultural methods.

In connection with the electrification of lines in and near New York City the Long Island Railroad is putting up telephone wires along 50 miles of its road and is to have 150 telephones on these wires, all connecting with the superintendent's office at Long Island City. There is to be a telephone at least every 2,000 feet along the road, and where there are not stations or signal cabins, or other offices, boxes will be put up. On the electrified lines, inspectors will be patrolling the road at all times, and by means of the telephones these men can be communicated with promptly at any time.

The passenger cars of the New York Central & Hudson River are being lettered "New York Central Lines," with the letters N. Y. C. & H. R. (small) on the ends of the cars. Similar changes in the passenger equipment of all the New York Central lines will be made as soon as practicable. Many of the freight cars of the various roads already bear the words "New York Central Lines" in an oval design (as here shown), in addition to the name of the road.

The amount of anthracite coal mined in the month of June was 5,844,052 tons, nearly the heaviest month's tonnage on record.

The distribution of the tonnage for June and the six months of 1905 was as follows:

	For June		For year.	
	1905.	1904.	1905.	1904.
Reading	1,161,603	1,131,896	6,187,544	5,668,798
Lehigh Valley	980,461	916,306	5,031,052	4,824,482
Jersey Central	700,917	728,185	3,922,054	3,697,244
Del., Lack. & Western	888,273	893,061	4,749,632	4,704,541
Delaware & Hudson	537,450	518,127	2,939,882	2,912,103
Pennsylvania	460,926	473,948	2,507,932	2,371,959
Erie	701,943	682,497	3,142,581	3,007,893
Ontario & Western	271,841	250,699	1,447,642	1,332,039
D., S. & S.	140,638	134,076	788,678	738,148
Totals	5,844,052	5,728,795	30,716,997	29,257,207

Panama Canal.

It is reported that John F. Stevens, Chief Engineer of the Isthmian Canal, has decided to have ten assistants, and that he will fill these positions with eminent engineers, men capable of carrying on the work without the presence of a superior, thus relieving the Chief Engineer of most of the minor details.

The Isthmian Canal Commission has bought from the Ward Line, the American steamers Mexico and Havana. These are to be leased to the Panama Railroad. These two vessels were built for the tropical trade and will be capable of making the round trip in four days' less time than is at present made. The price is said to have been $650,000 each. The purchase was made after careful comparison with foreign-built ships.

New York Subway.

Two additional sections of the New York Subway were opened on July 9, one from the Brooklyn Bridge southward and the other from the Harlem River and Lenox avenue (beneath Harlem River) northward; and the lines are now in operation from South Ferry, at the extremity of Manhattan Island, to the northern terminus at West Farms, near the boundary line of Bronx Park, on the east side, and to Broadway and 157th street (as heretofore) on the west side of the city. The southbound express trains now all go through to South Ferry, where all of the trains run around the loop, except that in the busy hours a part stop at Bowling Green, the next station north of the loop. The South Ferry station is to have passageways to the ferry houses there, but these are not yet finished. That part of the "Subway" north of 149th street is on an elevated structure. This part of the line has been in operation for some months past and the trains running over it have been run to and from the south end of the city over the Second Avenue elevated road. This arrangement is now discontinued, of course.

The line on the west side from 157th street northward is nearly finished, but there are two stations yet to be completed and it is said that it will be two or three months before that section is opened for traffic. Near Fort George, where the line is over 100 ft. beneath the surface, elevators are provided; and it is said that these have been made larger than originally planned. The new station at Mott ave-

nue, north of the Harlem river, on the east side, is one of the largest on the Subway. It has a platform 375 ft. long and in addition to stairways, two elevators are used to carry people the 50 ft. between the station and the street level. A sketch map of the Subway was published in the *Railroad Gazette* of September 16.

Report on the Panama Railroad.

The report of Joseph L. Bristow, Special Commissioner appointed by the President to examine the Panama Railroad, published July 11, concludes with the following recommendations:

That the Panama Railroad be continued as a commercial line; that its facilities for handling commerce be improved at once; that it be double-tracked and re-equipped with modern rolling stock; that its port facilities be enlarged by the construction of additional wharves, and that modern facilities for handling cargoes be provided.

That a schedule of rates for through business be provided, fixing the charges at the minima which the payment of operating expenses and a fair dividend on the investment of the government will permit. The cost of handling freight with improved facilities, and not what it has cost in the past, should be used as the basis in fixing rates.

That the present policy of charging a per cent. of the rates on through business, subject to certain minima, be adhered to.

That the steamship line between New York and Colon be retained.

That the contracts with the Pacific Mail steamship and the South American line be canceled, and the ports of Colon and Panama opened to the use of all steamship lines on equal terms.

That if, within a reasonable time, a regular steamship passenger and freight service is not established between Colon and the gulf ports, a line be established by the Panama Railroad.

That if the Pacific Mail Steamship Co. withdraws its present Panama line, an effort be made to induce some other company to establish a first class service between the important Pacific Coast ports of the United States and Panama, and in the event that no other company is prepared to furnish the service, that it be provided by the Panama Railroad.

That in traffic connections American steamship lines be favored so far as can be done consistently with the treaty obligations of the United States.

American Car and Foundry Company.

During the year ended April 30, 1905, this company built 35,857 cars, including all types and designs. This is a decrease of 30 per cent. as compared with the preceding year. On the other hand, the other business of the company, which amounts to about 20 per cent. of the total, shows an increase over the preceding year. The decrease in car building is largely overshadowed now by the orders on hand, which amount to 44,000 cars. This is the largest amount of orders on hand at this time of year in the history of the company. The figures for earnings for the past three years show the wide fluctuations in the car building business. For instance, total earnings in 1903 were $8,447,030; in 1904, $5,558,879, and in the year ending April 30, 1905, $3,754,274. Net earnings show almost as wide a fluctuation. They were $7,402,631 in 1903; $4,680,112 in 1904, and $2,935,485 in the last fiscal year. In both of the previous years, in addition to the dividend of 7 per cent. on the preferred stock, a dividend of 3 per cent., amounting to $900,000 annually, was paid on the common stock; but in 1905 this dividend was passed. In 1903 the surplus after paying dividends on the preferred was equal to 16 per cent. on the common stock; in 1904 it was 8 per cent., and in the year just past, about 1¾ per cent. The total surplus of the company is $12,755,434.

Fifty Miles an Hour for Two Days.

A press despatch from Chicago, July 11, says that a special train over the Atchison, Topeka & Santa Fe, which arrived in that city at 11.54 a. m., Central time, on that date, from Los Angeles, traversed the distance, 2,244.5 miles in 44 hrs. 54 min., having left Los Angeles at 1 p. m., Pacific time, on July 9. This is at the rate of almost exactly 50 miles an hour, but the distance does not agree with that given in the *Official Guide*. The time is about 13 hours shorter than the best time heretofore made by a special train over this route. (March 27, 1900.) It is said that the time lost in stops was 59 minutes, making the average rate of speed while in motion 51 miles an hour. The train was run to carry Mr. Walter Scott.

Revising Weight Marks on Freight Cars.

The Accounting Officers' Association at its recent convention, passed a resolution requesting the Master Car Builders to agree upon an increase in the allowance (10 cents a car) for re-weighing and re-stenciling foreign freight cars. The auditors find that old and incorrect weights are not erased with sufficient care and promptness.

New Fishing Territory.

The White River division of the St. Louis, Iron Mountain & Southern, between Newport, Ark., and Carthage, Mo., is fast approaching completion and through trains will probably be running by September. Already several thousand tourists have made the trip over the new line, and it is expected that there will be a heavy tourist travel. Excellent fishing may be found at many places and already a number of club houses have been built on the James river between Galena and Branson, and are well filled. Aside from the beautiful scenery on the new line, there are large agricultural and mineral possibilities in the region.

Transfer of Korean Railroads to Japan.

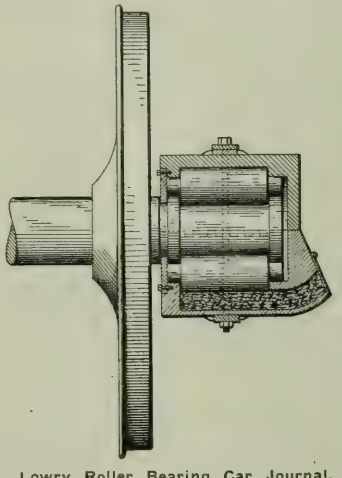
In the Official Gazette of Japan, on April 28, 1905, an agreement was published by which the postal, telegraphic and railroad systems of Korea were transferred to the control of the Japanese Government. The Japanese Government assumed the responsibility of good administration and agreed to bear expenses for all extensions. —*Consular Report.*

Contract for the New United Engineering Building.

The United Engineering Building Committee recently gave a contract to Wells Brothers Co., of New York, for the construction of the United Engineering Building on West Thirty-ninth street in that city at $795,000. This does not include the steam heating plant, electric wiring, etc., but is only for the general construction of the building. The ground is already excavated and the work will begin at once. It is expected that the building will be finished by October, 1906.

Lowry Roller Bearing.

A patent has been granted to A. A. Lowry, Anna, Ill., on a roller bearing for cars, a sectional view of which is shown herewith. The journal box is made in halves with interlocking teeth, the halves being held together by bolts passing through lugs on the sides, there being two bolts on each side. The interior of the box is turned circular, with the exception of a chamber in the bottom of the lower half provided to hold a lubricating material. This chamber has a mouth extending outwardly to the end of the box, the opening being closed by a door, as shown. The rollers have their ends shouldered down to approximately half the body diameter. The axle journal has a wide groove turned in it, into which the rollers fit and have their bearing, the reduced ends bearing on a collar formed on each side of the groove. The journal-box roller chamber has a corresponding shoulder at each end to encircle the roller ends and support the rollers across the lubricating chamber at the bottom. The front of the journal box is closed by a dust-guard formed in halves, secured to the corresponding halves of the box and fitting into a narrow groove in the axle, as shown.



Lowry Roller Bearing Car Journal.

Manufacturing and Business.

The Brooklyn Rapid Transit Company has given a contract to Charles C. Cranford, for painting all its elevated railroad structures. The work will take about one year and will cost $250,000.

It is reported by the London *Standard* that the recommendations of the London Traffic Commission will favor the broad extension of electric traction. Electric cars will be advocated for thoroughfares like the Strand and Piccadilly.

F. W. Bird & Son, East Walpole, Mass., makers of Neponset waterproof paper and Paroid three-ply roofing, announce that the Isthmian Canal Commission has given its first order for roofings and waterproof papers to their company.

The Continental Car and Equipment Co., Whitehall Building, New York City, announces that N. B. Porter, late with the South Baltimore Steel Car & Foundry Co. and the Ryan-McDonald Manufacturing Co., has been appointed its general sales manager.

The American Water Softener Co., Philadelphia, Pa., received two orders for water softening plants from the Norfolk & Western during the month of June, making a total of three orders from this road since April 1 of this year. The last order was for two plants to be installed in the coal lands in West Virginia.

The Electric Dynamic Co., Bayonne, N. J., will exhibit its Inter-Pole variable speed motors at the International Electrical Exhibition to be held at Mechanics Hall, Boston, Mass., July 15th to 22d inclusive. The company is rapidly enlarging its scope of operation

for the Inter-Pole motor and will within the next 90 days be prepared to sell at least 200 varieties of constant and variable speed motors running up as high as 150 h.p.

The Abner Doble Company, of San Francisco, has taken the contract for the machinery for an addition to the hydro-electric plant of the Cramer Electric Company, at Hailey, Idaho. This contract includes a 400-kw. alternator, an 800-h.p. set of water wheels, exciter and governor, switchboards and other accessories, 14 transformers, etc.

The Carolina Company has just been granted a charter in Tennessee. It was organized for the purpose of doing railroad construction work and to secure contracts in connection with the extension of the South & Western Railroad from Spruce Pine southward through the Carolina mountains, to connect with an existing line for the South Atlantic coast. The incorporators include George L. Carter, J. Fred Johnson, T. F. Davis, W. F. Kinsey and J. Norment Powell.

A contract is said to have been given to the General Electric Co. by the Philadelphia & Western for its electrical equipment. The work includes the complete equipment of a temporary and of a permanent power house and of all the passenger cars. The cars are being made by the St. Louis Car Co. The site of the permanent power house has not yet been definitely determined. The temporary power house will be built on Cobb's Creek. Contracts for other equipment, not included in the General Electric contract, will be let at once.

The Railway Electric Power Company has been organized in New York City with a capital of $1,500,000, to introduce the three-phase electric traction system on steam railroads. This system is in use on the Valtellina Line of the Italian State Railways which was described in detail in recent issues of the *Railroad Gazette*. Among the directors of the new company are: John E. Borne, President of the Colonial Trust Company; H. R. Duval, Henry Seligman, William L. Bull, of Edward Sweet & Company; Stephen Peabody and Gustave Leve.

Mr. Ernst Wiener has severed his connection with Arthur Koppel, with whom he has been connected for 18 years, and has opened an office at 68 Broad street, New York City, under the firm name of Ernst Wiener Company. The new company will make railroads and railroad materials for industries, both narrow and standard gage. A factory equipped with modern machinery has been put up in Youngstown, Ohio, for building the specialties of the new firm, so that it is in excellent condition to take care of all business. Associated with Mr. Wiener is Mr. Carl Koch, for many years Chief Engineer of Arthur Koppel, and also a large part of his former staff.

The Thermit Process in American Practice, was the subject of an interesting paper by Ernest Stutz, Vice-President of the Goldschmidt Thermit Company, accompanied by stereopticon views, which was read at the recent annual meeting of the American Society for Testing Materials, at Atlantic City. Illustrations showing the method of welding locomotive frames and driving wheel spokes were given. Mr. Stutz explained that the essential characteristic of thermit is that it welds by fusion and by reason of this fact calls for the foundryman's experience more than for that of the blacksmith. The success of the weld depends on the proper material, and the shape and condition of the mold. Copies of the above paper can be had from the Goldschmidt Thermit Company, New York City.

The Westinghouse Companies are reported to have received two foreign contracts for electrical equipment amounting to $2,000,000. One, taken by the Société Anonyme Westinghouse, calls for the installation of the Westinghouse single phase system on the Bergama-Valle Brembana line in Italy. This is about 20 miles long. The equipment includes five electric locomotives with four 75 h.p. single-phase, multiple-unit control motors. The power station is to have three single-phase, 500 k.w. alternating current generators, to run at a speed of 500 revolutions a minute. The other contract is from the Kanazawa Electric Company, of Kanazawa, Japan, and is for a large hydro-electric light plant to be equipped with Westinghouse rotary alternating 2,200 volt generators of the 60-cycle, three-phase type. This is to be arranged for direct connection of high-pressure horizontal turbines. The working head of water is to be 190 ft., and the generators are to be run at 720 revolutions a minute.

Iron and Steel.

The large demand for rails, averaging about 50,000 tons a week, and the inability of the manufacturers to supply them for August, September and October delivery, it is said, is causing the railroads to offer a premium on the current price.

According to reports from Pittsburg, the Midland Steel Co. will build large works on the north fork of the Ohio river at Cook's Ferry, in Beaver County, Pa., where a site of 1,000 acres has been bought. H. C. Fownes, of the S. Jarvis & Adams Co.; Charles McKnight, of the National Bank of Western Pennsylvania; Joseph McK. Speer and J. Ramsey Speer, are interested. It is proposed to at once put up a blast furnace to have a daily capacity of 450 tons, to which three others will later be added.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Association of American Railway Accounting Officers.

At the seventeenth annual meeting of this association in New York City the election of officers resulted in the choice of Mr. J. O. Clifford (C. & N.-W.), as President; A. H. Plant (Southern), First Vice-President; T. W. Roby (S. A. L.), Second Vice-President, and C. G. Phillips, of Chicago, Secretary. The next meeting of the association will be held at Hotel Champlain, Bluff Point, N. Y., June 27, 1906.

PERSONAL.

—Mr. John L. Moore, formerly General Manager of the Cincinnati, Sandusky & Cleveland, died at Sandusky, Ohio, on June 29.

—Mr. J. T. Robinson, who has been appointed Master Mechanic of the Seaboard Air Line, in charge of the Savannah and Americus shops, was born in Chesterfield County, Virginia, in 1859. For six years, from 1892 to 1898, he was General Foreman for the Southern Railway at Macon, Georgia. In 1898 he was made Master Mechanic at Selma, Alabama, and two years later was transferred to Spencer, North Carolina. In 1904 he left the Southern to go to the Seaboard Air Line as Assistant Master Mechanic, from which position he has recently been appointed Master Mechanic at Savannah.

—Mr. J. H. Travis, who has been appointed Superintendent of Bridges and Docks of the Panama Railroad and Canal, was born July 16, 1878, at Moberly, Mo. He began railroad work in 1889 as a water boy for a bridge gang on the Iowa Central. He worked with this company for three years, and in 1892 went to the Illinois Central. In 1899 he was appointed Assistant Bridge Foreman, and in 1902, Bridge Foreman. In 1904 he was appointed Supervisor of Bridges and Buildings of the Dubuque division. In February, 1905, he was made Supervisor of Bridges and Buildings of the Western division of the Missouri Pacific and of the Central Branch. He left this position in May for his present appointment on the Isthmus.

—Mr. J. W. Daniels, who has been appointed Superintendent of the Missouri division of the Missouri Pacific and the St. Louis, Iron Mountain & Southern was born in Missouri in 1870. He began railroad work at the age of 13 on the St. Louis & San Francisco at Springfield, Missouri. When he was 14 years old he was a night operator and at 20 was promoted to be despatcher. In 1893 he went to the Iron Mountain as despatcher. He was soon made chief despatcher and in 1902 was transferred to the Missouri division. On Dec. 1, 1903, he was appointed trainmaster of the Missouri division, from which position he was on June 10 promoted to be Superintendent.

—Mr. David Lee, Consulting Engineer of the Baltimore & Ohio, died in Zanesville, Ohio, on June 29, at the age of 76 years. He had been on the Baltimore & Ohio since 1851, having been Bridge Carpenter, Superintendent of Road, Roadmaster, General Superintendent, Superintendent of Maintenance of Way until Jan. 1, 1902, when he was appointed to his last position.

—Mr. H. P. Latta, who has been appointed Superintendent of Motive Power of the Mobile, Jackson & Kansas City, with headquarters at Mobile, Alabama, began railroad work in 1877 as an apprentice in the Elkhart shops of the Lake Shore & Michigan Southern. In 1883 he was made Roundhouse Foreman at Jackson, Michigan, and in 1884 Roundhouse Foreman at Air Line Junction, Toledo. In 1889 he was appointed Master Mechanic of the Norwalk shops. He went to the Chicago & Erie two years later as Master Mechanic at Huntington, Indiana, but soon left that road to go into private business, where he remained for two years. He came back to the railroad service in 1893 as General Foreman of the shops of the Ohio Central Lines at Toledo, and in 1903 was appointed Master Mechanic of the Toledo Railroad & Terminal Company. This position he has now resigned to go to the Mobile, Jackson & Kansas City as Superintendent of Motive Power.

—Mr. Martin Adson, who has been appointed General Passenger Agent of the Duluth, South Shore & Atlantic and the Mineral Range, was born in 1872 and entered the service of the Duluth, South Shore & Atlantic in August, 1893, at the age of 21 as a stenographer in the city ticket office at Duluth. From 1894 to 1898 he was ticket clerk and cashier at the Superior city office, and later at the Duluth city office, and in July, 1898, was made traveling passenger agent. In March, 1901, he was appointed General Agent of the road at Duluth, from which position he is now promoted to be General Passenger Agent. His office will be at Marquette, Mich.

—Mr. W. G. Bean, of Winchester, Mass., who recently resigned as Superintendent of the Boston division of the Boston & Maine Railroad, died at Rangeley, Maine, on June 29. Mr. Bean was about 45 years of age.

—Mr. R. H. Ingram, the first General Superintendent of the new Southern district of the Southern Pacific, with headquarters at Los Angeles, was born in Kentucky and entered railroad service as cashier for the Pullman Co. He next went to the Louisville & Nashville as chief clerk and afterwards as Assistant Comptroller. He was appointed Auditor of the Ohio Valley in July, 1887, but returned to the Louisville & Nashville in 1889 as Assistant to the President. In 1896 he went with Mr. Charles M. Hays when Mr. Hays was appointed General Manager of the Grand Trunk, being made Secretary and Treasurer of the Central Vermont when the Grand Trunk acquired control of that road. Mr. Hays was later made President of the Southern Pacific, and Mr. Ingram accompanied him as Assistant to the President. On Mr. Hays' retirement in 1902, Mr. Ingram was appointed Superintendent of the Los Angeles division, from which he has been promoted to be General Superintendent of the Southern district.

—Mr. D. C. Noonan, who has been appointed Superintendent of the Minneapolis & St. Louis, has spent his entire railroad life on this road. From April, 1890, to January, 1902, he was in the supply, traffic and transportation departments. For the last three years he has been Chief Clerk in the office of the Vice-President and General Manager of the Minneapolis & St. Louis and the Iowa Central. From this position he was promoted to be Superintendent, with jurisdiction similar to that of the former General Superintendent.

ELECTIONS AND APPOINTMENTS.

Alabama Great Southern.—See Cincinnati, New Orleans & Texas Pacific.

Arizona & New Mexico.—George Wagstaff has been appointed Superintendent.

Arizona & Utah.—W. G. Taylor, Auditor of the Atchison, Topeka & Santa Fe (Coast Lines), has been appointed Auditor.

Arkansas South-Western.—The authority of the Traffic and Accounting Departments of the Missouri Pacific has been extended over this road.

Atchison, Topeka & Santa Fe.—T. H. Sears, Trainmaster at Marceline, Mo., has been appointed Superintendent of the Missouri Division, with headquarters in Marceline, succeeding R. J. Parker, promoted.

Atlantic & North Carolina.—W. L. Bird has been appointed Auditor, succeeding W. B. Starke, with headquarters at Goldsboro, N. C.

Atlantic Coast Line.—C. M. James, late Assistant Engineer on the Baltimore & Ohio, has been appointed Acting Engineer of Roadway on the First Division, with headquarters at Wilmington, N. C., succeeding George B. Huske.

Boise, Nampa & Owyhee.—W. H. O'Neil has been appointed General Traffic Manager and Auditor of this road and the Idaho & Northern, succeeding R. E. L. Shore, resigned.

Canadian Pacific.—The authority of H. E. Beasley, Division Superintendent at Vancouver, B. C., has been extended over the Esquimalt & Nanaimo.

The office of George H. Smith, Assistant General Freight Agent, has been removed from Calgary to Winnipeg.

Chicago & Eastern Illinois.—The office of G. H. Trenary, Superintendent, has been removed from Villa Grove to St. Elmo, Ill.

Chicago, Burlington & Quincy.—Jacob Kastlin, Assistant Master Mechanic at Galesburg, Ill., has been appointed Master Mechanic at St. Joseph, Mo., succeeding J. H. Dacey, resigned.

Chicago Great Western.—Tracy Lyon has been appointed Assistant General Manager.

Chicago, Peoria & St. Louis of Illinois.—J. K. Howard, Engineer of Maintenance of Way of the Wabash, at Peru, Ind., has been appointed Engineer of Maintenance of Way.

The office of L. P. Atwood, Engineer of Maintenance of Way, has been removed from Alton to Springfield, Ill.

Chicago, Rock Island & Pacific.—Hereafter on this road and on the St. Louis, Kansas City & Colorado, General Managers, General Superintendents and Division Superintendents will have charge of the maintenance of the property. Division Engineers will report to Division Superintendents in all matters pertaining to the maintenance of the property, and will make such reports and perform such duties as may be required by the Engineer of Maintenance. Engineers of Maintenance will report to General Managers in all matters pertaining to the maintenance and improvement of the operated lines, and will make such reports and perform such engineering duties as are required by the Chief Engineer. The Bridge Engineer and Signal Engineer will report to the Chief Engineer. The Chief Engineer's office will be the office of record for the system. The Chief Engineer will approve all standard plans and all plans for bridges and important structures.

J. G. Bloom has been appointed Engineer of Maintenance of the Southwestern and Choctaw districts of the Chicago, Rock Island & Pacific, and of the St. Louis, Kansas City & Colorado, with headquarters at Topeka, Kan.

H. F. White has been appointed Engineer of Maintenance of the Central and Northern districts, with headquarters at Chicago, Ill.

Charles H. Hubbell, Superintendent of Terminals at Chicago, has been appointed General Superintendent of the Central District, with headquarters at Chicago.

It is announced that hereafter on this road and on the St. Louis, Kansas City & Colorado, distribution of all cars will be managed by the office of Assistant to the Second Vice-President.

The office of Superintendent of Car Service has been abol-

ished, and G. P. Johnson, who held that position, has been appointed Car Accountant.

A. C. McColl, Trainmaster at Herington, Kan., has been appointed Division Superintendent at Chickasha, Ind. T., succeeding H. M. Hallock.

Cincinnati, Flemingsburg & Southeastern.—The Covington, Flemingsburg & Ashland has been purchased by this road, which has organized with the following officers: Attilla Cox, President, Louisville, Ky.; C. D. Lanier, Vice-President, New York; W. N. Cox, Secretary and Treasurer; Attilla Cox, Jr., General Counsel; S. S. Bush, General Manager, all with headquarters at Louisville, Ky., and R. L. Dudley, Superintendent, Flemingsburg.

Cincinnati, New Orleans & Texas Pacific.—I. F. Hall, Superintendent of Car Service of this road and of the Alabama Great Southern, has been appointed Assistant to the Chief Engineer of both roads.

Cleveland, Akron & Columbus.—Samuel Moody, General Passenger Agent of the Pennsylvania, has been appointed General Passenger Agent of this road also.

Cleveland, Cincinnati, Chicago & St. Louis.—L. J. Hackney has been appointed General Counsel.

The title of E. E. Kruthoffer has been changed from Freight Accountant to Auditor of Freight Accounts, and that of F. M. Brine from Ticket Accountant to Auditor of Passenger Accounts.

Colfax Northern.—The officers of this company are as follows: J. L. Parish, President; J. B. Ryan, Vice-President; both with headquarters at Des Moines, Iowa; Frank B. Hooper, Secretary and General Manager; L. Bates, Treasurer; both with headquarters at Colfax, Iowa.

Colorado & Southern.—John H. Bradbury has been appointed Assistant General Auditor, with headquarters at Denver, Colo.

Coronado.—Geo. Wagstaff is Superintendent.

Denver & Rio Grande.—D. G. Sloan has been appointed Assistant Superintendent of the Rio Grande Western, with headquarters at Salt Lake City, Utah.

Dover & South Bound.—Officers of this company are as follows: W. A. Wimsatt, President, with headquarters at Washington, D. C.; D. W. Richardson, Vice-President and General Manager; W. B. H. Blandford, Secretary and Treasurer; J. S. Wooten, Superintendent; N. S. Richardson, Traffic Manager; W. R. Hinnant, Roadmaster; Raymond Pollock, M.D., Chief Surgeon; all with headquarters at Dover, N. C.

El Paso-Northeastern.—James Douglas has been elected President of the companies of this system, with headquarters at New York. A. C. James has been elected Vice-President of the New Mexico Railway & Coal Company; El Paso & Northeastern Railway (in New Mexico); El Paso & Rock Island; Alamogordo & Sacramento Mountain, and the Dawson Railway. His office is in New York. H. J. Simmons has been elected Vice-President as well as General Manager of the El Paso & Northeastern (in Texas); A. L. Hawley, Secretary and Auditor, and J. S. Wright, Treasurer; all with headquarters at El Paso, Tex. F. H. Ross has been elected Treasurer of the Dawson Railway, office at New York.

Erie.—Robert Gunn, Master Car Builder at East Buffalo, has been appointed Superintendent of these shops. Thomas Tracy, General Foreman of shops at Kenton, O., has been appointed Assistant Master Car Builder at Meadville, Pa.

Georgia, Florida & Alabama.—E. B. Eppes is Chief Engineer of Construction of this road and the Carrabelle, Tallahassee & Georgia, with headquarters at Cuthbert, Ga.

Georgia Southern & Florida.—William Checkley Shaw has been appointed Assistant to the President, with headquarters at Macon, Ga.

Gila Valley, Globe & Northern.—W. R. Martin has been appointed Superintendent with headquarters at Globe, Ariz., taking the place of A. M. Beal, who has been granted a leave of absence.

Great Central (of Nicaragua).—Robert Pitcairn has been elected Chairman of the Board of Directors, and Thomas B. Riter, President; both with headquarters at Pittsburg, Pa.

Great Northern.—J. M. Schweizer, Chief Clerk to the Superintendent at Willmar, Minn., has been appointed Assistant Superintendent of the Northern division, with headquarters at Grand Forks, N. Dak. R. C. St. John, Assistant Superintendent of the Northern division, has been appointed Assistant Superintendent of the Breckenridge division, with headquarters at Breckenridge, Minn., succeeding G. S. Stewart, promoted.

Kansas City Southern.—H. R. Duval has been appointed Vice-President and R. B. Sperry has been appointed Secretary and Transfer Agent; both with headquarters at New York. The title of F. W. Meyer has been changed from Auditor of Receipts to Freight and Passenger Accountant.

Louisville & Nashville.—Addison B. Smith, heretofore General Freight and Passenger Agent of the Atlanta & West Point and the Western of Alabama, has been elected Third Vice-President of the Louisville & Nashville, with headquarters at Louisville.

Louisiana & Northwest.—George W. Hunter has been elected Treasurer, with headquarters at St. Louis, Mo. A. R. Porterfield has been elected Secretary and Auditor, with headquarters at Ruston, La.

Michigan Central.—The construction of the Detroit Tunnel Line from Windsor, Ontario, to West Detroit Yard, Michigan, including the electrification thereof, has been placed in charge of an Advisory Board of Engineers, consisting of William J. Wilgus, Vice-President of the N. Y. C. & H. R.; Howard Carson, Consulting Engineer, and W. S. Kinnear, Chief Engineer of the Tunnel Company. The Chief Engineer will be in direct charge of construction, reporting to H. B. Ledyard, Chairman of the Board of Directors, on executive and financial matters, and to the Board of Advisory Engineers as to plans, specifications and methods of doing the work.

Midland Valley.—Eugene Mock, Chief Clerk in the freight department, has been appointed Assistant General Freight Agent. George H. McConnell, Chief Clerk in the passenger department, has been appointed Assistant General Passenger Agent. The headquarters of both will be at Fort Smith, Ark.

New York Central & Hudson River.—G. W. Vaughan, Division Engineer of the Western division, has been appointed Engineer of Maintenance of Way with headquarters at New York, succeeding A. T. Hardin, promoted. D. L. Sommerville, Division Engineer of the Pennsylvania division, has been appointed Division Engineer of the Western division with headquarters at Buffalo, succeeding Mr. Vaughan. B. M. McDonald, Supervisor at Albany, has been appointed Division Engineer of the Pennsylvania division with headquarters at Jersey Shore, Pa., succeeding Mr. Sommerville.

C. K. Lawrence, formerly Resident Engineer on various parts of the road, has been appointed Resident Engineer, in charge of four-tracking and structural work in connection with the electrification of the suburban district from Croton-on-Hudson to the Harlem River drawbridge, New York City.

New York, New Haven & Hartford.—H. P. Callendar, General Foreman of the New Haven shops, has been appointed Master Mechanic of the Providence Division, succeeding F. M. Twombly, resigned.

Northern Central.—See Pennsylvania.

Pennsylvania.—A. B. Cuthbert, Assistant Engineer at Pittsburg, Pa., has been appointed Assistant Engineer of the Philadelphia division, with headquarters at Harrisburg, Pa., succeeding J. K. Stewart, relieved on account of ill health. J. J. Rhoads, Superintendent at Tacony, Pa., has been appointed Assistant Engineer of the Eastern and Susquehanna division and of the Northern Central at Williamsport, Pa., succeeding E. B. Wiseman, transferred.

Peoria & Pekin Terminal.—The General Freight Agent of this company is George F. Nevins.

Pontiac, Oxford & Northern.—F. H. Carroll, Auditor, has also been appointed General Freight and Passenger Agent and Acting Superintendent, with headquarters at Pontiac, Mich.

St. Louis, Iron Mountain & Southern.—S. H. Busby, General Foreman of the Bridge and Building Department at the Baring Cross shops, has been appointed Division Engineer of the Central division, with headquarters at Van Buren, Ark.

St. Louis, Kansas City & Colorado.—See Chicago, Rock Island & Pacific.

Southern.—G. L. Best, Acting Superintendent of Dining Cars, has been appointed Superintendent of Dining Cars.

Southern Pacific.—The offices of Manager and Assistant Manager of Purchases and Supplies have been abolished. I. O. Rhoades has been appointed General Purchasing Agent and H. W. Ellicott, Assistant General Purchasing Agent.

Tennessee Central.—T. A. Rousseau, Chief Clerk, will take charge of the Traffic Department with the title of Chief Clerk, succeeding E. H. Hinton, Traffic Manager. The headquarters of the Treasurer have been moved to St. Louis.

Texarkana & Ft. Smith.—J. A. Edson, President of the Kansas City Southern, has been also elected President of this road, with headquarters at Kansas City, Mo. W. D. Sanders has been appointed Claim Agent, and T. E. Jarret, Superintendent of the Kansas City Southern, has been appointed Superintendent, both headquarters at Texarkana, Tex.

Toledo, St. Louis & Western.—C. R. Duncan has been appointed Superintendent of Telegraph and Chief Despatcher, with headquarters at Frankfort, Ind., succeeding A. W. Early.

Tonopah.—T. Thornton has been appointed Acting Auditor, W. F. Towne having resigned. George P. Schaefer has been appointed Assistant Auditor.

Ultima Thule, Arkadelphia & Mississippi.—The officers of this company are as follows: William Grayson, President; N. W. McLeod, Vice-President; W. E. Grayson, Secretary and Treasurer; all with headquarters at St. Louis, Mo.; M. J. Hale, Auditor, and C. G. Carpenter, General Manager; with headquarters at Arkadelphia, Ark. This road has just been put in operation, and is 24 miles long.

Vera Cruz & Pacific.—M. J. Schneider, having resigned as Superintendent, W. A. Hill has been appointed Superintendent and Chief Engineer.

Wabash-Pittsburg Terminal.—W. M. Bonar has been appointed Assistant Secretary and Auditor. J. G. Stidger has been appointed Assistant Treasurer. The headquarters of both are at Pittsburg.

Western Pacific.—George L. Dillman has been appointed Supervising Engineer, in immediate charge of construction.

Williamsport & North Branch.—R. J. Weishaupt has been appointed Freight Claim and Purchasing Agent; D. K. Townsend, Superintendent of the main line; George M. Case, General Freight and Passenger Agent, all with headquarters at Hughesville, Pa.

Wilmington & Powellsville.—J. J. Harrison has been appointed General Freight and Passenger Agent, with headquarters at Windsor, N. C., succeeding J. L. Bell.

LOCOMOTIVE BUILDING.

The Delaware, Lackawanna & Western is reported to have ordered six fast passenger locomotives.

The Cuba Central has ordered six large compound locomotives from the Baldwin Locomotive Works.

The United Railways of Havana have ordered eight large locomotives from the Baldwin Locomotive Works.

The Illinois Central has ordered five simple Pacific type (4-6-2) passenger locomotives from the American Locomotive Co. These locomotives are to weigh 225,000 lbs.

The Lake Shore & Michigan Southern has ordered 5 ten-wheel (0 10-0) switching locomotives from the American Locomotive Co. These locomotives are to be equipped with Walschaert valve gear.

The Mississippi Central has ordered three ten-wheel (4-6-0) locomotives and one American type (4-4-0) locomotive from the Baldwin Works. The ten-wheel locomotives are to weigh 140,000 lbs. and the American type, 110,000 lbs.

The Bergama-Valle Brembana line in Italy has ordered five electric locomotives from the Westinghouse Companies. They will be equipped with four 75 h.p. single phase multiple unit control motors. The trolleys will be of the pneumatically operated type.

CAR BUILDING.

The Mississippi Central has ordered four passenger cars from Barney & Smith.

The Spokane & Inland has ordered twenty 36-ft. flat cars of 60,000 lbs. capacity from the American Car & Foundry Co., for August delivery.

The Victorian Railways of Australia have ordered from the J. G. Brill Co. a number of California type cars. The California type is open at both ends with a closed compartment about one-half the length of the car in the center.

The Chicago & Eastern Illinois is reported to have ordered 1,400 Otis self-clearing gondolas, 750 steel under-frame box cars, and 250 Otis self-clearing box cars from the American Car & Foundry Co., and 100 self-clearing gondolas from the Pressed Steel Car Co.

The St. Louis & San Francisco, as reported in our issue of June 23, has ordered 500 gondola coal cars, 400 Otis self-clearing coal cars, and 500 twin-hopper self-clearing coal cars from the American Car & Foundry Co., and 100 self-clearing coal cars from the Pressed Steel Car Co.

The Atchison, Topeka & Santa Fe has ordered two chair cars and one coach from the Pullman Co. These cars will be 69 ft. 2½ in. long, 9 ft. 2 in. wide and 9 ft. 5 in. high, all inside measurements. The special equipment will include: National-Hollow brake beams, National couplers, Forsyth curtain fixtures, Pantasote curtain material, Miner draft rigging. Pullman standard heating system and trucks, Symington journal boxes and Pintsch light.

The British Columbia Electric is building for the Lulu Island electric line, recently taken over, a number of large interurban cars. They will be equipped with 200 h.p. motors by the Canadian Electric Company. The special equipment includes: J. G. Brill Co.'s trucks, air-brakes from the Canadian Foundry Co., Sterling-Meaker auxiliary hand-brakes and portable telephone instruments.

The New York City Interborough Railway has ordered 10 semi-convertible cars from the J. G. Brill Co. These cars will measure 28 ft. over bodies, 38 ft. over vestibules, width 7 ft. 11½ in. over sills, and 8 ft. over posts at belt; length of platforms, 5 ft. The improved method of raising the sashes into pockets in the side roof known as the "grooveless post" method is called for in the specifications. The vestibule entrances will have Brill folding gates instead of doors. The cars are to be mounted on the builders' No. 27-G-1 short-base double-trucks.

BRIDGE BUILDING.

Baltimore, Md.—The Western Maryland, according to local reports, has given a contract to the Pennsylvania Steel Co. for rebuilding two bridges on the West Virginia Central, one over the Potomac at Gerstell and one at Dawson; also for four on the Western Maryland; one over Antietam creek west of Edgemont, over Marshy run east of Hagerstown, over the Conococheague at Williamsport and over the Little Conococheague.

Birmingham, Ala.—Bids are wanted July 17 by the Board of Revenue for building four steel bridges in Jefferson County. John T. Reed is President.

Binghamton, N. Y.—Bids are wanted July 17, by the Common Council, for building a bridge over Chamberlain creek at Robinson street. H. C. Herrick is City Clerk.

Charleston, W. Va.—Bids are wanted July 20, by the City Council, for building a truss bridge, with roadway of 22 ft. and sidewalks 6 ft. each, over Elk river. W. A. Hogue is City Engineer.

Hartford, Conn.—Bids are wanted July 19, by the board, for building the foundation and substructure of a highway bridge over the tracks at Albany avenue. Joseph Buths is President.

Houghton, Mich.—A contract has been given to the Wisconsin Bridge & Iron Co. at its bid of $70,922 for building a drawbridge over Portage Lake connecting this place and Hancock. The contract calls for the completion of the work by April 1 of next year.

Knoxville, Tenn.—A contract has been given to William J Oliver & Co., of Knoxville, for building the West Clinch avenue viaduct to cost about $75,000.

Listowel, Ont.—Bids are wanted by W. E. Dinning for building steel bridges on Main and Wallace streets 300 ft. long; also a steel bridge on Elma street with concrete abutments.

Menominee, Wis.—Separate bids are wanted July 15, by the city authorities, for the substructure and the superstructure of a bridge to be built over the Red Cedar river. F. W. Rowe is City Clerk.

Montezuma, Ga.—Bids are wanted July 20, by the Atlanta, Birmingham & Atlantic, for approximately 9,000 yds. of concrete arches, piers and abutments, to be built along its road between this place and the Chattahoochee river, about eight miles west of Lagrange. Separate bids will also be received for approximately 2,500,000 ft. B. M., of trestling, to be built between Paschal, Ga., and Chattahoochee River. Alex. Bonnyman, Ch. Engr., at Oglethorpe, Ga.

Naponee, Neb.—Bids are wanted July 24 by John Parker, County Clerk, for building a two-span steel bridge over the Republican river.

Passaic, N. J.—The second set of bids recently opened by the bridge committee for building the drawbridge over the river at the foot of Gregory street were for a structure with wooden and for a structure with creosoted pavement, as follows: Owego Bridge Co., $64,500, $69,500; F. M. Stillman, $66,500, $70,300; Canton Bridge Co., $65,000, $70,300; Dean, Schwiers & Sutton Co., $74,950, $78,000; F. R. Long Co., $66,912, $71,400; West Virginia Bridge & Construction Co., $73,500, $75,000; New Jersey Bridge Co., $69,300.

Pollasky, Cal.—Bids will be asked about July 17 by the Board of Supervisors of Fresno County for putting up a Pratt truss steel bridge 785 ft. long over the San Joaquin river for the joint account of Fresno and Madera Counties, at a cost of about $30,000. Scott McKay, of Fresno, is County Surveyor.

Tyson's Mill, Pa.—Bids will soon be asked by the County Commissioners for building a steel bridge on stone abutments at this place.

Virginia City, Mont.—Bids are wanted September 8, by the Board of County Commissioners of Madison County for building two steel bridges over the Big Hold river at the Pennington bridge site seven miles from Twin Bridges.

West Newton, Pa.—The County Commissioners have given

a contract to the Penn Bridge Co., of Beaver Falls, Pa., at $67,885, for building the steel bridge over the Youghiogheny river at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA ROADS.—A railroad is projected to be built from Dothan, Ala., south to St. Andrews Bay, Fla., on the gulf coast, a distance of about 100 miles. The project is said to be backed by the Enterprise Lumber Co., of Atlanta, Ga., of which H. M. Steele is President.

ALBANY & NORTHERN.—This company, which operates a road from Cordele, Ga., southwest to Albany, a distance of 35 miles, has decided to extend its road from the latter place in a southwesterly direction through Dougherty, Baker and Decatur counties in Georgia, passing through Colquitt, in Miller County, and thence through Marianna, in Jackson County, Fla., west to Pensacola, a total distance of about 225 miles.

BARBERTON, WADSWORTH & WESTERN.—A meeting of the directors of this road is to be held to complete arrangements for at once building the road from Barberton, in Summit County, Ohio, west to the Medina County line, a distance of five miles.

CANADIAN NORTHERN.—Work has been commenced on the cut-off from Vassar west to Ridgeville, Man., about 70 miles, to make a direct line between the wheat district and the lake ports. By this line the distance will be shortened about 25 miles.

CANADIAN PACIFIC.—Announcement has been made that this company, which recently bought the Esquimalt & Nanaimo, will at once make surveys for extending the line to the north end of Vancouver Island.

Surveys have been completed and bids will soon be asked by this company for the construction of the new line east and west of Saskatoon, N. W. T. The eastern extension of this line will connect with the Pheasant Hills branch, which at present is almost ready for operation as far as Strassburgh, about 90 miles from Saskatoon. Work is progressing slowly on the second sections of the new lines east from Wetaskiwin and Lacombe, N. W. T. The first section on these branches, which are each 25 miles long, will be ready for operation this fall, but the second sections will not be ready until next spring.

This company will at once commence the construction of a branch line north of Winnipeg to shorten the route from the wheat fields to the lake ports. The new line will cross the Red River at St. Andrews, 15 miles north of Winnipeg, where a double track steel bridge will be built. It is expected that this line will be built this summer so as to be ready to carry the fall crops and obviate congestion at Winnipeg.

COLORADO, WYOMING & IDAHO.—This company, which is capitalized at $10,000, and which some time ago obtained a charter in Wyoming, has recently been granted a charter in Idaho. The road is projected to run from Denver, Colo., northwest to Laramie, Wyo., and thence west to St. Anthony and Boise, Idaho, a distance of about 750 miles. W. R. West, of Laramie, Wyo.; J. Underwood, of Chicago, Ill.; F. H. Stuart, of Boston, Mass.; J. S. Christian, of Danville, Ill., and others are interested. (See Construction Record.)

DENVER & RIO GRANDE.—Track laying has been begun on the first 18 miles of the Durango-Farmington extension of this road.

DENVER, ENID & GULF.—This road has been extended from Coldwater, Okla. T., west to Nashville, eight miles. The proposed route extends to Hays, Kan., 170 miles.

FAYETTE & FAYETTEVILLE.—Under this name a company has been incorporated in West Virginia to build a railroad from Fayette southwest, crossing the New river, to Fayetteville, a distance of about five miles.

FOX RIVER VALLEY.—The City Council of Manitowoc, Wis., has passed an ordinance granting a 35-year franchise to this company, which will build a bridge to cost about $50,000 at this place on its proposed interurban road from Sheboygan north to Manitowoc and thence northwest to Kaukauna, a distance of about 60 miles.

GEORGIA, FLORIDA & ALABAMA.—Work has been begun by this company on an extension from Havana, Fla., southwest to Quincy, on the Seaboard Air Line, a distance of about 12 miles.

ILLINOIS CENTRAL.—Contracts have been let by this company for double track work between Atoka and Millington, Tenn., about 13 miles. The old roadbed will be abandoned almost the entire distance between these two points and the station at Tipton, Tenn., will be moved west one mile. When the contract is completed the Illinois Central will have a double track between Chicago and Memphis with the exception of 12 miles between Woodstock and Memphis. This is to be concluded by building a belt line west of the city from Woodstock, running to Nonconnah yards, south of Memphis.

JAMES BAY.—D. D. Mann is quoted as saying that work will be commenced almost immediately on a branch from Toronto northeast to Ottawa, about 175 miles.

LORAIN & ASHLAND.—Under this name a charter has been granted to associates of Joseph Ramsey, Jr., in Ohio, to build a line to connect together the lines of the Little Kanawha syndicate to reach coal in West Virginia in case the Vanderbilt interests do not take over the holdings of the syndicate.

MENA & SOUTHEASTERN.—A charter has been granted this company in Arkansas with a capital of $400,000 to build a railroad from Mena, in Polk County, on the Kansas City Southern, east to Black Springs, in Montgomery County, a distance of about 40 miles. Survey has been completed and construction work will begin at once. C. C. Goodman, C. A. Smith, J. H. Hamilton and others, of Mena, Ark., and J. H. Foster and V. R. Andrews, of Kansas City, are interested. This is probably a project of the Kansas City Southern.

MEXICAN CENTRAL.—An officer writes that about six miles of grading on the extension from Tuxpan to Colima have been completed; also one tunnel. No track has as yet been laid. The work is heavy, with a maximum grade of 2 per cent. and 9-deg. curves. There will be 11 bridges and 12 tunnels. Hampson & Smith are the contractors.

MUSKOGEE & TEXAS.—A charter has been granted this company in Oklahoma, with a capital of $4,000,000, to build a railroad from Cushing, Okla. T., east through Payne County and the Creek nation to Muskogee, thence south through the Choctaw nation to Honey Grove, in Fannin County, Texas, a distance of 250 miles. The incorporators are: Horace Speed and Thomas J. Low, of Guthrie; W. Eaton, H. G. Baker and N. R. Maskell, of Muskogee.

NORFOLK & WESTERN.—The Tug Fork branch of the Pocahontas division has been extended from Garey, in McDowell County, W. Va., a distance of eight miles.

OCONEE COUNTY.—Application has been made by a company under this name in South Carolina with a capital of $200,000 to build a railroad from Westminster, S. C., on the Southern, south to Fair Play, a distance of 12 miles. The incorporators include: W. P. Anderson and William Bibb, of Westminster; A. W. Shelor, of Walhalla; J. J. Halley and L. A. Edwards, of Oakway; J. R. Heller, of Fair Play; J. W. Shirley, of Townville, and others.

PEORIA, PEKIN & SOUTHEASTERN.—Incorporation has been asked by a company under this name in Illinois, with a capital of $100,000 to build a railroad from Pekin south through Tazewell, Mason, Menard, Sangamon, Christian and Montgomery counties to Ramsey, in Fayette County, about 130 miles, where connection will be made with the Toledo, St. Louis & Western. Connection will be made at the northern end with the Chicago & North-Western, giving the latter road a connection to the south. It is proposed to enter Peoria over the Terminal Company's tracks from Pekin. The principal office will be in Peoria. The incorporators and first board of directors include: Guy Talbott, Robert P. Jack, W. T. Irwin and E. A. Borrill, of Peoria; P. L. Saltonstall, of Boston, Mass., and W. H. Trumbull, of Salem, Mass.

PINEY RIVER & PAINT CREEK.—Announcement has been made that a new railroad will be built by the MacDonald Colliery Co. from Beckley, in Raleigh County, W. Va., north to a point near the mouth of Mossy creek, in Fayette County, connecting with the Deepwater Railroad.

SAGINAW & SOUTHWESTERN.—Incorporation has been granted a company under this name in Michigan, with a capital of $50,000, to build a railroad from Saginaw southwest via St. Charles, Chesaning and Elsie to St. John's, about 50 miles, where connection will be made with the Lansing & Suburban. The directors include: A. S. Courtright, of Lansing; W. G. Emerick, W. S. Linton, E. P. Waldron and C. E. Linton, of Saginaw. The offices of the company will be at Saginaw.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—Announcement has been made that the new White River division of this road, from Newport, Ark., northwest to Carthage, Mo., about 200 miles, has been practically completed and that trains are being run. Through traffic will be established within 60 days. A further shortening of this line will be made when the branch from Newport southeast to Wynne, about 38 miles, is completed. This work will be commenced at once.

ST. MAURICE VALLEY.—A bill has been passed by the railway committee of the Canadian Parliament authorizing the building of a railroad from Three Rivers, Que., to a point on the line of the proposed eastern division of the Grand Trunk Pacific.

SANGAMON VALLEY.—Incorporated in Illinois to build a railroad from Decatur west to Quincy about 150 miles; also branches from the proposed route at Springfield and Petersburg. G. M. Skelly, J. E. Melick, J. S. Sutton, C. F. Morrow, of Springfield, and others are interested.

San Pedro, Los Angeles & Salt Lake.—Preliminary arrangements have been completed between this company and the Nevada-Utah Mining Co. for the construction of a branch line by the former from Caliente, Nev., north to Pioche, a distance of 30 miles, opening up a mining district which once was a famous Nevada bonanza camp. The entire distance between Pioche and Caliente was graded for a proposed narrow-gage road some years ago so that now little needs to be done but lay the track.

Shamokin & Edgewood (Electric).—Plans have been completed by New York, Philadelphia and local capitalists, including M. H. Kulp, to rebuild the electric road from this place northwest to Sunbury, a distance of about 12 miles, at an estimated cost of $1,500,000.

Somerset Railway.—An officer writes that this company has about four miles of grading completed on its proposed road from Deadwater, Somerset County, Me., through Mayfield and the townships of West Moxie and Squaretown to Indian Pond, where a crossing is made over the Kennebeck river, thence north to a junction with the Canadian Pacific at some point in Asqueth, and thence north about six miles to Birchpoint, in Tomhegan, a total distance of 41 miles. The general contract has been given to J. G. White & Co., of New York City, and other contracts have been let for track laying and bridge work. Track laying will be commenced this fall and, it is expected, will be finished early next spring. The work is light, the maximum grade being 1 per cent. There will be four steel bridges.

Stone Canyon.—Incorporation has been granted this company in California, with a capital of $300,000, to build a railroad from San Miguel on the Southern Pacific, north through San Luis Obispo and Monterey counties to Nelson Creek, a distance of 21 miles. The directors include: J. A. Chanslor, W. A. Sloan, W. G. Stafford, I. W. Hellman and E. W. Mason.

Tennessee Central.—This company has changed the plans for its northern extension and will probably build a line from Clarksville, Tenn., up the Cumberland River to the Ohio River, as well as extend the Hopkinsville line to Paducah.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Sante Fe.—Pfaelzer & Company, of New York, are offering at par $1,000,000 Eastern Oklahoma division first mortgage gold 4 per cent. bonds of 1928. These are part of an authorized issue of $10,000,000, of which $6,128,000 are outstanding.

Buffalo Railway (Electric).—Kean, Van Cortlandt & Co., of New York, are offering at 114 $1,000,000 first mortgage 5 per cent. gold bonds of 1931 of this company, part of an authorized issue of $5,000,000; all of which is outstanding, except $293,500 reserved to retire a prior lien maturing in 1912.

Cincinnati, Hamilton & Dayton.—Mason, Lewis & Co. have recently offered at 95 a block of $1,250,000 4 per cent. refunding 50-year bonds of 1954. These are part of an authorized issue of $25,000,000. Of this issue $15,023,000 are reserved for refunding the same amount of prior lien bonds, $2,595,000 of which mature this year and $2,728,000 in 1911. Subject to the underlying liens the refunding bonds are a direct mortgage on about 1,000 miles of railroad and on $11,000,000 common stock of the Pere Marquette. The refunding bonds themselves underlie the issue of $50,000,000 4 per cent. 50-year general mortgage bonds authorized in January.

Detroit, Toledo & Ironton.—Rudolf Kleybolte & Co., of New York, Chicago and Cincinnati, are offering at 99 a block of $5,500,000 of the 5 per cent. three and a half year collateral notes maturing Dec. 1, 1908, redeemable at 102½. The total authorized issue is $7,000,000. The $5,500,000 were issued as described in the *Railroad Gazette* of June 30 to pay for stock of the Ann Arbor Railroad. In connection with this purchase, the general traffic manager of the Detroit, Toledo & Ironton says:

"The acquisition of a controlling interest in the stock of the Ann Arbor gives the Detroit, Toledo & Ironton a continuous line from Ironton, Ohio, and (by car ferry) from Ashland, Ky., on the Ohio river, to Frankfort, Michigan, on Lake Michigan, and thence by car ferries to Manistique and other ports, a total mileage of 726 miles. From the Jackson and Wellston district in Ohio and from the West Virginia coal fields a large business is available which has not heretofore been handled on account of want of equipment. The new equipment recently bought will enable the roads to handle this additional business. The car ferries make possible close traffic connections with the Wisconsin Central, Chicago, Milwaukee & St. Paul, and Chicago & North-Western."

Great Northern.—For the year ended June 30 the approximate gross earnings of the St. Paul, Minneapolis & Manitoba (including the Eastern Railway of Minnesota) and the Montana Central, were $43,994,035. This is an increase of $3,031,837 over the year ended June 30, 1904. These figures cover 5,088 miles of the 5,888 miles of the Great Northern system.

Hocking Valley.—It is announced that by an arrangement with J. P. Morgan & Company, the first mortgage 7 per cent. sinking fund bonds of the Columbus & Toledo, maturing August 1, will be extended until August 1, 1955, with interest at the rate of 4 per cent. J. P. Morgan & Co. will buy at par and interest, less discount at the rate of 3 per cent. per annum, any of the Columbus & Toledo bonds which the holders may prefer to sell rather than to extend.

Millen & Southwestern.—F. J. Lisman & Co., of New York, are offering at 100 a block of $100,000 of the first mortgage 5 per cent. bonds of 1955 of this company. These are part of an authorized issue of $800,000. The road is 53 miles long and runs from Millen, Ga., to Vidalia.

New Orleans Terminal.—Harvey Fisk & Sons, of New York, are offering at 95 a block of $1,000,000 first mortgage 4 per cent. 50-year gold bonds of 1953. These are part of an authorized issue of $15,000,000, of which $7,000,000 have already been issued. The bonds are guaranteed jointly and severally by the Southern and the St. Louis & San Francisco. The President of the company states that five squares of land in New Orleans have been acquired at a cost of about $1,500,000. This gives a frontage on the main street of New Orleans of 248 ft. On this property plans are now being made for building a passenger station and construction is expected to be begun this fall. In addition to the four freight houses originally built, three new freight houses are now being built.

New York Central & Hudson River.—The New York Central & Hudson River and the Lake Shore & Michigan Southern are reported to have bought about 800 acres of land between Gardenville, N. Y., and Depew, near Buffalo, which is to be used for freight terminals. This acquisition will permit the construction of a short cut-off between the two roads outside of the city of Buffalo.

Placerville & Lake Tahoe.—This company has made a mortgage to the California Title & Trust Company, of San Francisco, as trustee, to secure $1,000,000 bonds.

St. Louis, Iron Mountain & Southern.—The stockholders of the Iron Moutnain Car Trust Association have authorized an increase in the capital stock from $6,000,000 to $10,000,000. Of the new capital it is proposed to issue about $2,000,000 to pay for new freight cars and other equipment recently ordered. The remaining $2,000,000 is to be reserved for future requirements. The Association was organized in 1880 to buy equipment for the St. Louis Iron Mountain & Southern, and the capital originally was $3,000,000. This was not long ago raised to $6,000,000. At present the Iron Mountain Car Trust certificates outstanding amount to $5,983,000.

St. Louis, Rocky Mountain & Pacific Company.—This is a new company which has been organized to build a railroad 120 miles long from Des Moines, N. M., on the Colorado & Southern, west to Raton, and thence southwest through Koehler on the Dawson Railroad, Cimmaron, and the Cimarron Canyon to the mining district near Elizabethtown, Colfax County. The company owns outright, or has mining rights on 503,700 acres of coal lands, or about 800 square miles. It is to issue first mortgage 50-year 5 per cent. gold bonds secured by (1) all the coal property, (2) $3,500,000 of the first mortgage bonds of the St. Louis, Rocky Mountain & Pacific Railroad Company and (3) $3,500,000 of the railroad company's stock. The authorized issue of the St. Louis, Rocky Mountain & Pacific Company's mortgage bonds is $15,000,000. Of this $3,000,000 is to be issued to acquire the coal properties; $500,000 to develop them, and $3,500,000 to build the railroad and put it in operation. Fisk & Robinson, of New York, are at the head of the syndicate which is financing the company.

Southern Pacific.—The stockholders will vote on August 28 on a plan to increase the capital stock of the Southern Pacific Railroad to $160,000,000. Of this amount $128,307,960 is to be issued to finally consolidate the Southern Pacific Railroad of California, the Southern Pacific Railroad of Arizona, and the Southern Pacific Railroad of New Mexico into the Southern Pacific Railroad.

Spokane International.—This projected road from Spokane, Wash., to a connection in British Columbia with the Canadian Pacific is capitalized at $4,000,000 common stock. There are also $4,000,000 first mortgage 50-year 5 per cent. gold bonds of 1955. Contracts are reported to have been let for building the 140 miles of road.

Western Maryland.—This company is now issuing regular reports of earnings. For the nine months ended March 31 gross earnings were $2,854,246 against $2,686,405 in 1904. Net earnings were $1,054,397 against $957,921 in 1904.

GENERAL NEWS SECTION

NOTES.

On June 29 the Twentieth Century Limited was run from Toledo to Elkhart, 133 miles, in 1 hr. 52½ min., equal to 70.93 miles an hour.

The schedules of the 18-hour New York-Chicago trains of the Pennsylvania have been slightly changed, but without altering the time through. The change was made principally to accommodate the dining car department.

It is announced that the merchants of Chicago who have been asking the Illinois State Railroad Commission to reduce freight rates have withdrawn their petition, the railroads having agreed to make reductions, from Chicago to the principal points in the state, averaging 32 per cent.

The officers of the Voluntary Relief Department of the Southwest System of the Pennsylvania Lines West of Pittsburg recently elected for the ensuing year are: Division 1, Charles D. Alexander; Division 2, John Haley; Division 3, Geo. M. McManigal; Division 4, Wm. J. Merrick; Division 5, Matthew J. Purcell; Division 6, Edward W. Alexander; Division 7, Theo. H. Haberkorn; Division 8, Wm. T. Brown.

In the Georgia Legislature a bill has been introduced by Mr. Parker, of Appling County, to make it a misdemeanor for any railroad to carry passengers on the Sabbath for less than the regular fare; or, in other words, it is proposed to forbid cheap excursions on that day. A railroad officer, interviewed on the subject, says that such a law would not cause great sorrow on the part of the railroads, for they have become somewhat tired of Sunday excursions, believing that they do not increase the total income from passenger traffic.

The General Superintendent of Transportation of the Baltimore & Ohio has prepared an elaborate map of the lines of the company, and of connecting lines, to enable superintendents to quickly decide what route should be selected for detouring trains when a main line is obstructed. With the map are recorded all necessary data concerning the limitations of the roundabout lines, as regards the weights that the track and bridges will sustain, and the other conditions necessary to be taken into account in sending a train out of its ordinary path.

The Kentucky Railroad Commission holds that under the constitution of that state the express companies are common carriers as well as the railroad corporations, and that it is within the province of the commission to regulate the rates where charges are made that the rates are exorbitant. The case arose when the city of Shelbyville levied a license tax of $25 a year upon the Adams and Southern express companies, and they retaliated by adding one cent to the charge on each package in and out of town at certain times during the year.

Complaints have been filed with the Interstate Commerce Commission by the National Wholesale Lumber Dealers' Association against the roads east of the Mississippi river, charging that the railroads discriminate against lumber interests in that an allowance for racking on gondola or flat cars given to shippers of other commodities is denied to shippers of lumber. It is claimed by the Lumber Association that the same character of rack is used for the shipment of lumber that is used for the shipment of many other commodities and that lumber shippers should receive the same allowance.

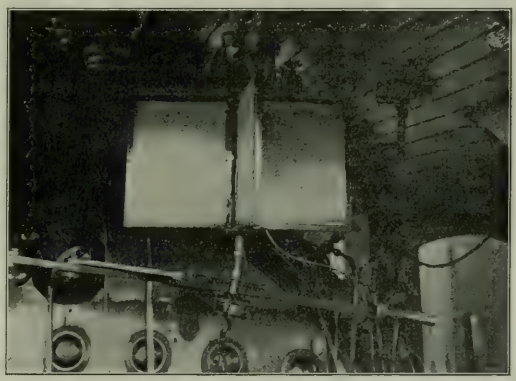
The special train which was run over the Pittsburg, Fort Wayne & Chicago from Chicago to Pittsburg on June 8 preparatory to the establishment of the 18-hour schedules, traversed the distance from Clarke Junction to Fort Wayne, 125 miles, in 101 minutes. This is equal to 74.25 miles an hour, or 4.25 miles an hour higher than the rate made by the Lake Shore special trains, of June 12 and 13, over the 133 miles between Elkhart and Toledo. The Pennsylvania run was made by Atlantic type engine 7,167, Class E2a. The weight of the train was 140 tons, or about 35 tons less than that of the Lake Shore train. The engines of the two roads are pretty nearly alike as regards power. Their principal dimensions were given in the *Railroad Gazette* of June 30, in connection with the record of the Lake Shore train.

On July 15 the eastbound 18-hour train on the Pennsylvania met with an accident near Port Royal, Pa., which narrowly escaped being a very serious one. According to press despatches the engineer of a westbound freight train near Port Royal made too violent an application of his air, with the result that a car buckled and was thrown over on the track on which the eastbound 18-hour train was running. An attempt was made to flag trains in front and in the rear of the wreck, but the break occurred almost simultaneously with the arrival of the fast train, which hit the wrecked car and threw it from the track without sustaining injury. The engineer of the fast train jumped from his engine and was hurt. No one else was injured, and the passengers, who were in their berths at the time, are said not to have known that there had been an accident until afterwards.

The Italian government announced only on June 15 the organization with which it was to begin the working of the railroads of the country July 1. The head of this organization is a General Manager (Bianchi), supported by an Executive Council of six other members, of whom one has been chief inspector of the treasury department, and another (Luiggi) is an eminent engineer, known best for a great naval harbor which he designed for Argentina in competition with English, French and German engineers, and which was built under his direction at Bahia Blanca. The direct operation of the lines will be managed from eight offices, one each in Turin, Milan, Genoa, Venice, Florence, Rome, Naples and Palermo. As there are just about 10,000 miles of railroad in the country, including some short lines not owned by the state, this gives about 1,200 miles, on the average, to each superintendency, each of which will have its own secretary, accounting office, chief of transportation and traffic, train movement and stores department, and department of road police and maintenance.

A Train Order Holder for Engine Cabs.

An order holder for the use of engineers and conductors has been patented by L. C. Gibbs, of Marceline, Mo., and the accompanying illustration shows its application in the cab of a locomotive on the Santa Fe. Train orders when received are usually crumpled up,



Train Order Holder Mounted in Cab.

and crowded into the pocket along with other orders, and when necessary to refer to them, sometimes half a dozen orders will be taken out and unfolded before the right one is found. The device consists of four steel frames which rest in grooves in the bottom plate. A folding glass slide slips in at the top of the frame and between the glass leaves is a sheet of cardboard. The slide is lifted from the frame, the order is inserted, and the slide is slipped back. The order is held securely, and in plain view of the trainmen. The grooves keep the frames from swinging, but by lifting them a quarter of an inch they can be swung around in any direction, or folded up entirely. The order holder may be attached to any engine without changing the cab.

Language of the International Railway Congress.

Following the entrance of the German Government into the International Railway Congress, a statement has been made to settle misapprehension on that point, that the official language of the Congress will remain French, as heretofore. But German will hereafter be placed in the same status as English, and it is expected that the proceedings of the last session and future bulletins as well will in future be printed in this additional language.

"Record Discipline" on the L. & N.

Discipline without suspension has now been in force on the Louisville & Nashville since 1895. The officers of the company express marked satisfaction with the Brown plan, and this notwithstanding the fact that on the southern lines of the company there are a large number of colored employees. Each year a statement is made up showing the number of reprimands and demerits, etc., and the amount of wages saved to the employees by not suspending

them. For the last fiscal year this statement shows: Number of employees subject to the system, 7,243; number of suspensions (book suspensions, not actual suspensions), 3,162; wages saved to employees, $126,127; number of reprimands, 244; discharges on account of accumulated bad record, 5; discharges for other causes, 709; suspensions cancelled, 773; credit marks given, 19.

The Wellman-Seaver-Morgan Air Compressor.

The accompanying illustration, Fig. 1, shows the cylinder and valve arrangement for air compressors, adopted by the Wellman-Seaver-Morgan Company, Cleveland. This design is especially adapted to high-speed work and embodies a principle developed several years ago in South Africa by Mr. F. E. Norton, of the above mentioned company. The particular compressor shown herewith has a capacity of 4,000 cu. ft. of free air per minute compressed to 75 lbs. gage pressure. There are two air cylinders, the intake cylinder being 40 in. x 60 in., and the high-pressure cylinder being 25½ in. x 60 in. The air cylinders are water jacketed.

The general purpose of this design is to completely separate the positive closing of the discharge from its automatic opening. This

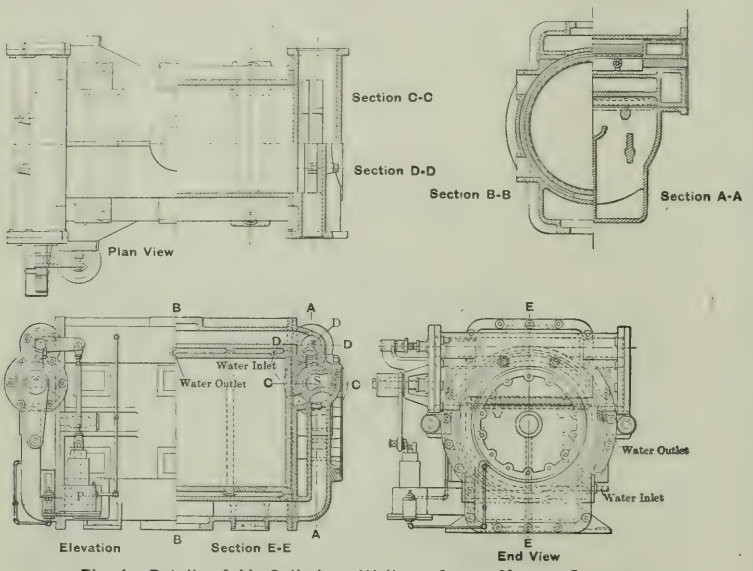


Fig. 1—Details of Air Cylinder—Wellman-Seaver-Morgan Compressor.

is accomplished by dividing the discharge valve into two parts, one of which is positive and a part of the mechanical inlet valve (S). The discharge valve (D) is automatic, being controlled by a differential piston (P) operated by air pressure. The inlet (S) also positively controls the opening to the discharge valve (D), the opening being timed to take place near the beginning of the compression stroke.

The theoretical card, Fig. 2, shows the events of the stroke. At (a) the valve (S) begins to open the inlet passage to the cylinder, air being drawn into the cylinder up to the end of the stroke at (b), at which latter point the inlet is closed by the return of the valve. As the piston moves toward the right, the valve (S) con-

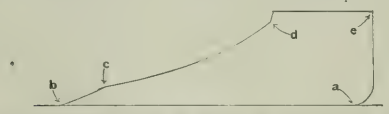


Fig. 2—Air Cylinder Card—Wellman-Seaver-Morgan Compressor.

tinues to rotate towards the left. At the point marked (c) on the diagram, the cylinder is brought in connection with the passage leading to the discharge valve (D). The discharge valve does not open until a point (d) is reached, the opening pressure being made a little less than the discharge pressure by the proportions of the differential piston (P), which controls valve (D). This arrangement overcomes any tendency of the air pressure in the cylinder to exceed the discharge pressure. The outlet valve (D) remains open during the entire discharge period and only commences to close on the return stroke of the main piston. In other words, the valve (D) closes during the period represented by the line (e a b) on the diagram. The time required for the opening and closing of the discharge valve is thus extended from about one-quarter of a stroke, with the usual poppet valve, to about 1¼ strokes with the improved valve. This feature permits high speed. There are no springs, hooks or complicated devices, and all parts, with the exception of the valves, are outside the cylinder. In case of water accumulating in the cylinders or operating pot, the valve (D) lifts from its seat so as to relieve the excessive pressure.

The inlet area of the compressor is proportioned so that the loss of pressure in the cylinder at the end of the inlet stroke is less than two ounces per square inch. This design also reduces the clearance to less than 1 per cent., and the weight of air discharged per stroke is over 92 per cent. of the weight corresponding to the piston displacement. The inlet valve (S) is driven by a heavy eccentric.

A New Automatic Signal.

One of the common occurrences in the office of a technical journal is the visit of the inventor who calls on the editor to show some device that he has re-invented, some device that the caller has laboriously and innocently worked out when he could have found the whole thing in the files of the patent office records of 10, 20 or 40 years past. The latest re-inventor, an Ohio genius, did not call on the *Railroad Gazette;* but he has achieved publicity without the trouble of a journey to New York. Like inventors in other lines, he got his principle all right but made a mistake in a detail—the thickness of his rope. The story, as told in the *New York Tribune*, the soberest paper in New York, is as follows:

Cincinnati, July 14.—The inventive genius of a night operator on the Cincinnati, Hamilton & Dayton this morning aroused and frightened the residents of Hartwell, almost wrecked his station, offended an engineer and resulted in a 10-day vacation for the operator. For three hours after midnight there are no trains and the operators along the line try to get in a little sleep. The great anxiety is to wake up in time to give the morning flyer the "block." Failure to do this would mean suspension. The Hartwell operator strung a rope between two telegraph poles, many yards below the station, extending them over spools to his desk. On these he hung a coal bucket loaded with rocks. He figured that the train would cut the rope and the rocks fall with a din.

This morning the rope used was too heavy to be cut. The bucket of rocks was jerked out of the operator's window, taking sash and all. It then swung into a residence, crashing the glass in a door, and took up its clattering way down the ties. Half the town was awakened in a fright. The engineer pulled up after eight miles of the din, and finding a can tied to his pet, "210," made a loud and long complaint. . . .

The 28-Hour Cattle-Carrying Law.

"Don't tell me," said a Missouri Pacific brakeman, "about those fast Pennsylvania passenger runs. We were making a stock run into Omaha and we had to stop and back up to let the cattle catch their breath."—*Kansas City Star.*

That fabulous speed is a result, no doubt, of the excited efforts now being made to stave off conviction under those 1,200 suits which the Government has brought to punish the railroads for keeping cattle in the cars beyond the lawful number of hours.

Law-Breaking.

When our railroads are accused of violating the Interstate Commerce or anti-trust laws they profess the strongest desire to obey all reasonable regulations. Either they have obeyed the law so far as they knew how, and violations have been accidental, or the law has been one impossible to obey and do business, so they have been forced to reluctant lawbreaking for sheer self-preservation. Yet the chances are that these same persons will be found violating other laws with equal readiness, but without any such excuse. Just now the Department of Agriculture has entered upon a campaign to make the great railroads treat cattle humanely. The law is specific, perfectly easy to live up to and has been on the statute book since 1873. There can be no reason for disobeying it, at least habitually, except the saving of a little time, trouble and expense. The railroads might be expected uniformly to arrange their schedules for cattle trains so as to comply with the law and equip feeding yards within 28 hours of one another. So far have they been from doing this, however, that the Department of Agriculture has prepared papers in twelve hundred suits against the cattle carrying roads of the West for failure to observe the 28 hour law.

Now, the railroad managers responsible for this long career of law-breaking and cruelty doubtless consider themselves good citizens.

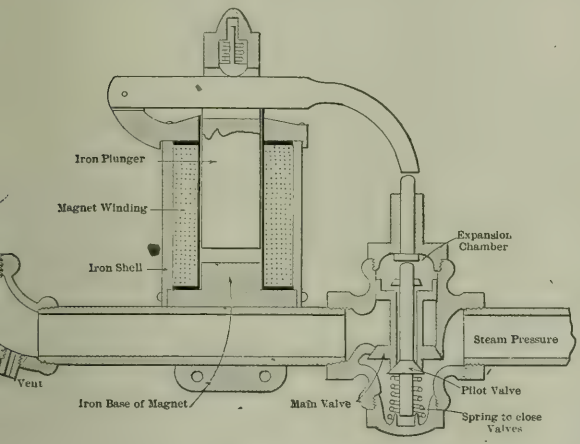
Probably some of them are members of societies for the prevention of cruelty to animals. But so little has their sense of personal responsibility for corporate acts guided them that they have, through their agents, inflicted suffering which they would recoil from inflicting with their own hands. . . . —*New York Tribune.*

Traffic Held Up by the Jaguar.

A press clipping from Colorado Springs, Colo., dated July 17, says that four passenger trains on the Colorado Midland Railroad were held at Tunnel No. 6, two miles west of Manitou, by a South American jaguar, which took possession of the line. The jaguar was traveling on a circus train. The roof of the tunnel knocked the top off his cage and he disembarked, and held the pass for some time.

Electrically Operated Whistle.

An electrically-operated whistle is shown in the accompanying cross-sectional engraving. It is intended chiefly for large shops or other plants where it is desirable to have a signal or an alarm whistle operative from remote points. The device is simple, its action being apparent from the drawing. The plunger of the solenoid actuates the lever, which opens the small pilot valve, admitting pressure to the expansion chamber above. This equalizes the pressure on the under side of the main valve, and further motion of the lever opens the main valve, permitting the fluid to pass. Spring pressure reseats the pilot valve and raises the solenoid plunger when the current is cut off. The solenoid may be wound for any voltage of either direct or alternating current, a "rectifier" being needed in the latter case. The valve may be used also on water, air or steam lines for other purposes than whistles, and is made for any pressure up to 200 lbs. It is made in two sizes, the smaller



Electrically Operated Whistle Valve.

operating whistles up to 3 in. diameter and the larger up to 6 in. diameter.

The Pennsylvania Railroad is using these whistles for fire alarm purposes. The Detroit Iron & Steel Company uses one to enable the power station engineman to signal the plant electrician whenever the switchboard indicates trouble. The Lodge & Shipley Machine Tool Co., Cincinnati, uses one for a signal and also in connection with the private telephone exchange in the plant. The whistle is made and sold by the Churcher Electric & Mfg. Co., Cincinnati, Ohio.

Relation Between Freight Rates and Tariffs.

One of the leaders of the German Liberal party, in the national legislature, spoke at the International Economic Conference recently held at Berlin on the subject of freight rates and their influence on tariff and trade policy. He held that freight rates should not conflict with nor impede the commercial policy of the home country. For instance, high rates on imported goods and low rates on exported products favor the formation of trusts, as is shown by the workings of the German coal trust. By such an arrangement raw materials or partly finished products are sold to foreign competitors at a much lower rate than to home consumers, to the serious injury of domestic manufacturers. The speaker also held that commercial treaties should guarantee the "most favored" treatment in regard to freight rates on goods of either of the contracting countries, so that the shipper in one country should have to pay no higher freight rates on his consignments carried in a foreign country than the native shipper of the foreign country pays, and that international through freight rates should be fixed from stations in one country to points in the other. The United States Consul General at Frankfort, Germany, declares that the proposition of most favored freight rates is an extremely important one and should be embodied in every future commercial treaty made by the United States with foreign powers. If this is done United States exports will not be discriminated against by differential freight charges when carried on the railroads, rivers, or canals of foreign countries.

Accidents in the First Quarter of 1905.

The Interstate Commerce Commission has issued accident bulletin No. 15, giving an account of railroad accidents in the United States during the months of January, February and March, 1905. This shows that during that quarter there were 28 passengers and 204 employees killed and 1,651 passengers and 2,062 employees injured in train accidents, making in all 232 persons killed and 3,713 injured. Other accidents to passengers and employees, not the result of collisions or derailments, bring the total number of casualties up to 15,306 (909 killed and 14,397 injured). There is a decrease of 42 in the total number of persons killed as compared with the quarter ending Dec. 31, 1904. The total number of collisions and derailments was 3,108 (1,787 collisions and 1,321 derailments), of which 284 collisions and 177 derailments affected passenger trains. The damage to cars, engines, and roadway by these accidents amounted to $2,449,248. There is an increase of 27 in the number of collisions and of 131 in the number of derailments as compared with the last preceding quarter. The total number of employees reported killed in coupling and uncoupling cars during this quarter was 62, being a decrease of nine as compared with those reported killed in the last preceding bulletin. The table showing the details of accidents to employees in coupling and uncoupling cars has been changed and amplified so as to show more clearly the circumstances under which the injuries occurred.

Freight and Express on Chicago Elevated.

The Chicago City Council has granted the Metropolitan West Side Elevated the right for ten years to carry freight and express.

New Turbine Steamer.

The Fore River Ship Building Company is to build a 6,000-ton turbine freight and passenger steamship for the New York and New Orleans service of the Morgan line (Southern Pacific).

Potatoes in Aroostook County.

The Bangor & Aroostook Railroad has completed its shipment of potatoes from the 1904 crop in Aroostook County, with a total of 6,693,612 bushels as against a total of 5,341,735 bushels last year from the 1903 crop, which was the largest on record.

Manufacturing and Business.

Charles H. Burgess, son of the late L. C. Burgess, of the Chicago Railway Equipment Co., has been appointed Sales Agent of the Holland Co., 77 Jackson boulevard, Chicago.

The Los Angeles (Cal.) office of the Westinghouse Electric & Mfg. Company, which has heretofore been in the Trust Building, has been removed to No. 527 South Main street.

The San Pedro, Los Angeles & Salt Lake Railroad, the new line from Salt Lake City to Los Angeles, has just opened an office in the Railway Exchange at 290 Broadway, New York City. This will be in charge of M. de Brabant, General Agent, and will be the eastern headquarters for freight and passenger business.

The N. L. Hayden Mfg. Co., Columbus, Ohio, has been given an order by the Baltimore & Ohio for 488 Hayden 4-in. all-brass pop safety valves for the 244 locomotives being built for that road by the American Locomotive Co. This is said to be the largest order of this sort ever given in this or any other country.

Mr. J. J. Casey has resigned as Superintendent of the works of the Haskell & Barker Car Company, Michigan City, Ind., which position he had held for over nine years. Mr. Casey was in the railroad and car building business for over 40 years, during which time he is said to have been out of employment only two weeks.

A. H. Whiteside, manager of the Allis-Chalmers Company's district office at Atlanta, Ga., has been transferred to the Philadelphia district office, where he succeeds as manager, W. A. Wood, resigned. M. W. Thomas has been appointed manager of the Chalmers Company's district office at Atlanta, Ga., and W. J. Buckley has been appointed manager of the company's district office at St. Louis. H. P. Hill, whom he succeeds, goes to the Salt Lake City district office, where he will devote himself to his specialty, the electrical features of the company's business.

During the six months ending June 30, 1905, the Westinghouse Machine Company, exclusive builders of the Westinghouse-Parsons type, have contracted for no less than 82,000 kilowatts in turbo-generating machinery, averaging nearly 1,175 k.w. capacity per turbine unit. These machines range in size from 200 k.w. to 7,500 k.w. The latter will be the largest turbines in the world, and three units of this size are under contract for Greater New York railway and lighting power stations. In the distribution of these machines among the various industries, the electric railway has claimed the largest number of machines, averaging 1,496 k.w. in capacity;

next in order, industrial plants, averaging 571 k.w. capacity, and light and power plants, averaging 1,529 k.w. capacity. In the order of total capacity, railway plants have required 38,900 k.w., lighting plants 26,300, industrial 12,000, miscellaneous 4,800.

In connection with the twenty-fourth annual convention of the American Street Railway Association, to be held at Philadelphia, Sept. 25 to 30, the American Street Railway Manufacturers' Association, through George Keegan, its Secretary, announces that the south pavilion of the Philadelphia Museums, together with another large building, have been secured as exhibition halls. These buildings together will furnish about 75,000 sq. ft. of floor space. There are also to be two railroad tracks of a total length of 1,000 ft. for outdoor exhibits. Space for exhibition purposes is restricted to members, who on payment of the annual membership fee of $35 will have the privilege of floor space at the exhibition.

The work of reinforcement of the Poughkeepsie bridge made necessary by the contemplated increase in the weight and amount of traffic by the New York, New Haven & Hartford Railroad, is soon to be started. The American Bridge Company, of New York, has been awarded the contract for the complete work on the metallic structure. Operations at the bridge site will be started in a short time and it is expected that the strengthening will be completed within 16 to 18 months. The entire work, which will involve an expenditure in the vicinity of $1,500,000, will be under the immediate supervision of Mace Moulton, Consulting Engineer, 150 Nassau street, New York, retained by the railroad company to investigate the strength and prepare plans for the reinforcement.

Iron and Steel.

The Colorado & Southern is negotiating with the Colorado Fuel & Iron Company for 6,000 tons of 80-lb. rails.

The Cleveland, Cincinnati, Chicago & St. Louis and the Lake Shore & Michigan Southern recently placed orders for rails aggregating about 23,000 tons, of which 15,000 tons will be furnished by the Carnegie Company, and 8,800 tons by the Lackawanna Steel Company.

The Kansas City Southern, it is reported, has placed an order for 12,000 tons of rails with the Republic Steel & Iron Company, which recently started its mills at Youngstown, Ohio. The daily output is 1,000 tons. The latter company is reported to have booked orders for about 25,000 tons.

Announcement is made by the Pittsburg Steel Foundry that it has organized a company to make steel castings, to be called the Pittsburg Equipment Company. Stewart Johnston, President of the Pittsburg Steel Foundry, will be the President of the company, and O. S. Pulliam, General Manager.

PERSONAL.

—Mr. Rolla Jabish Parker, who was recently promoted from Superintendent of the Missouri Division to be General Superintendent of the Western Grand Division of the Atchison, Topeka & Santa Fe, was born Jan. 27, 1857, at Roscoe, Minnesota, and was educated at the Shattuck School at Faribault, Minnesota. His first railroad work was in 1872 as brakeman on the Chicago, Milwaukee & St. Paul. After two years as brakeman he went back to school for a year and in July, 1875, returned to his railroad position. In 1877 he was made conductor. He left the Chicago, Milwaukee & St. Paul, in 1881, to go to the Northern Pacific as conductor of construction train, and in 1884, he was conductor and foreman in charge of construction on the Fargo & Southern, now part of the Chicago, Milwaukee & St. Paul. His first service with the Santa Fe was in 1887, when he went to that road in a position similar to that held by him on the Northern Pacific. He was promoted in 1887 to be Division Roadmaster, and in 1893 to be General Roadmaster of the Eastern division. When the office of General Roadmaster was abolished his title was changed to Division Roadmaster. This he held until January, 1897, when he was appointed Superintendent of the Middle Division, with headquarters at Newton, Kansas. Three years later he was transferred as Superintendent to the Western division, and in January, 1901, was appointed Superintendent of the Colorado division of the Santa Fe, including a joint line with the Colorado & Southern, with headquarters at Pueblo, Colorado. In April, 1903, he was again transferred, this time to the Missouri division, with headquarters at Marceline, Missouri, from which post he was promoted directly to be General Superintendent of the Western Grand Division.

—Mr. H. Cleveland Beattie, President of the Blue Ridge Railway, died at his home in Greenville, S. C., on July 15, after an illness of several weeks.

—Mr. William W. Buffum, for 14 years Superintendent of the Lake Shore & Michigan Southern, died recently at his home in Buffalo at the age of 63.

ELECTIONS AND APPOINTMENTS.

Arkansas Midland.—J. D. Moore has been appointed Superintendent of this road and of the Brinkley, Helena & Indian Bay, with headquarters at Helena, Ark., succeeding J. B. Johnson, resigned.

Baltimore & Ohio.—P. H. Irwin, Assistant Chief Engineer, has been appointed Consulting Engineer, with headquarters at Baltimore, succeeding David Lee, deceased. John E. Greiner, Engineer of Bridges and Buildings, has been appointed Assistant Chief Engineer, with headquarters at Baltimore, succeeding Mr. Irwin.

Brinkley, Helena & Indian Bay.—See Arkansas Midland.

California Western Railway & Navigation.—Frank Trumbull, President of the Colorado & Southern, has been elected President of this road also.

Canadian Northern.—J. R. Cameron, Assistant Superintendent of the Kamsack division, has been appointed Superintendent of the new division west of Humbolt, Saskatchewan.

Canadian Pacific.—H. H. Abbott has been appointed General Freight Agent, with headquarters at Calgary, Alberta.

Central of Georgia.—G. H. Richter, Chief Clerk of the law department, has been elected Assistant Secretary.

Chicago & Alton.—C. G. Delo, Division Engineer of the Chicago Great Western at Des Moines, has been appointed Engineer of Maintenance of Way of the Western division, with headquarters at Kansas City, Mo.

Chicago, Burlington & Quincy.—D. O. Ives, General Freight Agent of the Lines West of the Missouri River, has resigned.

Cleveland, Cincinnati, Chicago & St. Louis.—Charles B. Clark, Assistant Engineer, has been appointed Chief Engineer of Maintenance of Way of this road and of the Peoria & Eastern.

Arthur S. More, Assistant Engineer of the Chicago division, has been appointed Engineer of Maintenance of Way of the Michigan division, with headquarters at Wabash, Ind.

A. L. Kuehn, Engineer of Maintenance of Way at Wabash, Ind., has been appointed Chief Assistant Engineer, in charge of Maintenance of Way, with headquarters at Indianapolis.

Coal & Coke.—See South & Western.

Colorado Springs & Cripple Creek District.—J. H. Waters, President of the Florence & Cripple Creek and of the Midland Terminal, has been elected General Manager of this road.

See Wabash.

Conway Coast & Western.—James H. Chadbourn has been elected President, and E. P. Schulken, Secretary and Treasurer.

Cripple Creek Central.—D. C. MacWatters, General Passenger Agent of the Colorado & Southern, and of the Colorado Springs & Cripple Creek District Railway, has been appointed General Passenger Agent of the Cripple Creek Central, succeeding J. B. Wiggenhorn, resigned. F. C. Smith, Superintendent of the Colorado Springs & Cripple Creek District, has also been appointed Superintendent of the Cripple Creek Central. W. A. Matlock, General Freight Agent of the Cripple Creek Central, has been appointed Traffic Manager of the Cripple Creek Central and of the Colorado Springs & Cripple Creek District Railway.

See Colorado Springs & Cripple Creek District.

Delaware, Lackawanna & Western.—R. P. Schilling, Master Mechanic at Utica, has resigned, these shops having been abandoned.

Denver & Rio Grande.—W. B. Hall has been appointed General Storekeeper, with office at Denver, Colo.

The jurisdiction of W. E. Miller, Assistant Superintendent of the First and Second divisions, has been extended over the Third and Fourth divisions.

El Paso-Northeastern System.—F. L. Carson, Master Mechanic of

the Gulf, Colorado & Santa Fe, at Cleburne, Tex., has been appointed Master Mechanic at Alamogordo, N. Mex.

Grand Trunk Pacific.—Dennis O'Brien, Master Mechanic of the Grand Trunk at Point St. Charles, has been appointed Assistant to the Vice-President and General Manager, with headquarters at Winnipeg.

Great Northern.—W. Willerton, Assistant Division Superintendent at Spokane, has been assigned to special work in the general office at St. Paul. George E. Johnson, Chief Clerk to the Assistant General Superintendent, has been temporarily appointed Assistant Division Superintendent at Spokane, Wash., succeeding Mr. Willerton.

Gulf & Inter-State.—Louis Featherstone, Superintendent, has been appointed Traffic Manager. Dee Featherstone has been appointed Superintendent.

Gulf, Colorado & Santa Fe.—C. A. Snyder, General Foreman at Galveston, Tex., has been appointed Master Mechanic, with headquarters at Cleburne, Tex., succeeding F. L. Carson, resigned. Raymond Bell has been appointed General Foreman, succeeding Mr. Snyder. See El Paso-Northeastern System.

Illinois Central.—J. F. Merry, Assistant General Passenger Agent, has been appointed General Immigration Agent of this road and of the Yazoo & Mississippi Valley, with headquarters at Manchester, Iowa.

Isthmian Canal Commission.—Arthur M. Burtt, Assistant Engineer and Chief Draftsman, has been appointed Supervising Architect, with headquarters at Ancon, Canal Zone.

Lake Erie & Western.—G. P. Smith, Engineer of Maintenance of Way of the Indiana, Illinois & Iowa, at Kankakee, Ill., has been appointed Assistant Chief Engineer, succeeding G. C. Cleveland. See Lake Shore & Michigan Southern.

Lake Shore & Michigan Southern.—E. A. Handy, Chief Engineer, has been appointed Assistant General Manager, with headquarters at Cleveland, Ohio. Samuel Rockwell, Assistant Chief Engineer, has been appointed Chief Engineer, succeeding Mr. Handy. G. C. Cleveland, Assistant Chief Engineer of the Lake Erie & Western, has been appointed Assistant Chief Engineer, succeeding Mr. Rockwell.

Missouri, Kansas & Texas.—John Madden has been appointed General Attorney, succeeding T. N. Sedgwick, deceased.

Missouri Pacific.—E. Fisher, Engineer of Bridges and Buildings of this road and of the St. Louis, Iron Mountain & Southern, has resigned.

National Transcontinental Railway Commission.—Collingwood Schreiber, Deputy Minister of Railways and Canals of Canada, has been appointed Consulting Engineer. M. J. Butler, Assistant Engineer, has been appointed Deputy Minister of Railways, succeeding Mr. Schreiber.

New Orleans Terminal.—C. H. Fisk has been appointed Terminal Engineer, succeeding F. G. Jonah. See St. Louis & San Francisco.

Oregon Railroad & Navigation.—J. P. O'Brien, General Manager, has also been elected Vice-President.
See Union Pacific.

Pennsylvania.—J. P. Heindell, Assistant Trainmaster at Olean, has been appointed Superintendent of Docks and Terminals at Buffalo.

St. Louis & San Francisco.—F. G. Jonah, Terminal Engineer of the New Orleans Terminal Company, has been appointed Assistant Engineer in charge of the deep water terminals at Chalmette, with headquarters at New Orleans, succeeding E. M. Lisle, resigned.

St. Louis Southwestern.—C. H. Seabrook, General Foreman of the Pine Bluff shops, has been appointed Master Mechanic, with headquarters at Pine Bluff, Ark.

South & Western.—George F. Syme, Resident Engineer of the Coal & Coke at Delta, W. Va., has been appointed Resident Engineer at Spruce Pine, N. C.

Union Pacific.—Winslow S. Pierce has resigned as director of this road and also of the Southern Pacific, the Oregon Short Line and the Oregon Railroad & Navigation Company.

Tidewater.—The general offices of this new road will be located in Norfolk, Va.

Yazoo & Mississippi Valley.—See Illinois Central.

Wabash.—D. O. Ives, General Freight Agent of the Lines West of the Missouri River of the Chicago, Burlington & Quincy, has been appointed Freight Traffic Manager, succeeding Milton Knight, deceased.

LOCOMOTIVE BUILDING.

The Indiana Harbor is reported to have ordered $2,500,000 worth of equipment.

The Pennsylvania Lines West, it is reported, will order 20 new locomotives, 10 consolidation type (2-8-0) and 10 six-wheel (0-6-0) switching locomotives.

The Illinois Central, as reported in our issue of July 14, has ordered five simple Pacific type (4-6-2) locomotives from the American Locomotive Co. These locomotives will weigh 221,000 lbs., with 140,500 lbs. on the drivers; cylinders, 22½ in. x 26 in.; diameter of drivers, 75 in.; radial stayed boiler, with a working steam pressure of 210 lbs.; heating surface, 3,379 sq. ft.; 304 tubes, 2 in. in diameter and 20 ft. long; wide firebox, 102⅞ in. x 72⅝ in.; grate area, 51 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 15 tons.

CAR BUILDING.

The Grand Trunk has ordered 1,000 box cars from the Canada Car Co.

The Indiana Harbor is reported to have ordered $2,500,000 worth of equipment.

The Delaware & Hudson expects to build a sample coal car, preliminary to building several hundred.

The Philadelphia & Reading is reported to have ordered 1,000 steel hopper cars of 100,000 lbs. capacity from the Standard Steel Car Co.

The New York, Ontario & Western has ordered two combination passenger and baggage cars from the American Car & Foundry Co., for September delivery.

The Panama Canal Commission has given the Middletown (Pa.) Car Works a trial order for 40-ton King-Lawson self-dumping cars. If the cars are satisfactory, 500 more will be ordered.

The Tidewater Railroad is reported to have ordered 250 self-clearing hopper cars of 80,000 lbs. capacity, with wooden frames and underframes, and 250 steel underframe cars of 100,000 lbs. capacity. Part of these are for the Deepwater Railroad.

The St. Louis & O'Fallon has ordered 300 steel gondola cars of 100,000 lbs. capacity from the American Car & Foundry Co. These cars will weigh about 40,000 lbs., and measure 41 ft. 9 in. long, 9 ft. 4⅞ in. wide and 4 ft. high, all inside measurements. The special equipment includes: Westinghouse airbrakes and Miner draft rigging.

The Missouri, Kansas & Texas, as reported in our issue of June 30, has ordered 1,750 box cars and 250 ventilated box cars, both of 60,000 lbs. capacity; 50 flat cars of 80,000 lbs. capacity; 155 Rodger convertible ballast cars of 80,000 lbs. capacity, and 50 cabooses from the American Car & Foundry Co., for September, October and November delivery. All box cars will measure 36 ft. long, 8 ft. 6 in. wide, and 8 ft. high, with wooden frames and underframes. The flat cars will measure 40 ft. long, 9 ft. 3 in. wide, and 4 ft. 1¾ in. high, and will have wooden frames and underframing. The ballast cars will measure 22 ft. long, 8 ft. 8 in. wide and 4 ft. high. The cabooses will measure 29 ft. 3⅜ in. long, 8 ft. 3⅜ in. wide, and 7 ft. 4 in. high, with wooden frames and underframes. Dimensions are all inside measurements. The special equipment for all cars will include: Diamond "S" brake shoes, steel axles, American dust guards, Miner tandem draft rigging, M., K. & T. standard paint, and American Car & Foundry Co.'s wheels. The ballast cars will have Damascus brake-beams, Logan couplers, and Common Sense trucks. The box cars, flat cars and cabooses will have National Hollow brake beams, Major 5 in. x 7 in. shank couplers, and American cast-steel trucks, excepting the cabooses, which will have M., K. & T. standard caboose trucks.

BRIDGE BUILDING.

ATLANTIC, MASS.—The New York, New Haven & Hartford is planning to build a four-track steel bridge to replace the present wooden structure over the Neponset river on its Plymouth division between this place and Neponset.

AVONDALE, LA.—According to reports, plans are being made for building a large bridge over the Mississippi river at this place, near New Orleans. This is reported to be a project of the Southern Pacific.

BEDFORD, N. S.—The Intercolonial has given contracts to F. A. Ronan & Co., of Halifax, for building the substructure, and to the Dominion Bridge Co., of Montreal, for the steel superstructure of a bridge 285 ft. long to carry double track to be built over the Sackville river.

CLEVELAND, OHIO.—Petition has been made to the county to bear

a share of the cost of building a new viaduct connecting Fleet street, Harvard street and Washington Park. The city will contribute about $40,000, property owners $7,000, and the county will be asked to pay an additional $25,000.

Dayton, Ohio.—Bids are wanted July 27, by T. J. Kauffman, County Auditor, for the substructure and the steel superstructure, consisting of two spans each 150 ft. long, with 16 ft. roadway, also approaches of a bridge to be built over Big Twin creek between Montgomery and Preble counties.

Denver, Colo.—Bids are wanted July 29 by T. W. Jaycox, State Engineer, for building a steel bridge 125 ft. long over Purgatory River at Sopris, in Las Animas County.

Elmira, N. Y.—The Lake Street Bridge Commission which recently opened bids for the new Lake street bridge has decided to give the contract to the American Bridge Co. at $46,877, the work to be completed by November 1st of this year, and is asking bids for the sale of the metal work of the present structure.

Fort Wayne, Ind.—The County Commissioners have appropriated $17,000 for building a bridge over the Maumee river in Allen County.

Hoult, W. Va.—The Baltimore & Ohio, it is said, is planning to build a bridge over the Monongahela river at this place.

Iowa Falls, Iowa.—The Des Moines, Iowa Falls & Northern, it is reported, will build a bridge over the Iowa river, to cost $40,000.

La Porte, Ind.—Bids are wanted July 24, by the Board of Commissioners for putting up a number of bridges in La Porte County. Charles H. Miller is Auditor.

Lorain, Ohio.—The Lake Shore Electric is surveying to locate the site for a new steel bridge over the Black river at South Lorain.

Lowell, Mich.—The Council has decided to accept the proposition of the Grand Rapids & Ionia Interurban to build three bridges over Flat river.

Minneapolis, Minn.—Plans are being made for building a bridge over the tracks at University avenue.

Montreal, Que.—Bids are being asked by David Seath, Secretary of the Harbor Commissioners of Montreal, for building a steel foot bridge on Victoria pier, to cost about $12,000.

Morris, Man.—The Canadian Northern Railroad bridge to be built over the river at this place will be 800 ft. long and cost about $250,000.

New Brunswick, N. J.—Bids are wanted July 26, by the Board of Chosen Freeholders for putting in three steel spans each 150 ft. long at the Amboy bridge over Raritan river in Middlesex county. A. Fountain is Director.

New York, N. Y.—Plans for an underground terminal at the Delancey street end of the Williamsburg bridge have been approved by the Board of Estimate, and the Bridge Department instructed to go ahead with the work. The plans call for a subway terminal into which the elevated and surface cars will run from the bridge, the extension of the present plaza 200 ft. along the block bounded by Suffolk, Norfolk, Broome and Delancey streets to make Delancey street from Clinton to Norfolk of uniform width. The plaza so formed to Norfolk street is to be closed as a street and declared a bridge approach.

Pittsburg, Pa.—The Select Council, at a recent meeting, passed an ordinance providing for the building of a bridge at Washington avenue and Sedgewick street crossing of the Pittsburg, Fort Wayne & Chicago.

The Pittsburg union bridge is to be reconstructed and raised to a height of 70 ft. over the Allegheny river. The bridge is now only 40 ft. over the water line. The change has been ordered by the Secretary of War.

Portland, Me.—The bids recently opened for building the bridge to replace the Vaughans bridge, were for three kinds of structures. The lowest bid for a structural steel bridge was that of the Mount Vernon Bridge Company, of Columbus, Ohio, $333,000; the lowest for a pile structure with a steel draw, was made by P. E. Lane, of Atlantic City, N. J., $135,000; other bids were, American Bridge Company, $370,000, $372,500, and $376,700; New England Structural Steel Company, of Boston, steel bridge, $450,000; Boston Bridge Works, steel bridge, $480,000; Augustus Smith, of New York, various bids ranging from $229,032, to $366,765; Holbrook, Cabot & Roberts, pile bridge with steel draw, $253,000; New Jersey Bridge Company, steel bridge, $339,555.

Poughkeepsie, N. Y.—The New York, New Haven & Hartford has given the contract for building the Poughkeepsie bridge to the American Bridge Co., mentioned in another column. The order covers 15,000 tons of fabricated steel.

St. Boniface, Man.—The City Council has decided to contribute $50,000 toward building a bridge over the Red river.

St. Johns, N. B.—The Canadian Pacific has secured a controlling interest in the St. John Bridge & Railway Extension Co. and will shortly begin the rebuilding of the cantilever bridge.

Stockton, Mo.—Bids are wanted August 11 by J. H. Butler, County Clerk, for building a steel bridge about 180 ft. long in Cedar County.

Other Structures.

Austin, Tex.—The Houston & Texas Central is building with its own forces a 10-stall brick roundhouse.

Birmingham, Ala.—The Birmingham Terminal Co. has recently been organized to build a union passenger station. G. B. McCormack is President.

Brooklyn, N. Y.—The Brooklyn Rapid Transit Co. has commenced the work of rebuilding the present Union Station at Fifth avenue and 36th street, and will make other improvements, including the construction of a four-track station, a new shop building, inspection pits and sheds and a storage yard, at a cost of about $250,000.

Champaign, Ill.—The Cleveland, Cincinnati, Chicago & St. Louis is putting up with its own forces a brick station with slate roof, one story high, 32 ft. x 103 ft., to cost $10,000, at this place, on its Peoria & Eastern division.

Chikasha, Ind. T.—The Chicago, Rock Island & Pacific, it is said, will make improvements at a cost of $65,000, the principal part of which will be used to put up a new station which will also hold the division offices.

Iowa Falls, Iowa.—The Des Moines, Iowa Falls & Northern will, it is said, put up a new passenger station.

Knoxville, Tenn.—Work has been commenced by the Louisville & Nashville on large repair shops near this city, to cost about $100,000.

Las Vegas, Nev.—The San Pedro, Los Angeles & Salt Lake is planning to put up a passenger station.

Long Island City, N. Y.—The Long Island Railroad is planning to build five stations, at Lawrence, at Locust Valley and Sayville, on which work is to be started at once, and at Cedarhurst and Hewletts, at a total cost of about $90,000.

Mansfield, Ohio.—The Pennsylvania will build a roundhouse at this place.

Nashville, Tenn.—The roundhouse of the Louisville & Nashville was totally destroyed by fire July 6. Seven locomotives were also destroyed, and five others badly damaged, causing a loss of $150,000.

Newark, N. J.—The Central of New Jersey is making plans for putting up a combined freight station and warehouse, to cost over $500,000.

New York, N. Y.—The New York Central & Hudson River has filed plans for putting up three new brick stations in the Bronx at an aggregate cost of $125,000.

San Francisco, Cal.—The Atchison, Topeka & Santa Fe is said to be making plans to put up freight sheds at China Basin, which will be among the largest in the country. The plan is to have the piers and wharves so connected that freight may be transferred to overland trains.

Santa Maria, Cal.—The Pacific Coast Railway is planning to put up a large passenger station.

Sioux City, Iowa.—The Chicago, St. Paul, Minneapolis & Omaha has given a contract to G. S. Lounsburry, of Duluth, at about $50,000 to put up a 25 stall roundhouse near this place.

Springfield, Ohio.—Negotiations are under way between the Pittsburg, Cincinnati, Chicago & St. Louis and the Cleveland, Cincinnati, Chicago & St. Louis, to jointly build a passenger station here to cost $350,000.

Winnipeg, Man.—Plans for the new Canadian Pacific train shed to be built here, have been approved and work will be commenced at once.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—Announcement has been made that this company will build an extension of its Lampasas branch from San Angelo, Tex., west to Rincon, N. Mex., about 390 miles, where connection will be made with its transcontinental line. The building of this cut-off will reduce the distance between San Francisco and Galveston by the Santa Fe several hundred miles.

Buchanan & Tazewell.—A charter has been granted this company in Virginia to build a railroad in that state. The headquarters

f the company will be at Whitewood, Buchanan County, Va. The ncorporators include John F. Hager, G. F. Hager and M. F. Fleming, ll of Ashland, Ky.

BUFFALO & SUSQUEHANNA.—This company is building a freight xtension from Sykesville, Jefferson County, Pa., southwest to the lumville coal fields, a distance of about 25 miles. The northern xtension of the company's line from Wellsville to Buffalo is ex- ected to be finished and ready for the running of trains by the rst of next year.

CALIFORNIA-WESTERN RAILROAD & NAVIGATION COMPANY.—This ompany has been incorporated in California with a capital of 1,000,000 to build a railroad in Mendocino County from Fort Bragg o Alpine and Willets, about 41 miles. The road is to connect with he Union Lumber Company's railway, and with its branches is o have a length of 65 miles. The directors include Duncan McNee, Miles W. McIntosh, Charles H. Weller, H. M. Cochran and Max Goldberg, all of San Francisco.

CANADIAN YUKON WESTERN.—A bill has been passed by the Com- ons Railway Committee authorizing this company to issue stock nd extending the time for building its proposed road from the Yukon to the Pacific coast.

CHICAGO, ROCK ISLAND & PACIFIC.—This company, it is said, is lanning to build a cut-off from Fairbury, Neb., south to Herington, Kan. The proposed route is from Fairbury to Clifton, using the resent main line south from Clifton to Broughton, and the further onstruction of the line from Broughton to some point near Enter- rise on the Salina branch, and using this branch running directly outh the remainder of the way to Herington. The work requires he building of about 60 miles of new road; this will give a ew route between the northern main line of the Rock Island pass- ng through Omaha, and the south line of the Rock Island running hrough Wichita.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company is lanning improvements on its Cairo division, between Danville and Harrisburg. The work includes reduction of grades, elimination of urves, elevation of low places, widening of the embankment, laying f new and heavier rails, increase of terminal and yard facilities at arious points, and all curvatures are to be reduced to two degrees nd grades to 26.2 ft. per mile. The line from Harrisburg to Dan- ille will be entirely rebuilt, the roadbed being widened to 20 ft. nstead of 9 ft., as heretofore, and the entire surface ballasted with tone. The line will be materially changed at Norris City, cutting ut a troublesome curve at that place. No towns of importance will be cut out, although in many of them the road will pass hrough a different portion. All wooden bridges will be replaced by steel structures. All culverts and water openings will be of tone.

COLORADO, TEXAS & MEXICO.—This company, which has its gen- ral office at Abilene, Tex., has completed the grade of twenty-five miles of road south from that place. It is proposed to build from Vernon, Tex., on the Fort Worth & Denver City road, to San An- onio, with a branch line to Washburn, Tex.

EASTERN WASHINGTON.—Rights of way are being secured by this company for a railroad, projected to run from Fletcher in Adams County, Wash., southwest to Connell, a distance of about 30 miles.

GAINESVILLE, WHITESBORO & SHERMAN (ELECTRIC).—A charter has been filed in Texas by this company, with a capital of $500,000, and offices at Gainesville, to build a railroad 32 miles long. The in- corporators include G. A. Hassinger, H. L. Lazarus, New Orleans; H. G. Stinnett, Sherman; S. R. Cowell, Whitesboro, and John King and others, Gainesville.

GULF TERMINAL COMPANY.—Incorporation has been granted a company under this name in Alabama to build and operate a union passenger station in the city of Mobile and to construct and operate a terminal railway through and around that city. The incorpora- tors include: E. L. Russell, of the Mobile & Ohio; F E. Winson, of Washington, D. C., and others.

KANSAS CITY & EXCELSIOR SPRINGS.—A charter has been granted a company under this name in Missouri with a capital of $850,000 to build a railroad from Kansas City northeast to Excelsior Springs in Clay County, Mo. W. J. Thurman, McKinney, Tex.; A. F. Mar- tin, C. D. Pratt, J. Williams, and Eugene G. Jaccard, of Kansas City, are interested.

KANSAS CITY, MEXICO & ORIENT.—This company has put in opera- tion from Sweetwater, Tex., north to Sylvester, 22 miles of its railroad. Grading is finished from Sylvester north to the Red river, where it will connect with the Oklahoma division, now being built, a distance of about 100 miles from Sylvester. Track- laying is in progress on this division and it is expected that it will be completed and in operation by fall. Construction work is also under way south from Sweetwater towards San Angelo and the Mexican border.

LA CROSSE & SOUTHEASTERN.—This road has been completed from La Crosse, Wis., southeast to Viroqua, 42 miles, and is now in opera- tion.

MADISONVILLE, HARTFORD & EASTERN.—Articles of incorporation have been filed by a company under this name in Kentucky, with headquarters at Hartford, to build a railroad from Madisonville northeast to Fordsville or Cloverport, a distance of about 80 miles. The incorporators are R. E. L. Simmerman, J. W. Ford, H. H. Hole- man, Rowan Holbrook, G. R. Lynn, Dr. J. P. Ross, John T. Moore, of Hartford. (See Kentucky Roads, June 30, p. 215.)

MISSOURI VALLEY (ELECTRIC).—A charter has been granted this company in Missouri, with a capital of $650,000, to build an electric road from Kansas City north along the Missouri river to St. Joseph, about 65 miles, with spurs to Leavenworth and Atchison. The board of directors includes G. B. Blanchard, Charles P. Breen, George B. Tuggle, S. Facker, Wilson McAfee and Howard McAfee, all of Park- ville, Mo. Nevins & Co., of New York, are said to be interested.

MORGANTOWN & KINGWOOD.—This company, which operates about 15 miles of road in West Virginia, has completed its extension from Bretz southeast to Reedsville, and has now under construction about 12½ miles from that place to Kingwood. The company will at once ask for bids on an additional 18 miles south from the latter place to Rowlesburg.

NEW YORK CITY.—The Board of Estimate has approved the plans of the Rapid Transit Commission for building 19 new subways at an aggregate cost of $250,000,000.

NEW YORK, WESTCHESTER & BOSTON.—The amended route of this company's proposed road has been approved by the board of estimate and apportionment of New York City. The City & County Contract- ing Co., which has the general contract to build this road, will soon ask for bids on the work.

OKLAHOMA NORTHWESTERN.—Rights of way, it is said, have been secured by this company from Doxey, Okla. T., northwest for about 100 miles, and construction work is soon to be commenced.

PITTSBURG, BINGHAMTON & EASTERN.—Permission has been granted this company by the New York Railroad Commission to build in New York State. The proposed route is from Bingham- ton, N. Y., southwest to Ansonia, Pa., a distance of about 140 miles. (May 26, p. 175.)

PUBLIC SERVICE CORPORATION.—Petition has been made by this company for authority to build an electric road from Elizabeth, N. J., to Rahway, about eight miles.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—Announcement has been made that this company has authorized the laying of a second main track in Arkansas from Texarkana northeast to Fulton, a distance of 19 miles, and from Ensign, south of Little Rock, to Mc- Almont, north of that place, a distance of about 13 miles, to relieve the terminals at Little Rock and Texarkana.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—This company, which was recently organized, has just bought the Raton, N. Mex., coal fields, comprising about 520,000 acres, and including an area of more than 800 square miles. The new owners will, through a sub- sidiary company, immediately build 120 miles of steam railroad through the Cimarron canon, the only remaining pass across the Rocky Mountains that will admit of the construction and operation of a transcontinental road within the United States. This railroad, in addition to serving the coal mines of the St. Louis, Rocky Moun- tain & Pacific Company, will traverse a heavily timbered country and reach the well-known Elizabethtown mining district in the northern part of New Mexico, where there are a large number of gold mines and extensive iron deposits. It will also furnish an outlet to the Taoz valley. Work will begin on the new road early next month. (March 24, p. 90.)

ST. MAURICE VALLEY.—A bill has been passed authorizing this company to build a line from Three Rivers, Que., to the eastern di- vision of the Grand Trunk Pacific.

SAN PEDRO, LOS ANGELES & SALT LAKE.—Surveys are reported being made to build a branch from a point on this road in Salt Lake City southeast about 100 miles to the coal fields of Carbon and Emery Counties, paralleling the main line of the Rio Grande Western.

SPARKS, MOULTRIE & GULF.—This road, which was operated for some time but has since been abandoned, is to be rebuilt and oper- ated from Adel, in Berrien County, Ga., north to Sparks, and thence west to Moultrie, in Colquitt County, a distance of about 18 miles. At Adel connections will be made with the South Georgia and West Coast; at Sparks, with the Nashville & Sparks and the Georgia Southern & Florida roads, and at Moultrie, with the Atlantic & Bir- mingham and Georgia Northern.

TIDEWATER & WESTERN.—Under this name a charter has been given to this company in Virginia. The company will take over the Farmville & Powhatan, which operates 92 miles

of road in Virginia, from Bermuda to Farmville, with a branch from Coalboro three miles long. It is proposed to extend this road either to Danville or Lynchburg. The directors of the new company include T. F. Jeffress, H. W. Anderson, L. C. Lewis, J. S. Ellett and James N. Boyd, of Richmond, Va.

Ultima Thule, Arkadelphia & Mississippi.—This road, which extends from Daleville in Clark County, Ark., where connection is made with the St. Louis, Iron Mountain & Southern, southeast to Sparkman, a distance of 26 miles, has been opened for traffic. C. G. Carpenter, Arkadelphia, is General Manager.

Virginia & Southwestern.—This road has put in operation the Taylor mines branch from Rexford, Tenn., east to Buladeen, 10 miles.

Wabash.—Surveys are reported being made by this company for a line from a point on the West Side Belt (Wabash), near Castle Shannon, southward through Allegheny County, Pa., and across the eastern end of Washington County, to Clarksville, Greene County, to reach valuable coal lands. The proposed extension will cross the Baltimore & Ohio near Fanteville.

Yellowstone Park.—This company, which is being financed by Philadelphia capitalists represented by F. A. Hall, and in which P. H. Gallagher, of Billings, Mont., is interested, has given a contract for excavation work to Weast Bros.; also a contract for grading 18 miles of its road from Bridger, in Carbon County, Mont., to the Bear Creek Coal Camp. Additional contracts will soon be let for removing rock and for building bridges and culverts. Russell Kimball is Construction Engineer.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—A semi-annual dividend of 2½ per cent. has been declared on the common stock. The first payment on the common stock was in 1900 and ever since that time 4 per cent. has been paid annually.

Central of Georgia.—The directors have authorized an issue of $600,000 4 per cent. bonds, secured by mortgage on 10 miles of road now under construction to reach valuable coal fields in northern Alabama.

Cleveland, Cincinnati, Chicago & St. Louis.—The stockholders have subscribed to only $2,869,700 of the $7,600,000 new common stock recently offered to both classes of stockholders at par to the extent of 20 per cent. of their holdings.

Cripple Creek Central.—This company, which is the successor at foreclosure sale of the Denver & Southwestern, has declared its first dividend of 3 per cent. on its $3,000,000 4 per cent. noncumulative preferred stock.

It is probable that the Colorado & Southern now controls this road. J. H. Waters, President of the Florence & Cripple Creek and the Midland Terminal, has been appointed General Manager of the Colorado Springs & Cripple Creek District Railway, already controlled by the C. & S. The two companies, of which Mr. Waters is President, cover most of the main line mileage (83 miles) controlled by the Cripple Creek Central, which is in effect a holding company. Of this mileage, 63 miles is narrow gage. Several officials of the Colorado & Southern have also been appointed to similar positions on the Cripple Creek Central. The general offices of the Florence & Cripple Creek and the Midland Terminal are shortly to be removed from Cripple Creek to Denver.

Farmville & Powhatan.—See Tidewater & Western.

Galveston, Harrisburg & San Antonio.—The shareholders of the Gulf, Western Texas & Pacific, and the New York, Texas & Mexican will, on August 8, vote on selling these roads to the Galveston, Harrisburg & San Antonio. These are all Southern Pacific companies. The sale was authorized at the recent session of the Texas legislature.

Lehigh Valley.—The New York State Railroad Commission has recently authorized the Lehigh & Lake Erie, a subsidiary company of the Lehigh Valley, to issue $3,000,000 bonds for the construction of a terminal line at Buffalo.

Louisville & Nashville.—Application has been made to the New York Stock Exchange to list $2,840,000 additional unified 50-year 4 per cent. bonds of 1940, making the total amount listed $34,562,000.

Missouri Pacific.—The New York Stock Exchange has been asked to list $25,000,000 40-year 4 per cent. gold bonds of 1945. These are part of an authorized issue of $50,000,000 dated 1905. They are secured by St. Louis, Iron Mountain & Southern stock as collateral.

New York, New Haven & Hartford.—According to a press despatch from Newburg, N. Y., dated July 18, William Underhill, General Manager of the Newburg, Dutchess & Connecticut, has announced that negotiations have been concluded by which control of his road will soon pass to the N. Y., N. H. & H. The Newburg, Dutchess & Connecticut runs from Dutchess Junction, N. Y., on the Hudson division of the New York Central opposite Newburg, to a point on the Connecticut state line near Millerton, N. Y., 59 miles. It is capitalized at $500,000 common and $600,000 preferred stock. Its funded debt consists of $1,164,500 income 6 per cent. bonds of 1977, interest payable if earned, and $26,000 collateral trust 5 per cent. bonds of 1921. The New Haven road has been paying for trackage rights over the N. D. & C. between Wicopee and Hopewell Junction, 14 miles, as part of its freight line from Fishkill, N. Y., east into Connecticut.

Philadelphia & Reading.—This road has announced that it will purchase at maturity the $1,500,000 first and $300,000 second mortgage bonds of the Delaware & Bound Brook, which mature on August 1. Holders who presented their bonds before July 16 had the option, upon the payment of a premium of 1 per cent., of exchanging their bonds at par for a new issue of $1,800,000 first mortgage consolidated 3½ per cent. gold bonds of 1955 of the Delaware & Bound Brook.

Pittsburg, Binghamton & Eastern.—E. H. Gay & Co., of New York, are at the head of a syndicate which has bought $4,000,000 50-year 5 per cent. gold bonds and an equal amount of preferred stock, which will provide about $6,000,000 for building this road. The P., B. & E. is to run from Binghamton, N. Y., to Ansonia, Pa., on the Buffalo, Rochester & Pittsburg, 143 miles. The authorized bond issue is $10,000,000, of which not more than $5,000,000 including the present issue may be used for construction. The other $5,000,000 bonds may be issued only on additional mileage. The company has authorized issues of $5,000,000 common and $5,000,000 preferred stock.

Rio Grande.—A controlling interest in the $255,200 capital stock of this road has been purchased by the Yoakum-Frisco interests at a price said to be $30 per share. This is a narrow gage road 22 miles long, and runs from Brownsville, Tex., to Point Ysabel.

Tidewater & Western.—This company, the successor of the Farmville & Powhatan, recently sold at foreclosure, has been incorporated in Virginia with $500,000 authorized capital stock. It owns 89 miles of narrow gage line from Farmville, Va., to Bermuda Hundred, and its charter permits the building of branches not over 50 miles long from its line in any direction, and also the extension of its main line to the Virginia, Tennessee and Kentucky boundaries.

Vandalia.—The Vandalia Coal Company has been incorporated as an ally of the Vandalia Railroad to own 22,000 acres of coal lands and 27 operating plants in Indiana, and operate 9,000 acres of undeveloped coal lands under lease. The company has $2,000,000 common stock, $2,000,000 6 per cent. cumulative preferred stock and $3,000,000 first mortgage 6 per cent. gold bonds of 1930 authorized. The bonds are a first lien on 19,000 acres of coal land. It is proposed to issue at once $781,000 common stock, $1,562,000 preferred stock and $2,500,000 bonds.

A protective committee representing the holders of the first mortgage bonds of the Terre Haute & Peoria, formed in 1896, has reported that it has succeeded in obtaining a favorable court decree and that as a result of its efforts all coupons to and including March 1, 1905, have in the meantime been paid. In addition, it has been effected that the Vandalia Railroad, a much stronger corporation than the Terre Haute & Indianapolis, the original lessee, now guarantees the bonds. The Terre Haute & Peoria was leased to the Terre Haute & Indianapolis and its bonds guaranteed by that company in 1892. On default, the Terre Haute & Indianapolis was placed in the hands of a receiver. The litigation over the validity of the lease and the guarantee of the bonds of the Terre Haute & Peoria by the Terre Haute & Indianapolis has been going on for nine years. The Terre Haute & Indianapolis has recently been merged into the Vandalia Railroad Company and the latter company by a decree of the court has been required to comply with all provisions of the original lease, making the Vandalia the guarantor of the principal and interest of the $2,500,000 bonds.

Western Maryland.—In connection with the reported purchase of the railroad and coal properties of the Little Kanawha syndicate by the Vanderbilt and Pennsylvania interests, through an option held by Colonel J. M. Schoonmaker, Vice-President and General Manager of the Pittsburg & Lake Erie, F. S. Longstreet, Vice-President of the Western Maryland, is quoted as follows in a Baltimore despatch, dated July 18: "No matter what may be the final outcome of the negotiations which have been going on in regard to the disposition of the Little Kanawha syndicate, our plans will not be in the slightest degree affected. Our original plans contemplated an extension of the Western Maryland system to connect with the Wabash lines at Pittsburg. They were not confined to any particular route, nor did they contemplate making any particular properties auxiliary feeders, and the Little Kanawha syndicate is not essential to us in making our connections as we have planned them."

GENERAL NEWS SECTION

NOTES.

At the high school in Altoona, Pa., a special course of instruction is to be established for boys who intend to become apprentices in the railroad shops.

The Chicago, Milwaukee & St. Paul announces that no stopovers are to be allowed on tickets between points in the state of Wisconsin. This order is said to have been made to avoid violation of a new law of that state.

Mr. R. E. Kerkam has been appointed Chief of Police of the Long Island Railroad. It is said that the policemen, detectives and watchmen of the road are to be organized on a plan similar to that which is in use on the Pennsylvania Lines west of Pittsburg.

The long pending litigation against the Southern Pacific Company in Kentucky, concerning the taxes claimed from the company in that state, is still alive, and, as appears from a motion made in the County Court at Louisville, July 17, the amount now claimed by the state (or the county) is $12,000,000. The statutory penalties for non-payment would increase this sum to twenty-one millions.

The Consul General of the United States at Halifax reports that during the past year the government of Canada has paid out $98,930 in commissions to agents who induce people in other countries to emigrate to Canada. In the United States the commission paid is three dollars for each man, two dollars for each woman, and one dollar for each child induced to go as agricultural settlers to western Canada, and commissions were paid to 76 different agents. The amount paid in the United States was $14,428.

Protection vs. Free Trade in Georgia.

One of the railroad commissioners of Georgia having given out that the commission, in regulating freight rates, would endeavor to protect manufacturers of that state against outside manufacturers, the Savannah *News* favors the commission with the following lecture. From what has appeared in the Georgia papers during the past few weeks, it seems that the merchants of Savannah are well satisfied with the present low interstate rates, while those of Atlanta are trying to find some way either to have interstate rates advanced or to have intra-state rates reduced. The *News* says:

"If the state had wanted the Commission to do anything of that kind, wouldn't it have so stated in the law creating the Commission? Where does the Commission get its authority to adopt a policy of protecting manufacturers? As a matter of fact, has it any such authority? Is not the policy it has adopted a wholly arbitrary one?

"The Commission was created for the purpose of protecting the people against unreasonable and discriminating rates, not the manufacturers against outside competing manufacturers. Suppose every other state railroad commission should adopt the policy that the Georgia Commission has adopted, what a complicated and annoying condition of affairs there would be. Georgia's manufactured products couldn't get outside of the state and the manufactured products of other states couldn't get into the state. At least the effect of the policy would be to bring about that condition of affairs.

"It may be that some of the manufactured products of Georgia have a hard time to compete with similar manufactured products of other states, but, if so, it is because they are manufactured under unfavorable conditions. There are products manufactured in Georgia that are made cheaper than they can be made in other states, and so they take the markets in other states. For instance, there are certain kinds of cotton goods manufactured in Georgia at less cost than they can be manufactured in New England, and hence they undersell the same class of cotton goods in the New England market. Suppose the New England States should adopt freight rates that would shut these goods out of their market, would Georgia regard that as fair dealing? We think not. If the policy of the Georgia Commission should be generally adopted, interstate commerce would be brought practically to a standstill; that they haven't adopted any such policy shows that it isn't either good policy or permissible.

"And how lame and impotent is Commissioner Brown's argument in respect to jobbers. He hopes that their business will not be injured by the Commission's policy, but, if it is, their remedy is to deal only in products manufactured in the state. How preposterous! Jobbers must deal in what their customers want. It is not their business to dictate to the people what they shall buy. If the Commission didn't want to hurt the jobbers outside of Atlanta, why did it give the jobbers of Atlanta the same rate as it gave the manufacturers of that city? Why did it discriminate in favor of the Atlanta jobbers? The fact that it gave jobbers of Atlanta the same rate it gave Atlanta manufacturers shows that its aim was to discriminate in favor of Atlanta.

"And it seems that the Commission is afraid to defend its alleged policy. The report is that the Attorney-General intends to plead that the acts of the Commission can't be reviewed by the courts, that the Commission is above the courts and can do as it pleases. It will doubtless find out before this matter is settled that there is power somewhere that can prevent rank injustice being done and make it clear to the Commission that it has altogether misunderstood its business and the scope of its authority."

The Gentle Art of Hustling.

"Must be a good hustler." What an ejaculation of scorn and contempt would the average British engineering shop or machinist foreman a few years ago have uttered on seeing this sentence interwoven in the "Wanted" column of an engineering journal or daily newspaper. Even now, when so much of the Americanising methods have been introduced into many of our works, it carries an ill-odor with it to our more or less tender dictionary palate. When our young mechanic or engineer first sees the word, he pictures some huge monster of physical inhumanity, whose possession of brute force far outweighs his mental capacity or attainments, let loose in a works where each employee is in daily or hourly fear of coming under the terrifying ban of one who rules by curses if not by blows, where reason is entirely absent, where mistakes or blunders are never forgiven, and where brute force always triumphs over and effaces any finer feelings that a man may possess. The dictionary meaning of the term tends to this exaggerated idea. To hustle is "to crowd upon so as to shove about roughly; to push or elbow out or about rudely; to jostle." But what a mistaken idea that is of a successful hustler. For the wrong application of this term we must condemn our American brethren, for in this, as in many other words, an exaggerated term is used by them where a more modest and strictly truthful word could have been chosen. The successful hustler may be mild or rough in manner; he may be physically a giant—very often he is the opposite; he may choose his words with the highest refinement of culture, or he may besprinkle them with coarse expletives. There are scores—nay, hundreds, if not thousands—of successful hustlers, of whom probably not two are exactly alike in disposition or in method. The question then comes, "What constitutes a good hustler?" as the word is ordinarily employed and understood in engineering circles; and though it admits of several answers, possibly the truth will be spoken by saying that the successful hustler is he who gets the best out of the men and materials under his charge.

Piece-work and bonus systems are examples of hustling, and are typical of scores of other systems and methods, the principle underlying them being to constantly attempt to improve on past performances, and thereby get a greater reward; and emphasis needs to be laid on this latter point. Our British employers have one very common failing as compared with their American brethren. The axiom which a large number seem to accept is that a comparatively big wage is not economy; and while they are quite willing that American or any other modern methods should be introduced, they give very little thought to the accompanying factors. A large outlay on a machine-tool is considered both justifiable and commendable if its results bring increased economy of production; but mention a large outlay in salaries, and although the results may be—as they very often actually are—ten or fifty times greater than those from the tool, our engineering principals lose interest. While in many cases the fact that one's reputation as a good hustler does not prejudice an overseer or manager in the eyes of the men, it often happens that he is the object of a great deal of animus.

The successful hustler for a general engineering works must possess more than the average amount of brains, must be strong, both physically and mentally, possessed of indomitable perseverance, able to suit his methods to the class of men he has to deal with, and must have a knowledge of the ultimate requirements of the production he is engaged on and the uses to which it will be put. He should be possessed of great breadth of mind, and should keep himself thoroughly posted up in machine-tool developments and practice, and should possess withal an insatiable desire for an ever-increasing and efficient output.—*Engineering.*

A Derailment Caused by a Pushing Engine.

Lieutenant-Colonel Druitt, reporting to the British Board of Trade, describes the derailment of five cars in a long freight train at Burnley on the Lancashire & Yorkshire, April 20, under circumstances which led him to attribute the accident to a combination of three causes: the stopping of a car at the point of a frog on the outside of a curve; the sudden pushing of that car (when the train was started) by two engines at the rear of the train, and a

very slightly worn condition of the point of the frog. A train consisting of a train engine, 110 loaded wagons, three empty wagons, a brake van and two banking engines, was just starting from the station when the 85th wagon from the front ran off the track. Four others followed it. The train weighed 990 tons, a fact which indicates that all of the wagons were small. The signal man in the cabin nearby at once gave the stop signal and but little damage was done. Colonel Druitt says:

One of the points raised at this inquiry was whether long goods trains, of 100 wagons or more, are more liable to derailments and break-looses than short ones, or whether they are more dangerous to the men employed to work them, or to the traveling public generally, especially on the steep gradients near Burnley. These gradients consist of a length of nearly two miles of 1 in 40 between Accrington and Baxenden, and also of the seven miles of gradients varying from 1 in 65 to 1 in 80 between Burnley and Todmorden, over the Copy Pit summit.

Derailments of wagons at diamond crossings, after the wagons have come to a stand on them, are not of very uncommon occurrence should the wheels of a wagon have got somewhat askew when buffering up on stopping, and such cases are more liable to occur when wagons on starting again are propelled, than when drawn, and especially on curves; but such derailments could happen to short trains equally as to long trains should the gradients over which the train is to run require the use of a banking engine.

There is less danger of run-backs when a train becomes divided on a steep gradient when banking engines are employed, so there is no extra risk of this danger where long trains are employed as they always require banking engines on such gradients, and this reduces the liability to accidents to goods guards, who might suffer severely in the case of a run-back, if in the brake van.

I do not consider there is any extra danger to the men working long trains, though perhaps greater skill and care are required in the manipulation of them, but this has been forthcoming, as I am informed by the company that their records show that accidents have been neither more numerous since the introduction of long trains in 1901, nor do they happen more frequently to long trains than to short ones.

The length of goods trains will be gradually reduced when larger numbers of high capacity wagons become available, but meanwhile the old type of wagons must be continued to be used. A smaller number of wagons though conveying the same tonnage will be more compact and easier to handle. The company claim a great advantage in working traffic, by using one long train in lieu of two short trains on a crowded line with numerous block sections, the saving of time being very considerable.

The principal source of danger to passenger trains from goods trains is probably that in the case of a long train, a wagon off the road might not be noticed by the trainmen as soon as in that of a short train, and the other road on which a passenger train might be passing may be fouled and the danger not noticed so soon; but no accident has happened from this cause so far as I am aware owing to the introduction of long trains, which are now limited to 120 vehicles on the Lancashire and Yorkshire Railway whether loaded or empty.

United States Steel Corporation.

The quarterly statement of this company to June 30 was issued last Tuesday. The amount of orders unfilled on June 30, 4,829,655 tons, though a decrease of 768,105 tons on the same item on March 31, disproves recent rumors of a serious decline in the steel industry.

The net earnings for the half year compare with those of the same period in 1904 and 1903 as follows:

	1905.	1904.	1903.
Second quarter	$30,305,116	$19,490,725	$36,642,308
First quarter	23,025,896	13,445,232	25,068,707
Half year	$53,331,012	$32,935,957	$61,711,015

Interest, sinking funds and other charges amount to $13,429,516, $1,000,000 of this being a special improvement and replacing fund, an item which does not appear in the statement for the first quarter. This leaves $16,875,600 as the balance available for dividends. The quarterly dividend of 1¾ per cent. on the preferred stock amounts to $6,304,919, leaving a surplus of $10,570,681 as compared with $5,873,407 at the end of the first quarter. Of the present surplus, $5,000,000 is appropriated on account of expenditures made and to be made on authorized appropriations for additional property, construction and discharge of capital obligations. The first such appropriation was made on March 31 of this year to the amount of $3,300,000. This quarter there is also $2,500,000 specifically set aside for contemplated appropriations and expenditures. These deductions make the net surplus $3,070,681.

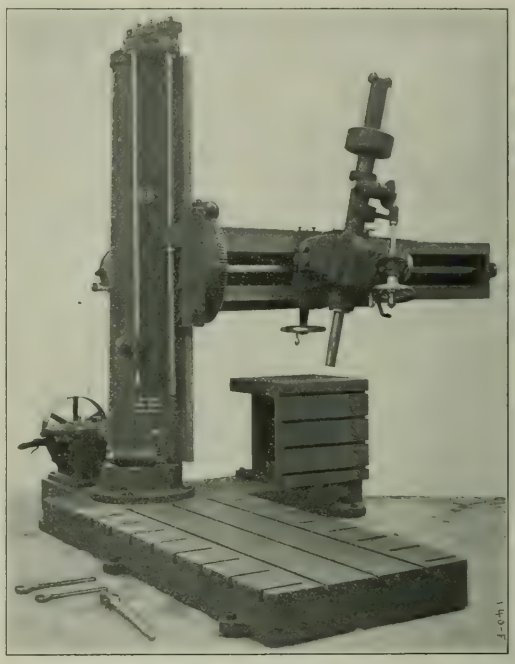
Egyptian Rolling Stock Contracts.

The Egyptian Government lately has awarded contracts for 63 locomotives (15 to be built by Henschel & Co., of Cassel, Germany; 32 by the North British Locomotive Company, of Glasgow, Scotland, and 16 by two factories in France and Belgium); 105 passenger cars to be built by the Metropolitan Railway Car Company, of Birmingham, England; 100 30-ton freight cars by the Leeds Forge Company, England, and 190 10-ton freight and cattle cars by three Belgian car works.—*Consular Report.*

New 6-ft. Niles Universal Radial Drilling Machine.

The accompanying cut shows a radial drill made by the Niles-Bement-Pond Co., New York.

The machine is the result of the experience of the five works of the company in the design and manufacture of radial drills. It is built to use high speed drills to their fullest capacity. The drill head saddle fits between as well as outside of the arm guides, which completes the double box section of the arm and insures great rigidity. The column saddle is strongly gibbed to flat scraped bearings on the column and the post about which the column revolves extends to the extreme top of the sleeve. The use of large shafts, steel



Niles-Bement-Pond New Universal Drilling Machine.

gears, bronze bushings and ring oiling bronze bearings for all fast running shafts makes a strong durable machine capable of standing the hardest service. The principal feature of this machine is its convenience and ease of manipulation. All the feeds and speeds are changed by means of levers, and great care has been taken to arrange the levers and hand wheels, so that they shall be within easy reach of the operator. The column rests on ball bearings.

The machine is adapted for use with either carbon or high speed drills, the range of spindle speeds being sufficient for this purpose. Friction clutches are used for starting and stopping the machine at high speeds, so as to prevent shock and consequent wear. The speed box is planed on the top, in order that the drill may be easily changed from a belt-driven machine to a motor-driven machine, by the simple substitution of two gears for the pulley. Reversing gears for tapping are provided and all speeds and feeds may be changed while the machine is running even at its highest speeds.

This radial drill is a full universal machine, that is, both the arm and the saddle swivel. The principal dimensions of the machine are as follows:

Drills to the center of	12 ft.
Max. distance from face of column to center of drill	77⅛ in.
Least distance from face of column to center of drill	22⅛ "
Greatest distance from spindle to base plate	72 "
Traverse of spindle	20 "

Georgia Peaches.

The peach shipments from the Augusta district this year will far surpass those of any other season. Within the twenty-four hours ending at noon yesterday the Georgia Railroad received and forwarded 165 cars of Elbertas, after icing the cars at the local refrigerators. This is the biggest day's record, though the season is now at its height, and will last about one week longer, during which the road and ice manufactories will be hard put to keep up with the supply from the orchards. Within 24 hours there had to be put

aboard the cars 825 tons of ice properly placed, with the concomitant shifting and regulating. Along every mile between Augusta and Macon the orchards extend in almost one unbroken line, there being a million and a half trees in bearing this year, an increase of 300 per cent. over last season—figures that mark this as one of the finest peach growing districts in the world. The fruit comes to its maturity midway in time between the South Georgia orchards and those above Atlanta, comprised in what is known as the North Georgia crop. One hundred and sixty-five cars, with an average of 500 crates to the car means 82,500 crates, or 495,000 baskets, or about 11,800,000 peaches concealed in their wooden casings, waiting in the cool depths of the cars to scatter their blessing to the ends of the United States. If these 11,800,000 peaches were placed end to end they would reach 567 miles; or from Augusta to Washington; one long connecting link of ruddy hued, crimson-cheeked lusciousness to which the ambrosia of the gods is as breakfast food to the epicure.—*Augusta (Ga.) Chronicle, July* 21.

Motor Omnibuses in England.

The increase in the number of motor buses for passenger traffic in London and other towns and cities of the United Kingdom has been very marked. The price of the standard double-deck omnibus, carrying 36 passengers, is $4,623 net London; of the single-deck type, carrying 18 passengers, $4,136 net London. The cost of running vehicles of this type, inclusive of all management expenses, depreciation, drivers and conductors' wages, petrol, etc., works out at about 21 cents per mile, while the average receipts of the various companies who have them in use is about 33 cents per mile. According to the London *Daily Mail* of May 26, 1905, the London motor omnibuses, all last spring succeeded beyond the most sanguine expectations of the companies and individuals running them.—*Consular Report.*

New York Surface Lines.

The earnings of the New York City Railway in June aggregated $1,887,834, as compared with $1,865,065 in June, 1904, and $1,764,798 in June, 1903. Thus there is an increase in two years of almost $125,000 a month (as indicated by the June figures) in spite of the competition of the subway. As a matter of fact, the surface lines have felt the subway competition quite sharply but in the hot weather the subway was slightly less popular than it was in the colder months. It will be recollected that the company's statement for the three months ending March 31, 1905, which was the first statement covering a full quarter's operation of the system in competition with the subway, showed gross earnings of only $3,639,468, a considerable decrease from the year previous. This March showing, however, reflected not only the competition of the subway, but also the result of an exceptionally severe winter, with much snow.

Establishment of a Canals Trust in Great Britain.

A recent bill enacted by Parliament establishes a strong central canals trust for the purpose, in the first instance, of taking over, improving and managing certain specified canals which form a chain of navigation between the principal ports in England. Powers are also taken for subsequently acquiring other canals, but not the Manchester Ship Canal, and for the improvement and management of these other canals. The purpose of the bill is by this consolidation of interests and management to improve the facilities for water carriage and to establish a complete system of intercommunication. The bill was first presented last winter and has now been amended in some slight particulars and appears under date of July 4, 1905. The canals trust is a body corporate composed of thirty-seven trustees, of which seven are appointed by the Treasury, seven by the Board of Trade, seven by the Board of Agriculture and Fisheries and two each by the port authorities of the principal seaports and by other associations. It is provided that no officer of a railroad company shall be eligible for the office of trustee. The trust is required as soon as possible to take steps to acquire the Birmingham, Coventry, Grand Junction, Leeds & Liverpool, Oxford, Staffordshire & Worcestershire, Warwick & Birmingham, and Warwick & Napton canals; also to undertake the Kennet & Avon canal navigation and the River Avon navigation (now managed by the Great Western Railway), the Sharpness New Docks and Gloucester & Birmingham Navigation Co., the Trent Navigation Co. and the navigation of the rivers Aire and Calder. After this has been done the trust may acquire further canal companies, apparently, at its own discretion. The provision for recompense is simply that the trust shall pay to each company such sums as may be mutually agreed upon; or in default of agreement the trust may obtain a provisional order authorizing the acquisition of the canal and a court of arbitration, provided for by the Act, may appraise the property. In determining the sum to be paid to each company in case of arbitration, it is provided that the court shall take into account the manner in which the canal has been maintained and administered; also whether reasonable efforts have been made to encourage traffic on it and whether any substantial and permanent increase in the value of the canal property, other than the part acquired by the trust, is shown to be probable by reason of this acquisition by the trust. The court of arbitration consists of three arbitrators, one to be appointed by the Lower Chief Justice of England, one by the Treasury and one by the President of the Board of Trade.

It is provided that a canal fund shall be established and all receipts of the trust shall be carried to that fund and all payments by the trust shall be made out of that fund. Any holder of securities shall have the same rights and remedies, as nearly as may be, against the trust and the canal fund as he would have had against the company. The trust is authorized to borrow money for the purpose of taking over the canal properties, for redeeming funded obligations and for completing new work which had been authorized by the canal companies, by Act of Parliament, before the passage of the Canals Act. To accomplish this the trust is authorized to create an issue of guaranteed canal stock bearing interest at a rate not to exceed 3¼ per cent. and this stock is to be charged on the canal fund and on all the revenues of the trust, with its interest guaranteed by the Treasury. It is provided that the trust shall carry a large reserve fund as fast as it can accumulate it and that current income after payment of current expenses, maintenance and fixed charges may be applied at the discretion of the trust under certain restrictions. It is specifically provided that the trust shall not itself undertake the business of a carrier of traffic on any of the canals acquired by it, but shall be in the nature of a holding company, as its name implies. The Act does not apply to Scotland and Ireland and the Manchester Ship Canal is specifically excepted from its rulings.

Manufacturing and Business.

A contract has been given to A. S. Schulman, of Cincinnati, at $90,000, for the electrical equipment of the new union station at Washington, D. C.

Announcement is made by Geo. M. Kenyon, of St. Paul, Minn., dealer in railroad supplies, that on August 1 he will remove to 600-601 Pioneer Press Building, St. Paul, Minn.

On July 24, according to reports from Guayaquil, Ecuador, the Guayaquil-Quito Railway Co. opened its line to Riobamba, which is the capital of the province of Chimborazo and 9,064 ft. above sea level.

Mr. E. M. Woodward has been elected President and Treasurer, Mr. A. M. Powell, Vice-President and Superintendent, and Mr. J. W. Robinson, Secretary, of the Woodward & Powell Planer Co., of Worcester, Mass.

The Pond Engineering & Contracting Co. has been incorporated in New York with a capital of $25,000 to conduct an engineering and contracting business by N. H. Nieman and R. H. Waddell, of New York, and A. A. Kelly, of Montclair, N. J.

Plans and specifications are on file with the Chilean Legation in Washington, D. C., and with the Consulate General, 135 West 11th street, New York City, for building docks and making improvements in the harbor of Valparaiso, at an aggregate cost of about $12,500,000. Bids are asked for this work by or before April 2, 1906.

Mr. William Jessop, chairman of William Jessop & Sons, Limited, steel manufacturers, of Sheffield, England, and president of the Jessop Steel Company, of Washington, Pa., died on July 4 at his country estate at Bradfield, England. He was the head of the fourth generation of the Jessop family in control of the firm. In 1903 he visited America.

Plans and specifications are on file with the Cuban Consul-General at 96 Wall street, New York, for the construction of a wharf, custom-house and appraiser's office in Havana harbor at an aggregate cost of about $3,000,000. Bids will be received in Havana for this work up to November 9. The government will also grant a 99-year concession for wharf rights and privileges.

Mr. Arthur Koppel announces, in connection with the notice published in our issue of July 14 that Mr. Ernst Wiener, formerly his manager, had severed his connection with Mr. Koppel, that Mr. Carl Koch was not his chief engineer, but was only one of many engineers. Also that the statement that Mr. Wiener has associated with him a large part of Mr. Koppel's former staff is exaggerated, as only five of Mr. Koppel's force left with Mr. Wiener.

The report of the United States Engineer, Lieut-Col. Charles E. L. B. Davis, in charge of the deep waterway between Duluth, Chicago and Buffalo, recently made public, recommends an appropriation of $3,393,000 to be spent on the St. Mary's Falls canal at Sault Ste. Marie. Of this sum, $3,300,000 is for the proposed new lock. One million dollars is asked for the completion of the Hay Lake and Neebish channels, the amount on hand being $2,146,428; the balance of $93,797 is to be used on improvements in the St. Mary's river. Lieut.-Col. Davis estimates that the maximum cost of building a 21-ft. channel from Lake Superior to Lake Huron would be $10,160,000, and to secure a uniform depth of 21 ft. in the Detroit river would involve an outlay of $2,000,000.

Iron and Steel.

The New York Central Lines, it is said, have given an additional order for 25,000 tons of rails.

The steamer Colon, which recently sailed from Baltimore, carried a cargo of steel rails and fish plates to be used in double tracking the Panama Railroad.

The American Rolling Mill Co., of Middletown, Ohio, has bought the property of the Muskingum Valley Steel Co., at Zanesville, and will now be able to make 35,000 tons of ingots and 30,000 tons of black and galvanized sheets yearly. George M. Verity, of Middletown, Ohio, is president and treasurer, and R. C. Phillips, of the same place, secretary.

Orders for rails recently placed aggregate about 75,000 tons. The Missouri Pacific and allied companies have ordered 30,000 tons, mainly from the Carnegie Steel Co., which also has an order for 10,000 tons for the Mexican Central and part of an order of 12,000 tons for the Kansas City Southern which the Republic Iron & Steel Co., it is said, cannot supply. An order has been given by a northwestern road for 17,000 tons of standard sections to an eastern independent mill. Negotiations are pending for about 50,000 tons for domestic use and approximately 8,000 tons for export. The Manhattan bridge specifications, which are now being advertised, call for about 50,000 tons of structural steel, which will be ordered during the coming month.

PERSONAL.

—Mr. Ira O. Rhoades, who has been appointed General Purchasing Agent of the Southern Pacific, with headquarters at San Francisco, was born in 1863 at Rockland, Maine, and was educated in the public schools of Omaha, Nebraska. He began his railroad service with the Union Pacific in 1880, as messenger and office boy in the stores department. During the next eight years he was receiving and shipping clerk, foreman, tie inspector and chief clerk to the General Storekeeper. On September 1, 1888, he was made chief clerk to the General Purchasing Agent and held that position until March, 1897, when he went to the Oregon Short Line as General Purchasing Agent, with headquarters at Salt Lake City, Utah, where he remained until he was appointed to his present position on June 15 of this year.

Ira O. Rhoades.

—Mr. G. W. Vaughan, who has been appointed Engineer of Maintenance of Way, of the New York Central, was born in 1859. After a course at Warren Polytechnic College he entered railroad service in 1881 as a rodman on the Pittsburg, Cincinnati & St. Louis. From April, 1883, to April, 1884, he was Assistant to the Engineer of Maintenance of Way; from April, 1884, to March, 1887, Supervisor of Track on the third subdivision, and to April, 1887, Assistant Engineer of Maintenance of Way. He then went to the New York, Chicago & St. Louis, where he was Assistant to the Division Engineer of the Eastern division until February, 1889, when he became Division Engineer of the same division. From March, 1894, to August, 1898, he was Engineer of Maintenance of Way and from August, 1898, to November, 1899, Engineer in charge of reconstruction and of maintenance of bridges and buildings. In December, 1899, he went to the New York Central as Supervisor of Bridges and Buildings on the Eastern division. In December, 1900, he was appointed Division Engineer of the Pennsylvania division, and in September, 1901, Division Engineer of the Western division, which position he held until July 1st of the present year.

G. W. Vaughan.

—Mr. Lyman Erastus Roys died on July 12 at Rutland, Vt., at the age of 77. Mr. Roys entered the employ of the Central Vermont at the age of eighteen. In 1865 he was appointed Civil Engineer and Superintendent of Buildings, and when the New London Northern was acquired he held the same position on that road. He surveyed and built the Addison Railroad, running from Leslie Junction to Ticonderoga, N. Y.

—Mr. R. D. Hawkins, who has been appointed General Master Mechanic of the Central district of the Great Northern, is a graduate of the mechanical engineering course of Purdue University. He remained at Purdue as instructor a year after graduation, and then went to New Orleans, where he installed an iron foundry and woodworking shops. Later he served as a machinist in the Buchel Machine Works in that city. In 1898, he opened an office in Indianapolis as Consulting Engineer and the next year went to the Great Northern.

—Mr. Daniel S. Lamont, former Secretary of War and Vice President of the Northern Pacific, died suddenly at his home in Millbrook, N. Y., on July 23. Mr. Lamont was born in 1852 and graduated from Union College in 1872. In 1896, after serving as Secretary of War under President Cleveland, he became Vice President of the Northern Pacific, in charge of its eastern affairs, and was prominent in the reorganization of the road. He was a director of the Northern Pacific, the Northern Securities Company, the St. Paul & Northern Pacific, the International, the Manitoba and the Syracuse, Binghamton & New York; and a trustee of the Washington & Columbia River.

ELECTIONS AND APPOINTMENTS.

Arkansas Southern.—M. A. Hansen, Engineer of River Protection on the Missouri Pacific, has been appointed Chief Engineer, with headquarters at Ruston, La.

Augusta & Florida.—The following officers have been elected: Allen W. Jones, President; W. M. Blunt, Vice-President and General Manager; H. S. Jones, Secretary.

Chicago Great Western.—F. A. Peterson has been appointed Division Engineer of the Southwest division, succeeding C. G. Delo.

Chicago, Rock Island & Pacific.—The position of Assistant to the General Manager, heretofore held by W. G. Bierd, has been abolished, and Mr. Bierd has been appointed Superintendent of Terminals at Chicago, succeeding C. H. Hubbell.

Detroit, Toledo & Ironton.—F. A. Durban has been elected President and Benjamin S. Warren, Vice-President. H. Scott has been elected a director. C. P. Lamprey has been appointed General Traffic Manager of this road and of the Ann Arbor, with headquarters at Toledo, Ohio. John J. Kirby, General Passenger Agent of the Ann Arbor, has been appointed General Passenger Agent of the two roads, with headquarters at Toledo. The office of General Freight Agent of the Ann Arbor has been abolished, C. H. Bell, Chief Clerk to the General Freight and Passenger Agent, has been appointed Assistant General Freight Agent of both roads.

Erie.—W. H. Peddle, Superintendent of Terminals with authority over the stations at New York City, Jersey City, Weehawken, Bergen and the Pavonia Ferry, has resigned, effective August 1. J. M. Barrett, Superintendent of the Chicago & Erie division, will succeed Mr. Peddle.

The authority of George Van Keuren, General Superintendent, has been extended over the New York station and the Jersey City properties.

Great Northern.—Howard James, Purchasing Agent, has been appointed Assistant to the President, with headquarters at Seattle, Wash., and also President and General Manager of the Great Northern Steamship Company, with headquarters at Seattle, Wash., succeeding in both positions J. D. Farrell, resigned.

Lake Erie & Western.—G. P. Smith, Engineer of Maintenance of Way of the Indiana, Illinois & Iowa, has been appointed Chief Engineer of the Lake Erie & Western and of the Indiana, Illinois & Iowa, with headquarters at Indianapolis, Ind., succeeding E. A. Handy.

The office of Wilmer Mitten, Master Mechanic, has been moved from Fort Wayne to Muncie, Ind. I. W. Kurtz, Master Mechanic at Peru, Ind., has resigned, effective August 1. He will be succeeded by C. H. Mashey.

Lake Shore & Michigan Southern.—F. E. Woodruff, Chief Clerk to the General Manager, has been appointed to the new position of Inspector of Passenger Trains and Station Service. Charles Donahue, Chief Clerk to the Superintendent of Motive Power, succeeds Mr. Woodruff.

Lehigh Valley.—J. F. Schaperkotter has been appointed General Solicitor, with headquarters at New York, succeeding H. S. Drinker.

J. W. Platten, Assistant to the President, has resigned, effective September 1. E. A. Albright, Assistant Secretary, succeeds Mr. Platten, with headquarters at Philadelphia. The General Auditor, Treasurer and Secretary will report to the Assistant to the President. L. D. Smith has been elected Assistant Secretary, with headquarters at New York, succeeding Mr. Albright.

Louisville & Nashville.—Commencing August 1, the Alabama Mineral Division will be operated as a part of the Birmingham Mineral Division, with T. E. Brooks, Superintendent; office at Birmingham. The office of Superintendent at Anniston will be discontinued, W. E. Knox having been assigned to other duties.

Macon & Birmingham.—S. F. Parrott, recently elected Vice-President and General Manager of the Georgia Southern & Florida, has been appointed Acting Vice-President of this road, succeeding W. C. Shaw, resigned.

Missouri Pacific.—F. B. Scheetz, Assistant Engineer at St. Louis, has been appointed Engineer of Bridges and Buildings of this road and of the St. Louis, Iron Mountain & Southern, with headquarters at St. Louis, succeeding E. Fisher.

Herbert Murphy has been appointed Division Engineer at Kansas City, in charge of the construction of new yards.

New York Central & Hudson River.—H. Fernstrom, Chief Engineer, has resigned. Until further notice, all maintenance and construction work and organizations engaged therein, except as otherwise arranged, will be under the authority of Charles Parker, Principal Assistant Engineer.

New York State Railroad Commission.—Frederick E. Gunnison has been appointed commissioner, completing the board of five as provided for by the new law. The other members are: Joseph M. Dickey, G. G. Dunn, Frank M. Baker and George W. Aldridge.

Oregon Railroad & Navigation.—Andrew Maclean, Constructing Engineer of the Colorado Fuel & Iron Co., has been appointed Chief Electrician and Constructing Engineer, with headquarters at Portland, Ore.

Panama Canal.—Jackson Smith, Assistant to the First Vice-President of the National of Mexico, has been appointed one of the Assistant Engineers of Construction.

Pennsylvania.—Elliott Sumner, Assistant Engineer of Motive Power at Jersey City, has been appointed Engineer of Motive Power of the United Railroads of New Jersey division. H. P. Meredith, Assistant Master Mechanic at Altoona, has been appointed Assistant Engineer of Motive Power at Jersey City, succeeding Mr. Sumner. M. J. Davis, Inspector at Altoona, and P. L. Grove, Foreman of the Bedford, Pa., shops, have been appointed Assistant Master Mechanics, succeeding Mr. Meredith.

Pere Marquette.—The authority of J. S. Pyeatt, Superintendent of the Buffalo division, has been extended to Grand Rapids. His headquarters will be at Detroit.

Pullman Company.—F. N. Bostwick, Assistant Superintendent of the Southeastern division, has been appointed Assistant General Manager with headquarters in Chicago, effective August 1. John T. Ranson, Chief Clerk, will succeed Mr. Bostwick.

Rio Grande.—August Celaya has been elected President; Joseph Celaya, Treasurer; and William A. Neale, Secretary. The following directors have been elected: Joseph Celaya, August Celaya, James B. Wells, George L. Edwards, Edward C. Eliott, Thomas W. Carter and Duval West.

St. Louis, Iron Mountain & Southern.—See Missouri Pacific.

St. Louis Southwestern.—T. E. Adams, General Master Mechanic, has been appointed Superintendent of Motive Power, the office of General Master Mechanic having been abolished.

San Pedro, Los Angeles & Salt Lake.—H. B. Worden, Assistant General Freight Agent, has resigned.

Seaboard Air Line.—R. I. Cheatham, Assistant General Freight Agent, has resigned. J. A. Pride, Commercial Agent at Columbia, S. C., has been appointed Assistant General Freight Agent, succeeding Mr. Cheatham.

Union Pacific.—Ernest Stenger, Assistant Superintendent of the Wyoming division, has been appointed Superintendent of the Colorado division, with headquarters at Denver, Colo., succeeding H. C. Ferris, resigned. H. L. Anderson, Trainmaster at Green River, Wyo., has been appointed Assistant Superintendent of the Wyoming division, with headquarters at Cheyenne, Wyo., succeeding Mr. Stenger.

Webb C. Ball has been appointed General Time Inspector, succeeding J. W. Forsinger.

Virginia & Truckee Railway.—The following officers and directors of this company, which is the successor to the Virginia & Truckee Railroad, have been elected: D. O. Mills, President; H. M. Yerington, General Manager; E. B. Yerington, Secretary; and W. E. F. Beal, A. M. Ardery, James Newlands, Jr., W. E. Sharon and J. W. Eckley, directors.

Wabash.—John Lange, Master Car Builder at Moberly, Mo., has resigned. Mr. Lange is 77 years old and resigns because of ill health.

Steven E. Cotter, Superintendent of the Middle division, has been appointed General Superintendent, with headquarters at St. Louis, succeeding H. L. Magee, resigned on account of sickness.

LOCOMOTIVE BUILDING.

The Wabash has ordered 15 consolidation locomotives from the Baldwin Works.

The Chicago Junction has ordered two mogul locomotives from the American Locomotive Co.

The New York Central & Hudson River is building a four-cylinder balanced inspection locomotive.

The Chicago, Peoria & St. Louis has ordered two simple six-wheel (0-6-0) switching and two consolidation (2-8-0) locomotives from the Rogers works of the American Locomotive Co., for September delivery. The switching locomotives will weigh 133,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; straight boiler, with a working steam pressure of 180 lbs.; heating surface, 1,840 sq. ft.; 280 National tubes, 2 in. in diameter and 11 ft. 6 in. long; Otis steel firebox, 102 in. x 40½ in.; grate area, 29 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, 6 tons. The consolidation locomotives will weigh 165,000 lbs., with 145,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 54 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 2,245 sq. ft.; 288 tubes, 2 in. in diameter and 13 ft. 10 in. long; firebox, 116 in. x 40⅜ in.; grate area, 32½ sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The special equipment for all includes: Westinghouse air-brakes, Cambria axles, Magnesia boiler lagging and metal brake-beams for switching locomotives, steel back brake-shoes, Tower couplers for switching locomotives and Kelso couplers for consolidation locomotives, Dressel headlights, Ohio injectors, Jerome piston and valve rod packings, Hayden safety valves, Leach sanding devices, Nathan triple sight-feed lubricators for switching locomotives, Scott springs, Ashcroft steam gages, Midvale driving wheel tires for switching locomotives, cast-steel tender wheel tires and wheel centers, and Richardson valves for consolidation locomotives.

CAR BUILDING.

The Canadian Pacific is building 19 sleeping cars and nine tourist cars.

The Chicago & North-Western has recently ordered nine passenger cars from the Pullman Co.

The Cuba Company has ordered from the Middletown Car Works 300 platform cars with King patent steel underframes.

The Central Northern of Argentina has ordered from the Middletown Car Works 40 platform cars fitted with King patent steel underframes.

The Harriman Lines have ordered 2,550 steel-underframe box cars of 100,000 lbs. capacity and 400 steel-underframe stock cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Chicago, Rock Island & Pacific has ordered two combination parlor and coach cars, four combination dining and passenger cars and two dining cars from the Pullman Co., and 56 combination smoking and baggage cars, 10 passenger cars, 10 chair cars and 10 baggage cars from the American Car & Foundry Co.

The Norfolk & Western has ordered 500 drop bottom gondolas of 100,000 lbs. capacity from the Pittsburg works of the Pressed Steel Car Co. These cars will be built according to the specifications of the sample car built recently by the Norfolk & Western in its Roanoke shops. They will have steel underframes and will weigh 38,000 lbs. each.

The St. Louis & San Francisco has ordered 400 National coal dump cars of 80,000 lbs. capacity, 500 hopper coal cars of 100,000 lbs. capacity, 500 coal cars of 100,000 lbs. capacity, six postal cars and 10 combination baggage and mail cars from the American Car & Foundry Co. and 100 coal dump cars of 100,000 lbs. capacity from the Pressed Steel Car Co. The National coal dump cars will be 34 ft. 8 in. long, 9 ft. 7 in. wide and 4 ft. 2 in. high, inside measurements, and 36 ft. 4 in. long, 10 ft. wide and 9 ft. 1 in. high over all, with wooden frames and steel underframes. The special equipment includes: Simplex bolsters, Hewitt brasses, and Miner draft rigging. The hopper coal cars will be 33 ft. 9 in. long, 8 ft. 9½ in. wide and 7 ft. 11 in. high, inside measurements, and 36 ft. 1 in. long, 9 ft. 6 in. wide and 10 ft. 6 in. high over all, with wooden

frames and steel underframes. The special equipment includes: Simplex brake-beams, Ajax brasses, Miner draft rigging and McCord journal boxes. The coal cars will weigh 39,200 lbs. and will be 40 ft. long, 9 ft. 3½ in. wide and 4 ft. high, inside measurements, and 41 ft. 6 in. long, 10 ft. 2½ in. wide and 8 ft. 11¼ in. high over all. The special equipment includes: Simplex brake-beams, Ajax brasses, Miner draft rigging and McCord journal boxes. The coal dump cars will be 40 ft. long, 9 ft. 3 in. wide and 4 ft. 3⅜ in. high, inside measurements, and 41 ft. ½ in. long, 10 ft. 2 in. wide and 8 ft. 10 in. high over all, with steel frames and underframes. The special equipment includes: Hewitt brasses, Miner draft rigging and McCord journal boxes. All these cars will have Chicago couplers. The baggage and mail cars will be 69 ft. 2 in. long and 9 ft. 1¾ in. wide, inside measurements, and 73 ft. 2 in. long and 10 ft. wide over all, with wooden frames and underframes. The postal cars will be 60 ft. long and 9 ft. wide, inside measurements, and 63 ft. 11 in. long and 10 ft. wide over all. The special equipment for both the baggage and mail cars and the postal cars includes: Diamond special brake-beams, Streeter brake-shoes, Hewitt brasses, Janney couplers, Westinghouse friction draft rigging, New York safety heating system, Pintsch light, Lawler platforms and Pullman vestibules.

BRIDGE BUILDING.

Alviston, Ont.—Bids are being asked by R. S. Code, County Engineer, for putting up a steel bridge over the Sydenham river.

Ashland, Ky.—The Cincinnati, Hamilton & Dayton is locating the site to build its proposed bridge over the Ohio river.

Benton, Me.—A contract has been given to the New England Construction Co., of East Everett, Mass., at $10,450 for building a bridge 255 ft. long over the Sebasticook river.

Bridgeport, Conn.—Bids are wanted, August 10, by E. T. Buckingham, City Clerk, for building a reinforced concrete arch over Ash creek, between Bridgeport and Fairfield.

Chillicothe, Ohio.—Bids will soon be asked by the County Commissioners for repairs to the present structure at Bainbridge and for building two steel bridges each 200 ft. long, one at Vigo and one at Austin. B. H. Walker is County Surveyor.

Clarksdale, Miss.—Bids are wanted, August 7, by the Board of Supervisors of Coahoma County, for building a steel bridge over the Sunflower river. A. M. Searles, Vicksburg, Miss., is engineer in charge.

Fairmont, W. Va.—A contract has been given by the Baltimore & Ohio to F. H. Clements & Co., of Philadelphia, for the stone work on the bridge which it is building over the Monongahela river at Hoult. The bridge, which is to replace the present structure, will cost, when completed, nearly $400,000.

Kansas City, Mo.—The Chicago, Rock Island & Pacific has under consideration the question of building a steel bridge over the Kaw river at Kansas avenue in Armourdale, plans for which have been approved by the War Department.

Manitowoc, Wis.—Plans have been submitted by City Surveyor Unger to the City Council for two kinds of bridges, one for a swing bridge to cost about $70,000 and the other for a bascule bridge to cost $100,000, to be built over the river at Main street.

Mt. Clemens, Mich.—Bids, it is said, are wanted, August 7, by William F. Kracht, City Clerk, for putting up a two-span reinforced concrete bridge with a total length of 195 ft. and a roadway 50 ft. wide.

New Albany, Ind.—The Board of County Commissioners will give a contract on August 7 for building two stone abutments and an iron bridge over Little Indian creek at Wheeler's Ford, in Lafayette township; also for the abutments and bridge to be built at Burkhardt's mill, in Georgetown township.

New York, N. Y.—Bids are wanted, August 10, by Commissioner of Bridges George E. Best for the metal work for the superstructure, the anchorages, towers, etc., of the Manhattan bridge, to be built over the East river between the boroughs of Manhattan and Brooklyn.

Redding, Cal.—The Supervisors of Shasta County will soon ask for bids for putting up a steel bridge 150 ft. long over Cow creek. R. L. Reading is County Surveyor.

Richmond, Va.—The Joint Bridge Committee, at a recent meeting has decided in favor of a bridge to cost $100,000, to be built over the James river, between this place and Manchester.

Sacramento, Cal.—Plans, it is said, have been ordered to be made by the Board of Supervisors for a concrete bridge over Buffalo creek to cost about $30,000.

St. Johns, N. B.—Bids are wanted by G. S. King and George McAvity, commissioners for the New Brunswick Coal & Railway Co., for putting up a number of bridges between Norton and Chipman.

Wilkesbarre, Pa.—The Delaware & Hudson and the Jersey Central, it is said, have agreed to jointly build a bridge over the tracks between the east end and North Wilkesbarre.

Other Structures.

Allegheny, Pa.—Roydhouse, Arey & Co. have the contract for building the new Pennsylvania station. Work is to be commenced next month.

Americus, Ga.—The Central of Georgia is planning to put up a new passenger station here.

Chicago, Ill.—Bids will be asked next month by Frost & Granger, architects, for building a one-story stone station, 40 ft. x 115 ft., at 47th street, for the Chicago & Western Indiana, to cost about $30,000. Work is to be commenced as soon as bids are received and examined. Bids will also be asked about the same time for putting up a one-story station at 55th street, 30 ft. x 70 ft., to cost about $20,000. E. H. Lee is chief engineer of the road.

Louisville, Ky.—The union passenger station was destroyed by fire on July 17; loss about $300,000.

Mahanoy City, Pa.—The Philadelphia & Reading will soon begin putting up a stone passenger station to cost $15,000.

Philadelphia, Pa.—The Philadelphia Rapid Transit Co. is building a large underground station, 375 ft. long, on both sides of Market street between 15th and 17th streets.

Pine Bluff, Ark.—An ordinance has been introduced in the City Council to grant the St. Louis, Iron Mountain & Southern a 50-year franchise and permission to build a new station and make other improvements.

Pittsburg, Pa.—The Wabash is building a large fireproof freight station here.

Sapulpa, Ind. T.—The St. Louis & San Francisco improvements to be made here at a cost of about $40,000, include a new passenger station and an addition to the roundhouse.

Valdosta, Ga.—The Georgia Southern, it is said, has plans ready for putting up a brick passenger station to cost $20,000.

Wilmington, Del.—The Philadelphia, Baltimore & Washington has given a contract to Roydhouse, Arey & Co., for putting up its office building, to cost about $175,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Apalachicola & Northern.—A contract has been given by this company to the Morey Engineering Company, of St. Louis, for building its proposed railroad from Apalachicola to Quincy, Florida, a distance of about 80 miles. (April 14, p. 121.)

Atlantic, Quebec & Western.—This company, which has been granted a charter by the Dominion Government, also a subsidy of $6,400 a mile, and a grant of 4,000 acres of land per mile by the Province of Quebec, is making plans to build its proposed road from Gaspe Village, southwest to Causapcal on the Intercolonial, a distance of about 170 miles. The road is designed to make connection with a fast line of steamers, to avoid the dangers of the St. Lawrence river and to gain 24 hours over the present route from Montreal. The same company will build along the Gaspe coast, south, for a distance of 100 miles, to a connection with the Atlantic & Lake Superior.

Baltimore & Ohio.—A contract has been given by this company to Thomas A. Shoemaker & Co., of Pittsburg, Pa., for building about three miles of new track on the main line from Hollofields to Alberton, a short distance west of Ellicott City, Md. This is a continuance of the work which has been carried on for several years in straightening the alinement and making a low grade freight line from Relay to Washington Junction, upon which over $2,000,000 has already been spent. The new improvements on which the contractors will begin work at once will cost between $600,000 and $700,000.

Cairo & Tennessee.—Surveys have been completed by this company for building a railroad from Bristol, Tenn., west through Hawkins, Hancock, Claiborne and Campbell counties in Tennessee, and Whitley, Wayne, Clinton, Cumberland, Monroe, Allen, Simpson, Logan, Todd, Christian, Trigg, Calloway, Marshall, Graves, Carlisle and Ballard counties in Kentucky, a distance of about 400 miles. The company is negotiating with a New York trust company for a loan of $12,500,000. Construction work is expected to commence in a short time. New York and Kentucky capitalists are backing the project.

California & Northeastern.—A charter has been granted this company in California with a capital of $5,400,000 to build a railroad from the Southern Pacific at Weed, in Siskiyou County, Cal., north to Klamath Falls, in Oregon, with branches to Rhett Lake and the

Lake of the Woods. The main line will be 100 miles long and the branch 70 miles. The directors are A. H. Naftzger, G. X. Wendling, H. Naething, C. M. Cross and G. E. Bettinger.

CANADIAN PACIFIC.—Work, it is said, will be commenced at once by the contractors, Foley Bros., on double tracking the main line of this road from Fort William to Winnipeg, a distance of about 426 miles. The estimated time for the completion of this work is three years.

This company, it is said, will at once begin work on two lines in Northern Manitoba along the west shore of Lake Winnipeg. One will extend to Gimli and the other to Icelandic river.

Announcement has been made that this company will extend its road from Steveston to New Westminster, B. C., on the north end of Lulu Island, a distance of about 12 miles.

CENTRAL ILLINOIS.—A charter has been granted this company in Illinois with a capital of $50,000 to build a railroad from Roodhouse, Ill., east to Paris, a distance of about 145 miles. Incorporators include: A. S. Somerville, J. Devine and others of Chicago. The road is being built chiefly to accommodate the coal traffic from the Peabody mines.

CENTRAL OF GEORGIA.—The directors of this company at a recent meeting decided to issue bonds for the purpose of securing funds to open up valuable coal fields in Northern Alabama, and to build a road about 10 miles long to connect with its Henry Ellen spur.

CHATTANOOGA & MONTLAKE.—This road, now under construction in Tennessee, will build a branch from a point on its line to the Tennessee River, a distance of about seven miles. (See Construction Record.)

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—An officer writes that contracts have been given for work on the Cairo Division as follows: Tilton-Danville Extension—District A: MacArthur Bros. Co., Chicago, Ill., earthwork, 500,000 yds.; masonry, 3,000 yds.; Bates & Rogers Cons. Co., masonry, 9,000 yds. Tilton to Allendale—District B: W. J. Oliver, Knoxville, Tenn., earthwork, 1,400,000 yds.; Widell-Finley Co., Chicago, Ill., masonry, 15,000 yds. Allendale to Harrisburg—District C: Walsh & Johnson, Davenport, Ia., earthwork, 1,600,000 yds.; Collier Bridge Co., Indianapolis, masonry, 17,000 yds. Lawrenceville Relocation—District D: Wells Bros. & Brown, St. Louis, Mo., earthwork, 250,000 yds.; Moore-Mansfield Construction Co., Indianapolis, masonry, 10,000 yds.

This company, it is said, is to double track its road from Coal Bluff, Ind., to Gale, a distance of 40 miles. Some of the curves and grades will be taken out.

COLUMBIA, CHICAGO & NORTH-WESTERN.—Rights of way are being secured by this company for its proposed road from Columbia, north to Clark, Mo., a distance of about 30 miles.

COLUMBIA SOUTHERN.—This company, which operates 70 miles of railroad in Oregon, is planning to build an extension south from Shaniko, Ore., its southern terminus, for a distance of 50 or 60 miles.

GRAND TRUNK PACIFIC.—Minister of Railways Emmerson is quoted as saying that the Dominion Government has set aside $1,000,000 for immediate work on the Government section of the new Canadian transcontinental line to be used principally for terminals and securing right of way. The Government had decided to own its own terminals at Winnipeg and Quebec.

GREAT BEND & GULF.—A charter has been granted this company in Kansas, with a capital of $1,500,000, to build a railroad from Great Bend, Kan., south to Medicine Lodge, a distance of 80 miles. It is intended to eventually extend the line to a Gulf port to get an outlet by direct route for shipments of wheat from the Wheat Belt. The incorporators include R. C. Otis, B. C. Sammons, H. S. Duncombe, R. Pringle, of Chicago, and F. V. Russell, G. L. Chapman of Great Bend, and others.

GREAT NORTHERN.—This company is building a branch from York, N. D., for a distance of 40 miles. A. Guthrie & Co., of St. Paul, Minn., are the contractors.

HICKS RUN.—A charter has been granted this company in Pennsylvania, with a capital of $100,000, to build a railroad for a distance of 10 miles in Elk and Cameron Counties, Pa. W. C. Arnold, Duboise, Pa., is president.

HOUSTON, BEAUMONT & RED RIVER.—This company has located the line of its proposed road and contracts will soon be let for building the road from Houston, Tex., northeast to Alexandria, La., a distance of about 200 miles.

HUDSON BAY.—A contract has been given by this company to the MacDonald-McMillen Contracting Co. for the first 80 miles of its proposed line. The survey leaves the main line of the Canadian Northern at Erwood and the line runs in a northeasterly direction to Fort Churchill.

JACKSONVILLE, FERNANDINA & SOUTHERN.—A charter has been granted to a company under this name in Florida, with a capital of $250,000 to build a railroad from Jacksonville, northeast through Duval and Nassau Counties, to Fernandina, a distance of about 28 miles. Eugene E. West is president; John R. Young, vice-president; Samuel A. Swann, secretary, and Frank Adams, treasurer. Others interested in the company are: William A. Evans, of Fernandina, and John W. West, of Valdosta.

LEHIGH & LAKE ERIE.—This company has been authorized to extend its main line from East Buffalo to Tifft's Farm, a distance of over 12 miles. Bonds will be issued to secure funds to carry out this work.

LOUISIANA RAILWAY & NAVIGATION.—Surveys have been completed by this company and as soon as right of way has been secured bids will be asked for building a line from Alexandria, La., northeast to Jena, about 30 miles. Rights of way for an extension of the main line from Lutcher, east to New Orleans, 35 miles, have been secured, and bids are asked, August 1, for the grading and trestle work. Bids are also asked for double tracking the incline at Maples and at Angola, where the line of the proposed road crosses the Mississippi river.

MOBILE & WEST ALABAMA.—This company, which was incorporated in Alabama with a capital of $10,000,000, has made surveys from Dolphin Island, Mobile Harbor, Ala., north to Florence, Ala. The proposed road will have main line of 325 miles, and with branches over 375 miles. It is proposed ultimately to extend the road into Tennessee for a distance of about 125 miles farther. The promoters have options on large terminal property at Dolphin Island. The island may be reached by the construction of one draw. The route of the road as surveyed will cross the Louisville and Nashville, Southern Railway, the Mobile and Ohio, and the 'Frisco. The plans include the building a branch 53 miles long into Birmingham to tap the heavy iron tonnage originating at that point. Contracts have been let for this portion of the work. (See Construction Record.)

NEW MEXICO RAILWAY & COAL COMPANY.—The improvements to be carried out by this company according to its last yearly statement, includes an expenditure of $1,000,000 for improvements on its roads, also for the building of large shops at El Paso, Tex., at an additional cost of $500,000.

NEW PARK & FAWN GROVE.—This company has given a contract to John H. Dobbling, of York, Pa., for grading and track laying its proposed road to be built from Stewartstown, Pa., east to Fawngrove, a distance of about nine miles.

NORTHERN MAINE SEAPORT.—Bonds have been issued by this company to raise funds to build about 70 miles of new road from La Grange, in Penobscot County, Me., to Belfast, with branches on both sides of Stockton, at which point terminals are now being built. The Bangor & Aroostook will have a tidewater outlet over this road.

OCEAN SHORE (ELECTRIC).—This company which was organized this spring in California with a capital of $3,000,000, proposes to build an electric road from the Bay of San Francisco to Santa Cruz and Monterey, and is securing the necessary rights of way. Application has been made to the Board of Supervisors of San Francisco for a 50-year franchise for entrance through the streets of that city. Walter E. Dean is president, and Burke Corbert, secretary and treasurer.

OKLAHOMA CITY, HENRYETTA & ST. LOUIS.—This company, which was granted a charter with a capital of $3,000,000 in Oklahoma City, has filed a mortgage for $6,000,000 to secure funds to build its proposed line from Woodward, Oklahoma, southeast to Oklahoma City, thence east of Henryetta and Checotah, in the Creek nation, a distance of about 280 miles. The incorporators include: H. W. Clergen, J. H. Wheeler, J. W. Shartel, J. W. Pryer and J. H. Dibble, all of Oklahoma City.

PENNYLVANIA.—The directors of this road, at a recent special meeting, authorized a change of line from Southwest Junction to Beatty, a distance of three and one-half miles, on the Pittsburg division. This work requires an expenditure of about $1,250,000 and permits the abandonment of Donohoe tunnel, a single track structure about 3,000 ft. long. When this work is completed the present road will be used only for handling eastbound freight. Contracts for part of these improvements have been given to Drake & Stanton and the Columbia Construction Co.

Plans are being made by this company to elevate its tracks in and near Rahway, N. J.

This company, it is said, is planning to secure right of way over the abandoned Lancaster & Delaware River Railroad, 12 miles of which was built over 40 years ago. The proposed route is from Phoenixville, Pa., west to Lancaster.

PENSACOLA & NORTHEASTERN.—A charter has been granted this company in Alabama, to build a railroad from Andalusia, Ala., southwest to Pensacola, Fla., a distance of about 100 miles. In-

corporators include: F. C. Brent, J. S. Avery, C. M. Covington, S. B. Milligan and C. W. Lamar, all of Pensacola.

PHILADELPHIA RAPID TRANSIT.—Construction work has been commenced on the Market street elevated line west of the Schuylkill river.

PITTSBURG, WESTMORELAND & SOMERSET.—This road, which operates a road from Ligonier, in Westmoreland County, Pa., south to Zufall, a distance of 15 miles, has given a contract to H. Frank Stark, a contractor of Greensburg, for building an extension south to Somerset, a distance of about 8 miles.

ROCK ISLAND SOUTHERN.—This company is building an electric road from Galesburg, Ill., west to Monmouth, a distance of 15 miles.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—A contract is said to have been given by this company to Johnston & Gommet Bros., of St. Elmo, Ill., for building the new road from Eudora, Ark., to Gilbert, La., about 78 miles.

Surveys are being made by this company for a line from Henson, Mo., south to a point on the Mississippi river opposite Hickman, Ky., a distance of 25 miles.

SHREVEPORT, ELDORADO & MEMPHIS.—Under this name a charter will be applied for by a company to build a railroad from Shreveport, La., northeast to Homer, about 50 miles, and eventually via Eldorado, Ark., to Memphis, Tenn. A. K. Clingman, Shreveport, may be addressed.

SOUTHEASTERN ARKANSAS.—A charter has been granted this company, in Arkansas, with a capital of $3,600,000, to build a railroad from Leslie, Arkansas, the present southern terminus of the St. Louis & North Arkansas, southeast to Garner, on the St. Louis, Iron Mountain & Southern, and thence to Lonoke, with a branch from the latter to Little Rock, the aggregate distance being 141 miles. It is proposed to ultimately extend the road to a point on the Mississippi river. The officers are: George Sands, St. Louis, president; John Scullin, St. Louis, vice-president; W. K. Smith, Little Rock, secretary, and C. L. Gilbert, St. Louis, treasurer. The Board of Directors consists of the officers named above and David R. Francis, St. Louis; S. W. Reyburn, C. F. Penzel and E. G. Thompson, Little Rock.

SPOKANE & INTERNATIONAL (CANADIAN PACIFIC).—Contracts have been given by this company to Winters, Parsons & Boomer, of Helena, and Grant, Smith & Co., of Chicago, for building its road from Bonners Ferry. These contracts include the heaviest work on the line in Idaho and Washington. It is expected to have the road completed to Sand Point, Idaho, by November 1. About 50 miles of road are now ready for the rails. (June 16, p. 199.)

SUMPTER VALLEY.—Plans are being made by this company, which operates 54 miles of road in Oregon, to build an extension from its western terminus to Prairie City, a distance of about 25 miles.

TACOMA EASTERN.—This company has given a contract to build an extension of its road to Ferndale, Wash. H. Shaw, Tacoma, is chief engineer.

TACOMA TRANSIT.—This company has been incorporated in Maine with a capital of $1,000,000 to build a railroad, probably in the State of Washington. M. W. Baldwin and H. E. Mas[illegible], of Portland, Me., are interested.

TEXAS ROADS.—Plans are being made by Maj. J. D. Beardsley, of Gibsland, La., and others, to build a railroad from Abilene, Tex., to Quanah, a city north on the Fort Worth and Denver line, a distance of about 125 miles through a good farming district, touching the towns of Anson, Haskell and Benjamin.

TOLEDO & JACKSON (ELECTRIC.—Under this name a company will ask for incorporation in Michigan, to build an electric road from Toledo, Ohio, northwest to Jackson, Mich., about 70 miles. It is said that the company has secured all the necessary rights of way, and the franchises. C. R. Bran, William Nagle, S. A. Foster and W. P. Heston, of Toledo, and M. R. Bacon, of Wyandotte, are interested.

VANDALIA.—Surveys have been made to connect the tracks of the Vincennes division of the Vandalia lines with those of the Vandalia proper by the building of one and one-half miles of new track from Maywood, Ind., to the tracks of the Vandalia line, a short distance west of Indianapolis. It is proposed to make the connection for the near future.

YOSEMITE SHORT LINE.—The shareholders of this company will vote next month to issue bonds to raise funds to build a 60-mile extension from the Sierra Railway to a point in Tuolumne County, California, into Yosemite Valley, with a branch from Crocker Station to the Hetcho Hetchy Valley, for which surveys have been completed.

WABASH-PITTSBURG TERMINAL.—An agreement has been completed between the United States Steel Corporation and the Wabash-Pittsburg Terminal Railroad for the immediate construction of a connecting link between the Union Railroad, belonging to the United State Steel, and the West Side Belt Railroad. One-half of the connecting line is to be built by the Wabash-Pittsburg Terminal and one-half by the Union Railroad.

RAILROAD CORPORATION NEWS.

CANADIAN NORTHERN.—The Canadian Northern Prairie Lands Co. has been incorporated at Toronto, with $5,000,000 capital stock, to buy from the Canadian Northern Railway Co. a part of its land grant.

CENTRAL OF NEW JERSEY.—This road is reported to have bought the New Jersey Terminal Railroad, which has six miles of track, connecting with the Central of New Jersey at Carteret, N. J. It serves an important manufacturing district. It has a capital of $500,000 and a funded debt of $250,000.

CHOCTAW RAILWAY & LIGHTING COMPANY.—This company has been organized, with $500,000 capital stock, as the successor of the Indian Territory Traction Co., whose $450,000 bonds remain outstanding.

CUBA RAILROAD.—The Cuban House of Representatives has authorized a loan of $798,450 by the state to this company, without interest, to run until 1917. This loan is secured by a lien on the income derived from the carrying of mail and from other government transportation. The purpose of the loan is to cover interest charges on the company's bonded debt for the next three years, in order that all net earnings may be used for betterments.

DANVILLE, URBANA & CHAMPAIGN (ELECTRIC).—John Christensen & Co., of Philadelphia, are offering for sale the unsold portion of $1,500,000 first mortgage 5 per cent. bonds of 1923. This is part of a total authorized issue of $2,000,000. These bonds are guaranteed by the Danville Street Railway & Light Co. and the Urbana & Champaign Railway, Gas & Electric Co., and are further secured by $1,200,000 capital stock of these two companies. The Danville, Urbana & Champaign Railway is 56 miles long and operates these other two companies.

INDIAN TERRITORY TRACTION.—See Choctaw Railway & Lighting Co.

MASSACHUSETTS ELECTRIC COMPANIES.—A meeting of the stockholders has been called for July 28, to vote on an issue of $3,500,000 five-year 4½ per cent. collateral notes, $2,700,000 of which is to be used to retire the 4½ per cent. coupon notes maturing January 1, 1906.

MISSOURI, KANSAS & TEXAS.—Application has been made to the New York Stock Exchange to list $1,484,000 first and refunding mortgage 4 per cent. bonds of 2004.

NEW YORK & OTTAWA (N. Y. C. & H. R.).—A mortgage for $2,500,000 has been made to the Guarantee Trust Co., of New York, as trustee, to secure $2,500,000 4 per cent. gold bonds of 1955.

NEW YORK CENTRAL & HUDSON RIVER.—This company, through Horace E. Andrews, has acquired the Rochester & Eastern Rapid Railway (Electric), which operates 44½ miles of track between Rochester, N. Y., and Geneva, and is building a branch from Canandaigua to Phelps, 14 miles. It has $1,500,000 capital stock and $1,500,000 first mortgage, 5 per cent. bonds due in 1933.

ST. LOUIS & SAN FRANCISCO.—Application has been made to the New York Stock Exchange to list $1,107,000 additional refunding mortgage 4 per cent. bonds of 1951, which will make the total amount listed $60,104,000, and also, $957,000 additional 4 per cent. refunding mortgage bonds of 1936 of the Kansas City, Fort Scott & Memphis. This will make the total amount of the latter issue listed $17,810,000.

UNION PACIFIC.—A semi-annual dividend of 2½ per cent. has been declared on the common stock. The first payment on the common stock was in 1900, when an annual dividend of 3½ per cent. was paid. Since then dividends have been paid at the rate of 4 per cent. per annum.

VIRGINIA & TRUCKEE RAILROAD.—The shareholders have authorized the sale of this company's property to the Virginia & Truckee Railway Co., recently incorporated with, it is said, an authorized capital stock of $7,000,000 . The road runs from Reno, Nev., on the Central Pacific, to Virginia, 52 miles, and an extension from Carson City to Garnerville, 20 miles, is projected.

WESTERN MARYLAND.—According to Wm. A. Read & Co. and George P. Butler & Bro., who are offering a block of the authorized issue of $50,000,000 first-mortgage 4 per cent. 50-year gold bonds, of which $31,923,000 are already outstanding, the connecting line, 59 miles long, between the Western Maryland and the West Virginia Central & Pittsburg, which will give the Gould lines an eastern extension to tidewater at Baltimore, will be completed about Nov. 15.

GENERAL NEWS SECTION

NOTES.

Automatic block signals are being put up on 71 miles of the Union Pacific between Green River, Wyo., and Table Rock.

The Wabash Railroad is to abandon the pay car and pay employees by means of checks, which will be sent to division officers and to agents for distribution.

A press despatch from Montgomery, July 30, says that the Alabama Railroad Commission has ordered substantial reductions in freight rates on all the railroads of the state.

The grain elevators of the Great Northern at Duluth have been leased to A. D. Thomson & Co., a large grain firm. The total capacity of the three elevators is 6,500,000 bushels, one alone having a capacity of 3,000,000 bushels.

The city authorities of Atlanta, Ga., have notified the railroads that henceforth the state and city laws forbidding the movement of freight cars on Sunday, except those containing perishable freight, will be enforced in the Atlanta yards.

A press despatch from Washington says that the amount of money paid into the treasury in two weeks by railroads, in the shape of fines for violating the 28-hour live stock transit law, was $20,000. This probably represents 200 violations.

On the evening of July 24 one of the regular express trains of the Pennsylvania Railroad from Broad street, Philadelphia, to Atlantic City, ran through in 63 minutes, the distance being 69.4 miles. Stops were made at West Philadelphia and North Philadelphia.

The State Board of Health of Indiana has promulgated a sanitary code for railroads. Day coaches must be cleaned at the end of each trip. In no case shall they be uncleaned longer than two days. In all waiting rooms notices prohibiting spitting must be posted.

At the "Traction Terminal Station" in Indianapolis six electric railroads now have freight stations. The Indianapolis & North-Western runs freight cars eight times daily between Indianapolis and Lafayette and the same number between Indianapolis and Crawfordsville. Each of the electric roads has a freight agent at the terminal.

The Supreme Court of Florida has affirmed the decision of a lower court holding unconstitutional the law recently passed in that state requiring the separation of the white and black races in street cars. The act is declared invalid because, in permitting negro nurses in charge of white children to ride with the whites, it discriminates between persons.

One of the news items lately appearing in the daily press, which isn't so, is that speed indicators are to be put into cabooses of the Delaware & Hudson. For a long time, until a few years ago, speed indicators were in use in the freight cabooses of that road, but they have been taken out, and an officer of the road informs us that there is no intention of replacing them.

The contract which the Union Switch & Signal Company has taken for automatic block signaling on the Lake Shore & Michigan Southern, recently noticed in the *Railroad Gazette*, is for about 400 miles of line, all of it double track, except short pieces on which there are four tracks. The amount of the contract is more than $1,000,000, said to be the largest signal contract ever made.

At Tribes Hill, N. Y., on the New York Central, one day last week six men in a work train gang were killed by a passenger train, and three others fatally injured. The men were leveling sand which had been dumped along the track, and when they stepped out of the way of a westbound freight train stepped in front of an eastbound passenger. It is said that the sand was so whirled about by a high wind that the view of the approaching train was obscured.

The Railroad Commissioners of Texas are to hold a public hearing on the question of rates for refrigeration in refrigerator cars. Some investigation has been made already, and it is said that one contract shows that a Texas line pays the American Refrigerator Transit Company 1 cent a mile for all its refrigerator cars [illegible], loaded or empty; gives its employees free transportation [illegible] company the free use of the railroad telegraph wires, and pays it 12½ per cent. of the gross freight earned by the cars.

Cement rock has been discovered in New York City, or at least so it is asserted by a reporter who has found large piles of the rock around the shaft in which is being sunk the caisson for the Pennsylvania Railroad tunnel at the foot of East Thirty-fourth street, Manhattan. The deposit of rock was found by the tunnel diggers about 100 ft. below the surface and large quantities have already been taken out. The reporter says, however, that the contractors and workmen on the tunnel refuse to give any information as to the origin of the rock.

The prescribed time for running a freight train over the Middle division of the Pennsylvania Railroad, which has been 22 hours, has been changed to 18 hours. The length of this division is 132 miles, Harrisburg to Altoona; which indicates that the time named is that allowed for a round trip. At 15 miles an hour a train needs nearly nine hours to run over the division one way. At 20 miles an hour the running time would be 6 hrs., 36 min. This, under an 18-hour schedule, would allow the crew about five hours for rest at the far end of the division. A similar change has been ordered on the Pittsburg division, which extends from Altoona to Pittsburg.

The Chicago, Rock Island & Pacific is trying an experiment to head off the construction of an electric line between Des Moines, Iowa, and Indianola. Heretofore three passenger trains have been run each way daily, but commencing July 23 the company began running six trains each way daily, or every three hours. The officials are evidently exercised by the encroachments of the electric interurban lines. During the past three years two interurban lines have been built in Iowa paralleling the Rock Island, one from Des Moines to Colfax, 23 miles, and the other from Iowa City to Cedar Rapids. In both cases the interurban lines have taken over about all of the local passenger and freight traffic between the points mentioned, and in many instances passengers from distant points on the railroad have taken advantage of the cheaper rates on the interurban lines by stopping at one or the other of the terminals mentioned and taking the interurban for the remainder of the trip.

In the United States Court at Kansas City, August 1, the Atchison, Topeka & Santa Fe filed its answer in the proceedings lately begun by the Government against the road for contempt of court, in violating the injunction against secret rates, which was issued against all of the roads in the West two or three years ago. The complaint in the present case has to do with rates on coal shipped by the Colorado Fuel & Iron Co., which have been the subject of so much newspaper discussion in connection with the accusation of law-breaking against former Vice-President Paul Morton. The company's answer says that prior to the injunction the Atchison, having found that its competitors were secretly cutting rates, also secretly cut its own rates; that when the Interstate Commerce Commission investigated the case Vice-President Morton freely described the methods of the Atchison, in order to aid in stopping unlawful practices; that on the issuance of the injunction the traffic managers of the Atchison notified agents to comply with it, and that the unlawful tariff subsequently issued by the road was prepared by the traffic manager, who inadvertently, without any desire to avoid the order of the court, included the cost of the coal in the published prices for transportation. The payment of the shippers for their coal and the collection of the sum from the consignee was to facilitate business, and not to afford a vehicle for rebates.

Yellow Fever.

Yellow fever has prevailed to some extent in New Orleans for more than two weeks, and the total number of cases reported up to August 1 was 346. The total number of deaths in the city to that date was 62, and a few cases had been discovered in other towns, one of them in Plaquemine Parish, 100 miles from New Orleans. In consequence of the confidence now entertained by the authorities in their ability to control the disease by killing mosquitoes, the public alarm has not been so serious as in former years; but a considerable number of quarantines have been established, and many merchants have stopped ordering goods from New Orleans, so that traffic has already been seriously affected. Most, or all, of the railroads have taken off some of their passenger trains to and from New Orleans. The last yellow fever epidemic in the Southern States was in 1897.

The Chicago Teamsters' Strike.

The teamsters' strike, which terminated last week with a rush of the men to get positions with their former employers, had lasted 15 weeks. The following statistics of the strike are given by the *Evening Post*: Strike called, April 6; ended, July 23. Men thrown out of employment, 4,250. Cost to the unions, $300,000. Wages lost by strikers, $750,000. Cost of the strike to the employers, $2,100,000 in wages, and loss of business estimated at more than $12,000,000. Cost of the strike to the city, $175,000, and to the county, $100,000. Persons injured by the strike, 450; deaths, 21. To preserve peace there were 2,200 policemen, 1,400 specials, and 3,400 deputy sheriffs. The strike started over an attempt to uphold 16 little tailors who went out on a strike. There was at no time any question of wages or hours among the teamsters, but they went out on a sympathetic strike.

Royal Commission on London Traffic.

The following is a digest of the report: The Commission, appointed on Feb. 9, 1903, by Royal Warrant, consisted of Sir David Barbour, Chairman; the Right Hon. Earl Cawdor, the Right Hon. Viscount Cobham, the Right Hon. Lord Ribblesdale, the Right Hon. Sir Joseph C. Dimsdale, Bart.; Sir John P. Dickson-Poynder, Bart.; Sir Robert Threshie Reid, Sir John W. Wolfe-Barry, Sir Francis J. S. Hopwood, Sir George C. T. Bartley, Sir George S. Gibb, Mr. Charles S. Murdoch, Mr. Felix Schuster, Mr. Lynden Macassey, Secretary. The Chairman, four other members and the Secretary visited New York, Boston, Philadelphia and Washington in 1903, and studied American rapid transit.

The population of Greater London in 1901 was 6½ million persons, and the number of rides per capita per annum, by all local means of transport excluding trunk line railroads, is 200, compared with 300 in New York and 270 in Berlin, thus indicating statistically a substantial comparative deficiency. Particularly in relation to the working classes, facilities for locomotion are deficient. Under existing conditions, the serious over-crowding in the central districts of London cannot be alleviated; the population per acre in those districts is 148, in the rest of the county of London 54; in districts adjacent to the county 16.6; and in the rest of "Extra London" 2.5. Upwards of 1½ millions of persons live in the central districts. In the central districts the average weekly rent of newly-erected working class houses is 3s. 3½d. per room, in the rest of the county 2s. 4½d., and in "Extra London" 2s.

The only difficulty in the way of completely reorganizing London for purposes of locomotion is, the Commission says, the question of cost. The ideal scheme is the construction of railroads in London for purposes of long distance urban traffic, and of railroads radiating to the suburbs for purposes of suburban traffic, connected with tramways for short distance distribution; the widening of existing and provision of new streets for local urban traffic, and the regulation of street traffic to prevent or reduce congestion, and the provision of complete facilities for passenger interchange. The most important proposal calls for the construction of two main avenues through London, one 4¾ miles from west to east to connect Bayswater Road with Whitechapel, the other 4½ miles north to south to connect Holloway with the Elephant and Castle. Each avenue would be 140 ft. in width, from house to house, with subways for water mains; with four lines of tramway on the surface, and four lines of railway below the surface, for express and local stopping trains. The east and west avenue, with its subways, railways, and tramways, is estimated approximately to cost about £15,550,000, and the north and south avenue about £8,550,000 net.

The Commission, after consultation with the Advisory Board, recommends that new streets or widened streets should forthwith be laid out according to the following standards of width from house to house: Main avenues, 140 ft.; first class arterial streets, 100 ft.; second class streets, 80 ft.; third class streets, 60 ft.; fourth class streets, 40 or 50 ft.

As regards tramways, even where they now exist there is an entire absence of through communication between the systems, and every through passenger is obliged to change cars at the junctions, if any, of the various systems. Accordingly, all the cars are obliged to discharge their passengers at dead-end terminals. At the six principal terminals nearly a quarter of a million of passengers alight from, or join the cars every day in the streets. Apart from the great inconvenience caused, the result is a very great congestion, both of tramcars, and of ordinary vehicular and pedestrian traffic, at these terminal points. The Advisory Board of Engineers estimates that the carrying power of a tramway system may be diminished by about one-half by reason of the cross-shunting necessary at dead-end terminals. It will be seen that, from every point of view, tramway accommodation is glaringly defective. In a great area, there is no tramway service at all. It is difficult to appreciate how such a state of things can have been tolerated so long.

In smaller cities, tramways supply a double want. They carry passengers from one part of the city to another, and also between the city and adjoining areas, to a distance of eight or ten miles. In London, it is probable that their usefulness will be more restricted. They will be chiefly used for short distances in urban and suburban districts. Experience shows that the metropolitan railways, even where no tramways compete, practically do not attract passengers for journeys of less than a mile. Railways and tramways can, with advantage, be worked in inter-connection. "Tubes" might be prolonged till they reach the surface, at some point in the more open country, and then be continued on the surface to the suburbs.

The competitor of the tramway for short distance traffic is the omnibus, and the horse omnibus, it is said, will always serve a useful purpose in London, unless superseded by the motor omnibus, in distributing passengers where tramways do not penetrate, but the Commission believes that on all the routes, where there is fair competition, the same thing will happen in London as happened in Liverpool between the years 1897 and 1903. Within a period of seven years all the omnibuses disappeared from the streets and gave place to electric tramcars, while the number of passengers carried was nearly trebled. Few would object to an extensive tramway system being laid down all over London, but for the belief that it must involve an extensive system of street widening. This is the great difficulty.

Judged by the standards of width, many of the main thoroughfares of London will admit of tramways. Of course the decision must depend partly upon the extent to which the street is crowded, as well as upon its width. Certainly some street improvement is necessary in places, from any point of view. Through communication, without rebooking or trans-shipment of passengers, is of great importance, and it is desirable that all tramway systems within Greater London ought to be worked by one and the same authority. The Commission does not deal directly with the question of the municipal operation of tramways, but considers it reasonable that some profit should be derived from the tramways for the benefit of the municipality. It does not follow that the best way of securing the largest profit will be that the municipality, even if it finds the money for construction, should undertake the task of operating.

The Commission strongly recommends the consolidation of the tramway and light railway laws, and would abolish the veto power of local and street authorities and of frontagers, and provide that, in Greater London, the County Councils and the Corporation of the City of London shall have a preferential right to construct any tramways, within their districts, if they are prepared to do so.

The needs of London in the matter of railroad accommodation, according to the report, are:

(1.) Main trunk railroads connecting London with the entire railroad system of the country, with adequate running and terminal accommodation, and sufficient services for the convenient and speedy conveyance of long-distance passengers, and for the carriage of merchandise traffic.

(2.) Railroads to every suburban district in the neighborhood of London, with full running accommodation to enable trains to be run at quick speed and short intervals, especially during "rush hours."

(3.) Railroads in, through, across, and round the center area of London, to provide, not only for urban movement at higher speeds, and for longer distances than those which can be conveniently provided for by street tramways and omnibuses, but also for the distribution of suburban and long-distance passengers to the fullest practicable extent.

The needs of urban and suburban traffic are, the Commission points out, wholly different in character, and many of the mistakes of the past have been due to not keeping this distinction in mind with sufficient prominence. The considerations affecting location, accommodation and working of urban and suburban railroads are radically different, and, to some extent, conflicting; and the absence of comprehensive design in the railroad system in London is nowhere more apparent than in the confusion which has arisen from not distinguishing, with sufficient clearness, between the requirements of these different classes of traffic. Railroads intended for urban traffic have been used, and partly designed, for suburban traffic to an extent, and under conditions, which have adversely affected their utility for both purposes. It is of vital importance not to attempt to use urban railroads in any way, or for any purposes, which may prevent the running on them of train services of maximum frequency.

With regard to the building of further "tubes," the Commission believes that a sufficient number of successful underground railroad schemes remain to justify the hope that there is no need, as yet, to make an alteration in the present system of private promotion in the direction of looking to public sources for any part of the funds required for railroad enterprise, unless undue financial obligations are thrown upon the railroad undertakings, either in respect of works or compensation, or in regard to the carriage of passengers at unremunerative fares, or otherwise.

If public assistance is inevitable, the Commission suggests various methods of assistance—the remission of rates, direct subscription to capital or guarantee of receipts by local authorities, permission to railroad companies to acquire large tracts of land before development, and, in cases, permission for construction underneath the parks.

The existing defects of the means of locomotion and transport in London are, in the opinion of the Commission, due mainly to the haphazard manner in which questions connected therewith have been treated in the past. The streets were not originally laid out on any general plan, nor were they made of sufficient width. No general and systematic improvement of the streets of London has ever been attempted, and the works carried out have not been sufficient to meet the ever-growing wants of the population, and the construction and maintenance of the main roads leading out of London have never been properly controlled or regulated. Under such conditions the best results could not be obtained. The method of obtaining Parliamentary sanction is both costly and inefficient without any attempt to bring proposal into harmony with a gen-

eral and comprehensive scheme of locomotion for London. Railroads of all classes have been practically left to private promoters, subject to such regulation as could be enforced by the intermittent control of Select Committees of Parliament. The only effective remedy appears to be the creation of a permanent authority, possessed of special knowledge and experience, and giving continuous attention to all questions affecting locomotion and transport in London.

It would be impossible to confer the necessary powers, with jurisdiction over the whole of Greater London, which extends into five adjoining counties, on the London County Council or any other existing local authority or body, and the creation of a new authority, empowered to deal finally with all questions of London locomotion, would involve intolerable interference with the existing local authorities, and give rise to endless friction. Nor would it be possible to entrust such powers to a new and elected authority, without an interference with existing institutions, so violent as to amount almost to a municipal revolution.

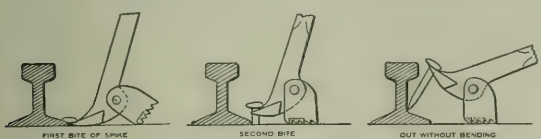
The authority which the Commission recommend to be established should be a Traffic Board, and should discharge definite and practical duties. It should make a yearly report to Parliament on locomotion, transport and traffic in Greater London, dealing with the whole subject, including such matters as the control of traffic, the provision of new lines of railway or tramway, etc. It would also deal with the question of street improvements. The most important function of the Board would be the preliminary examination, before consideration by Parliament, of bills seeking statutory powers for the construction or extension of works affecting the means of locomotion and transport in Greater London. The board would sit continuously, and bills that required serious amendment could remain before the Board until the necessary antecedent formalities were completed.

It might also hear and determine all disputes relating to through running or the interchange of traffic on or between railroads and tramways, and could perform a useful service by facilitating and suggesting amalgamation or joint working under suitable conditions. The services of the Board would be valuable in connection with the abolition of the "veto" in the case of tramways, because the existence of such a body would, at any rate, lessen the objection to such a measure on the part of the authorities now possessing the "veto."

It will be seen that the functions of the Board are of an advisory and semi-judicial character, and do not, as recommended for the present, involve the exercise of executive or legislative authority. What is required for such purposes, in the opinion of the Commission, is a small number of specially-qualified persons, selected solely on the ground of their competence, and holding office for a considerable period.

The Justice Spike Puller.

The accompanying illustration shows the action of the Justice spike puller, made by P. S. Justice & Co., 421 Chestnut street, Philadelphia. The bar starts the spike in the ordinary way, then the handle is thrown up and the trig falls down, giving a new bite for the second pull. It is claimed that the spikes are never bent, and can be drawn in half the time taken with the common claw bar. The weight of the puller is 30 lbs.



The Justice Spike Puller.

Disastrous Collision of Electric Cars at Hall Road, England.

Press despatches of July 27 report a collision, on the evening of that day, on that portion of the Lancashire & Yorkshire which was recently electrified. An express train from Liverpool for Southport ran into a standing train of empty passenger cars. The leading car of the express was crowded and 23 persons were killed. Many were injured, most of them slightly. The body of the first car was lifted off the frame and fell back upon the passengers. The wreck took fire at once and many of the passengers were burnt. This is the most serious accident reported on a British railroad since the Armazh disaster of 1889, 16 years ago.

The local service from Liverpool ends at Hall Road, and the train service consists of local trains from Liverpool to Southport every 20 minutes, with a local stopping service from Liverpool to Hall Road in between, so that there is a 10-minute service from Liverpool to Hall Road. Express trains running without a stop from Liverpool to Birkdale (part of Southport) run every hour, and it was apparently one of these trains that ran into one of the Liverpool-Hall Road local trains.

All the trains consist of four cars, two first class (in the center) and two thirds. At the busy hours when the city men are returning to their homes the carriages are crowded and this probably accounts for the big death roll.

The line is properly protected by the absolute block system and fixed signals with distant signals the regulation distance out (at least 1,800 ft. from the stop signal is the Lancashire & Yorkshire rule). The line is quite open at this point and consequently the collision must have been due to either the towerman's error in allowing the express to approach or to the motorman losing control. It is hardly likely that the man overran his signals, as under English rules he would have to pass two sets of signals—one at the tower in the rear and those protecting the standing train.

It may be interesting to state that there are no automatic signals on this road. Whilst the Lancashire & Yorkshire has done considerable with track-circuit and has put down a set of the Westinghouse automatic signals, yet nothing of the kind has been done on the Liverpool-Southport line, nor are there any automatic stops. Possibly had there been such an appliance the accident would not have occurred or its results probably would have been modified. There are, however, difficulties in the way of the provision of such safeguards on the Southport line. For instance the freight traffic is still worked by steam power; also another company, the London & Northwestern, has running powers over the greater part of the line and its trains are worked by steam.

It may be stated in connection with this matter that on the Metropolitan District Railway, recently converted from steam to electricity, automatic signals have been provided throughout by the Westinghouse Brake Company, and automatic stops are also used. There is an overlap of 300 ft. and the stop is at the home signal, there being no distant signals. Overlaps are of this standard length regardless of grade and curvature of the line. But the Southport line is different. Firstly, it is all in open country with a good view of the line and signals as a rule, and were automatic stops proposed the question would arise as to where they should be placed. If at the stop signal they might not be effective in case a train was immediately on the other side of the stop signal. Then, at the distant signal they would go to opposite extremes and pull up the train prematurely and often unnecessarily, and would be bound not only to cause delay but its utility would be abused and deprecated. To fix it midway between the home and the distant signal would not meet the case, as much would depend upon the speed of the trains and the grade of the line.

This accident must be a source of great anxiety to the Lancashire & Yorkshire officers. Two years ago they had a serious accident at Waterloo near the same place, before the line was electrified, when a Southport express left the rails from some still unknown cause and several lives were lost. They have now spent a considerable sum of money in electrifying this line, an outlay which Mr. Aspinall, the General Manager, admitted at the Washington congress has not led to any reduction in expenses of working. But they are hoping to reap their reward by the popularity of the road, especially amongst Liverpool business men whom they hope to attract to reside on the Southport line. This accident must therefore have a retarding effect on these efforts and one must sympathize with the railroad company, and with Mr. Aspinall in particular, to whose personal initiative this change from steam to electricity was due.

The cars used on this line are not of steel and when the matter is fully looked at it will be admitted that the railroad company might consider that the increased expense would not be justified. The line does not run at any point through a tunnel and, as has already been said, the country is open. It hardly seems necessary then, coupled with the high average immunity from accident in England, for any such increased expense to be incurred in order to mitigate the effects of a collision. Such a conclusion may, however, be modified if it be correct that the wreckage caught fire.

Delightful Delaware.

Dover, Del., July 18.—Seven hundred and fifty-three loaded cars of vegetables and fruits, grown on the Delaware peninsula, were moved up through Delaware and into Pennsylvania, New York and New England yesterday. It was the greatest day in history for the Delaware peninsula's business of supplying the East with fruits and vegetables, and on the little Delaware railroad, besides a heavy passenger traffic, these 30 or 40 tremendous freight trains were moved with great despatch and without accident. Peaches, although only a side issue, were in evidence everywhere. Each peach grower averaged 50 baskets. Apples were shipped from almost every Kent and Sussex shipping place of importance. Plums of several varieties made a beautiful sight as they glistened in the sunlight at three score of stations. Watermelons, cantaloupes, early grapes and garden truck were shipped in large quantities. The largest shipments to Philadelphia were of potatoes. This staple product has been overgrown in Accomac and Northampton Counties, and they are scarcely paying for the picking. So productive were the vines this year, highly fertilized with nitrate of soda and other strong plant foods, that as many as 100 bushels to the acre have been produced. It is estimated that the yield of these counties alone this year will be 1,250,000 bushels. This has already lowered the price to 75 cents a barrel.—*Wilmington News.*

Proposed Consolidation of Car Builders.

The long-pending project of consolidating the fifteen or twenty companies which build street cars in the United States is now the subject of widespread comment, and some of those interested say that the success of the project is assured. Messrs. Kean, Van Cortlandt & Co., bankers, of New York, are the managers of a syndicate which, it is said, will carry out the consolidation; and they expect to get enough subscriptions to the stock and bonds by the middle of August to assure their success. It is proposed to issue stock and bonds amounting to fifty-six millions, as follows:

20-year 5 per cent. gold bonds	$13,000,000
Preferred stock, 6 per cent. cumulative	15,500,000
Common stock	27,500,000
Total	$56,000,000

The shops included in the consolidation are the following:

J. G. Brill Co., Philadelphia.
John Stephenson Car Co., Elizabeth, N. J.
Laclede Car Co., St. Louis.
St. Louis Malleable Casting Co., St. Louis.
American Car Co., St. Louis.
Cincinnati Car Co., Cincinnati.
St. Louis Car Co., St. Louis.
Wason Manufacturing Co., Springfield, Mass.
Osgood Bradley & Sons, Worcester, Mass.
John J. Cummings Car Co., Paris, Ill.
Jewett Car Co., Newark, Ohio.
J. M. Jones Sons, Agents, Troy, N. Y.
Laconia Car Co., Laconia, N. H.
McGuire-Cummings Manufacturing Co., Chicago.
Peckham Manufacturing Co., Kingston, N. Y.
Niles Car Manufacturing Co., Niles, Ohio.
Journal Bearing Co., St. Louis.
Easy Access Door Co., Boston.

The average annual net earnings of the companies named for four or five years past aggregate $1,263,391, and the last year's net earnings were $1,381,710. It is estimated that the net earnings of the new company for the first year will be $2,400,000. It is said that the present owners of the plants will take at least $15,400,000 of the bonds and stock, or $8,500,000 of the bonds, $10,300,000 of the preferred and $6,300,000 of the common stock. Edward Harrison Power and William T. Van Brant have been the principal promotors of the scheme for consolidation. It is estimated that the production of the consolidated plants will be about $15,000,000, on which a saving of 10 per cent., or $1,500,000, is expected to be made by reduction of expenses, and the company will save the expense of considerable litigation, which in the past has been the cause of much loss to the constituent companies.

A number of the plants are equipped for turning out freight cars, steam railroad cars and steel street cars. It is announced that Martin Brill, of the J. G. Brill Co., of Philadelphia, has consented to become the president of the proposed company.

Passes for Southern Pacific Employees.

On the Southern Pacific Lines in Texas passes are now given to train despatchers, station agents, conductors and engineers, as follows:

To those who have served over ten years and less than fifteen years, annual passes for each over the division on which he is employed.

To those who have served over fifteen years and less than twenty years, annual passes will be issued to each for himself and his wife over the division on which he is employed.

To those who have served more than twenty years, annual passes over the entire system will be issued to each for himself and the members of his family dependent upon him.

Increase of Wages on the "O. W."

The New York, Ontario & Western has increased the pay of freight enginemen on large engines from $4 a day to $4.25; enginemen on other engines from $3.75 to $4. Conductors, both passenger and freight, are advanced 10 cents a day, passenger conductors now receiving $3.60 and freight conductors $3.30. Firemen are advanced 10 cents a day, and will now receive on large freight engines $2.60; on passenger engines, $2.20, and on switching engines $2.20. Brakemen are advanced 10 cents, to $2.30.

Passes and Bribery.

A railroad manager, quoted by the *Wall Street Journal*, says that the liberal use of free passes among legislators and public office holders is necessary to prevent hectoring legislation; that if every railroad corporation in the State of New York should cut off every annual pass that it has issued to people in public life and discontinue its trip passes, before another year had passed there would not be a train running faster than 20 miles an hour, and it would cost one-third more for operating expenses; and there would be a flood of municipal and state legislation enacted that would practically tie up the railroads; not that such legislation is needed, but it would be passed and enforced because the passes were not issued.

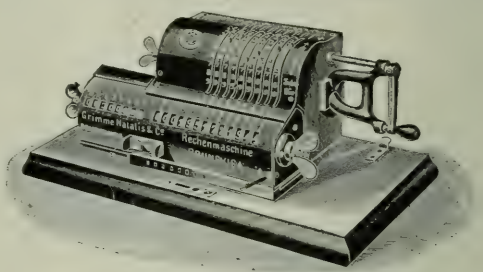
Perhaps this railroad manager thinks that the people would submit to such conduct on the part of their representatives, but he is mistaken. No doubt the free pass secures immunity from petty blackmailing efforts in legislative bodies, but probably the railroads keep up the bribery rather to prevent legislation of a justly reformatory kind.—*Springfield Republican.*

Electric Train Service on the Long Island.

The electric train service on the Long Island Railroad from Flatbush avenue to Rockaway Beach was inaugurated July 26. Twelve round trips were made and a total of nearly 5,000 passengers carried. The first train left Rockaway Park at 7.55 a.m., arriving at Flatbush avenue, a distance of 16 miles, in 35 minutes, after making 13 stops. This is about five minutes less than the running time under the steam schedule. As soon, however, as the work now in progress of removing the remaining grade crossings is completed, it will be possible to reduce the time of the trip still further. The next section of the road to be operated by electricity will be the line from Woodhaven Junction to Jamaica and Springfield. This, it is expected, will be ready very soon. Later in the year it is probable that electric trains will be running on the North Division, through Flushing to Whitestone and Port Jefferson.

The Brunsviga Calculating Machine.

The accompanying illustration shows a form of mechanical calculating machine which is in extended use in Europe and has been introduced in a number of large commercial offices in this country. It performs the four principal functions of arithmetic, multiplication, division, addition and subtraction, and is adapted for much more complex calculations such as square root, foreign exchange, ratios, etc. It is simple and strong in construction, cannot get out of order and it is claimed that learning its manipulation is only a



The Brunsviga Calculating Machine.

matter of a few minutes practice. After having "set" the necessary figures for the calculation on the cover plate by means of the small levers, the working consists of turning the handle at the side and moving the lower figure case or slide. The figures are always visible during a calculation and if a mistake is made it can at once be rectified by turning the handle in the opposite direction, thus avoiding the necessity of commencing again at the beginning of the calculation. The machine is especially adapted for multiplication and division, and is, of course, absolutely accurate. It is made in three sizes, having 18, 13 and 9 figures respectively for the products. The larger sizes are fitted with a belt which rings when the calculation is beyond the capacity of the machine. The machines are made by Grimme, Natalis & Co., Lim., of Brunswick, Germany, and are sold in the United States by Felix Hamburger, 90 William street, New York.

Manufacturing and Business.

The Philadelphia & Reading Coal & Iron Co. is making plans for putting up a new modern coal storage plant at New Bedford, Mass., in addition to the present one.

A quarterly dividend (No. 154) of $2 a share from net earnings has been declared by the Pullman Co., payable August 15 to stockholders of record at close of business July 31, 1905.

The South Atlantic Car Manufacturing Co. is reported to have bought the plant of the Georgia Car & Manufacturing Co. at Savannah, Ga., and will begin equipping and operating it at once.

The Missouri, Kansas & Texas cars, the specifications for which were printed July 21, will be equipped with Trojan couplers. A typographical error in the previous item had it "Logan" couplers.

The Berwind-White Coal Mining Co., it is said, has bought 50 acres of ground near Hollidaysburg, Pa., to be used as a site for building new works. The company will make steel cars to be used to transport coal from its mines.

R. D. Hunter, formerly District Manager of the Sullivan Machinery Co. at Denver, Col., has been made General Sales Manager, with headquarters in the Railway Exchange Building, Chicago. W. P. J. Dinsmor, of the Denver office, succeeds Mr. Hunter as District Manager at that point. Matthew Brodie, formerly of the Pittsburg office, has been appointed local manager of the Salt Lake branch, with offices at 128 Keith Building.

The Westinghouse Electric & Manufacturing Co. has booked orders from Nelson Morris & Co. for 19 new type induction motors and

from the Decatur Car Wheel & Manufacturing Co. for eight motors of the same type; also from the Illinois Steel Co. for 80 direct-current railway type motors; from the Hawaiian Electric Co. for two 1,200-kw. three-phase 2,200-volt engine-type generators, and two 125-kw. exciters and seven 500-kw. oil-insulated self-cooling transformers; from the Rumford Falls Power Co. for one 550-kw. and one 800-kw. alternating-current generators, two 450-h.p. variable-speed induction motors and 120 transformers.

The J. G. Brill Company has just booked an order for 35 semi-convertible cars for the Memphis Street Railway. The cars were ordered through the engineering firm of Ford, Bacon & Davis, of New York City. The semi-convertible system includes the recent improvement eliminating the sash trunnions and runways formerly used and simplifies the method of connecting each pair of sashes. The arrangement is known as the "Grooveless Post Semi-Convertible," and has been specified in recent orders from Philadelphia, Boston, Baltimore and elsewhere. The general plan of the lower sash carrying the upper into pockets in the side roofs is preserved. The cars are for fast and heavy city and suburban service. They will measure 30 ft. 6 in. over the end panels and 42 ft. over all.

Iron and Steel.

The American Bridge Co. has ordered 25,000 tons of structural material in the last few days. Part of the order, amounting to 7,000 tons, is for the frame work of the American Express Co.'s building at Trinity place, New York.

The Maryland Steel Co. recently shipped from Sparrows Point, Md., a cargo of railroad material for Cuba. The cargo was valued at more than $100,000 and included 11,135 steel rails, 4,666 bundles of splice plates, 394 kegs of spikes, bolts, etc., and 11,920 reels of barbed wire fencing.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Car Foremen's Club.

The place of meeting for this club in Chicago has been changed to 26 Van Buren street, Room 218. The next regular meeting will be held there August 8. P. H. Eskridge, Secretary.

Traveling Engineers' Association.

The thirteenth annual convention of the Traveling Engineers' Association will be held in Detroit, Mich., beginning September 12. Headquarters will be at the Cadillac Hotel, and the meetings will be held there. W. O. Thompson, Oswego, N. Y., is Secretary.

St. Louis Railway Club.

This club held no meeting in July. The *Proceedings* for that month contains the paper on the cost of construction of telephone lines on railroads, by F. F. Fowle, of the American Telegraph & Telephone Company, which was read before the Railway Telegraph Superintendents' Association last May.

Master Car and Locomotive Painters' Association.

The 36th annual convention of this association will be held in Cleveland, Ohio, Sept. 12 to 15, 1905. Headquarters will be at the Hollenden Hotel. Eight subjects relating to car and locomotive painting will be considered in committee reports and individual papers. Robert McKeon, Secretary, Kent, Ohio.

PERSONAL.

—Mr. George Demarest, formerly Treasurer of the Master Car-builders' Association, died July 19. Mr. Demarest had been master car builder on the Camden & Amboy, and later was on the Pittsburg, Fort Wayne & Chicago.

—Mr. H. A. Childs, formerly Master Mechanic of the Erie at Jersey City and later Superintendent of the Fitz-Hugh Luther Co.'s plant at Chicago, has been appointed Superintendent of Motive Power of the Guayaquil & Quito Railroad, Ecuador.

—Miss Rebecca S. Bracken, who died at her home in Niles, Mich., on July 20, had been telegraph operator at the Michigan Central station in that city for 40 years. She was a very efficient telegrapher and was held in the highest esteem by the officers of the road, the employees and the public. Miss Bracken is referred to by reporters familiar with railroad men in Niles, as the "railroad angel," and from the expressions of esteem and regard published in the *Niles Daily Sun*, and elsewhere, it is evident that this characterization was not an empty compliment. She was not only competent and faithful at her work, and uniformly courteous, but manifested such marked feminine virtues that she was known and respected in all the circles with which she came in contact.

—Mr. J. E. Greiner, who has been recently appointed Assistant Chief Engineer of the Baltimore & Ohio, has for many years had charge of the designing of the bridges built on the Baltimore & Ohio, with the exception of the Cleveland division, the Pittsburg & Western and part of the Baltimore & Ohio Southwestern. He was born at Wilmington, Del., in 1859, and graduated from Delaware College. He began railroad work in 1885 as draftsman on the Baltimore & Ohio, having had some previous experience in outside companies. In 1889 he was made Assistant Engineer in charge of bridge designing, and in 1891 became Designing Engineer of the Philadelphia Bridge Works. He returned to the Baltimore & Ohio in 1893 as Engineer of Bridges, and in 1899 was appointed Engineer of Bridges and Buildings, which position he has held until his present promotion.

J. E. Greiner.

—Mr. George H. Webb, who has been appointed Chief Engineer of the Michigan Central, is a graduate of the Pennsylvania Military College in the class of 1880. After graduation he went to the Baltimore & Ohio as rodman, and was later levelman and transitman on the Pittsburg Southern and the Pittsburg & Western. In 1883, he became City Engineer of Johnstown, Pa., and was for three years on branch lines of the Chicago, Burlington & Quincy as Assistant Engineer and Locating Engineer. He also located and constructed portions of the Seattle, Lake Shore & Eastern and the Puget Sound, Skagit & Eastern. In 1889 he went to Chile in charge of construction of government railroads. He was appointed, in 1891, Division Engineer and Superintendent of Construction on the Central of Peru, and built the Summit division, which is 15,657 ft. above sea level, and has 57 tunnels in 70 miles, with a 4 per cent. grade and a maximum curvature of 16 degrees. He returned to this country in 1893, and was engaged in private practice for four years. He was then appointed Chief Engineer of the Cincinnati, Georgetown & Portsmouth, and in 1899 became Roadmaster of the Cleveland, Cincinnati, Chicago & St. Louis, later taking the same position on the Chicago & Alton. In 1901 and 1902 he was Engineer in charge of construction of the Baring Cross, Ark., shops of the St. Louis, Iron Mountain & Southern, and in 1903 went to the Michigan Central in charge of location of the Ostimo division. He was appointed Engineer of the Middle division in April, 1903, and Assistant Chief Engineer in November, 1903, which position he held until June 16, of this year, when he was promoted to be Chief Engineer.

George H. Webb.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—A. P. Prendergast, Master Mechanic of the Philadelphia, Baltimore and Shenandoah divisions, has been appointed Assistant Master Mechanic of the Mt. Clare shops. T. R. Stewart, Master Mechanic at Cumberland, Md., succeeds Mr. Prendergast. J. Kirkpatrick, Master Mechanic at New Castle Junction, Pa., succeeds Mr. Stewart.

Chicago & Alton.—C. B. Stanton, formerly in the engineering department of the Wabash, has been appointed Superintendent of Construction for the new short line between Springfield and Murrayville, Ill., with headquarters at Springfield, Ill.

Chicago City Railway.—Thomas E. Mitten, First Vice-President, has been elected President, and Lawrence A. Young, Second Vice-President, has been elected First Vice-President.

Chicago, Zeigler & Gulf.—James Chamberlain has been elected Auditor.

Durham & Southern.—R. I. Cheatham, formerly Assistant General Freight Agent of the Seaboard Air Line, will take charge of this road, which is in the course of construction.

East Broad Top.—Edgar Shellabarger, General Foreman, has been appointed Master Mechanic.

Erie.—F. J. Moser, Engineer of the Chicago & Erie division at Huntington, Ind., has been appointed Superintendent of that division, succeeding J. M. Barrett. A. Crable succeeds Mr. Moser.

H. B. Hunt, Assistant Mechanical Superintendent at Meadville, Pa., has resigned. A. G. Trumbull, Mechanical Engineer at Meadville, Pa., succeeds Mr. Hunt. G. O. Hammond succeeds Mr. Trumbull.

Fort Worth & Denver City.—Frank T. Dolan, General Superintendent, has resigned. G. F. Cotter, Division Superintendent of the Colorado & Southern, at Trinidad, Col., has been appointed General Superintendent, succeeding Mr. Dolan.

Grand Rapids & Indiana.—W. B. Stimpson, Superintendent of the North division, has been appointed to the new position of Assistant General Manager. J. W. Hunter, Superintendent of the South division, succeeds Mr. Stimpson. B. H. Hudson, Engineer of Maintenance of Way of the North division, succeeds Mr. Hunter.

Great Northern.—G. Willius, Jr., Assistant Mechanical Engineer, has been appointed Mechanical Engineer, succeeding R. D. Hawkins, promoted.

Illinois Central.—E. P. Skene, Land Commissioner, has been appointed Right of Way Agent. The position of Land Commissioner is abolished, the Illinois Central having disposed of all its land grants in Illinois and Mississippi.

Indiana, Illinois & Iowa.—W. R. Sanborn has been appointed Assistant Engineer, with office at Kankakee, Ill.

Indianapolis & Southwestern.—L. B. Pierce, Vice-President of the Commonwealth Trust Co., of St. Louis, has been elected President of this road.

Missouri Pacific.—E. F. Vincent, Chief Draftsman, has been appointed Assistant Engineer at St. Louis, succeeding F. B. Scheetz, promoted.

New York Central & Hudson River.—G. A. Berry, Engineer of Bridges, has been appointed Assistant to the Principal Assistant Engineer of the electric zone, with headquarters at New York. C. P. Marsh has been appointed Bridge Engineer, succeeding Mr. Berry.

New York, New Haven & Hartford.—James N. States, General Ticket Agent, has been retired on a pension after 43 years' service. His duties will be performed by F. C. Coley, Assistant General Passenger Agent.

Northern Pacific.—S. G. Fulton, Assistant General Freight Agent at Portland, Ore., has resigned. F. H. Fogarty, General Agent of the Freight Department at Chicago, succeeds Mr. Fulton.

Henry Blakely, Assistant General Freight Agent at St. Paul, Minn., has been transferred to Tacoma, Wash.

Ohio River & Columbus.—Dennis Sullivan, formerly Superintendent of the Choctaw division of the Missouri, Kansas & Texas, has been appointed Vice-President and General Manager.

Pennsylvania Lines West.—A. C. Watson has been appointed Assistant Chief Engineer of the Indianapolis & Vincennes division.

Pittsburg Terminal Railroad & Coal Company.—The following officers have been elected for this road and for the West Side Belt: B. A. Worthington, Director and Vice-President, succeeding J. W. Patterson, resigned; J. G. Stidger, Assistant Treasurer, and W. M. Bonar, Assistant Secretary and Auditor, both succeeding W. G. Rock, resigned. The following appointments are for the Wabash-Pittsburg Terminal and the Wheeling & Lake Erie, as well as the above roads: D. O. Ives, General Traffic Manager, with headquarters at St. Louis, Mo. H. J. Booth, General Freight Agent, and J. P. Stark, Purchasing Agent.

W. D. Holliday is now Assistant General Freight Agent of the Wabash-Pittsburg Terminal, the Pittsburg Terminal Railroad & Coal Co., and the West Side Belt.

E. B. Coolidge is Assistant General Freight Agent of the Wheeling & Lake Erie.

Seaboard Air Line.—See Durham & Southern.

Southern Pacific.—William H. Averell, Assistant Superintendent of the San Joaquin division, has been appointed Assistant Superintendent at Bakersfield, Cal.

Sumpter Valley.—F. M. Shurtliff, Superintendent, has resigned, and Joseph Barton, General Freight and Passenger Agent, will perform the superintendent's duties.

Tidewater.—H. P. Reigart, formerly Purchasing Agent of the St. Joseph & Grand Island, has been appointed Purchasing Agent of this road, with headquarters at Norfolk, Va.

C. P. Howard, Chief Engineer, has resigned. H. Fernstrom, formerly Chief Engineer of the New York Central & Hudson River, succeeds Mr. Howard.

Wabash-Pittsburg Terminal.—See Pittsburg Terminal.

West Side Belt.—See Pittsburg Terminal.

Wheeling & Lake Erie.—See Pittsburg Terminal.

LOCOMOTIVE BUILDING.

The United Railways of Havana, as reported in our issue of July 14, have ordered eight simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works for September and October delivery. These locomotives will weigh 125,000 lbs., with 115,000 lbs. on drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 50 in.; Belpaire boiler, with a working steam pressure of 180 lbs.; heating surface, 1,625 sq. ft.; 217 charcoal iron tubes, 2 in. in diameter and 13 ft. long; firebox, 103 in. x 42 in.; grate area, 28.8 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, five tons. The special equipment includes: Westinghouse air-brakes, Washburn couplers, Pyle-National electric headlights, Nathan injector, United States metallic piston and valve rod packings and Nathan sight-feed lubricators.

The Cuba Central, as reported in our issue of July 14, has ordered three simple 10-wheel and three simple consolidation locomotives from the Baldwin Locomotive Works for September delivery. The 10-wheel locomotives will weigh 108,880 lbs., with 79,930 lbs. on drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 56 in.; Belpaire boiler, with a working steam pressure of 180 lbs.; 204 iron tubes, 2 in. in diameter and 12 ft. 9 in. long; steel firebox, $71^{11}/_{16}$ in. x 24 in.; grate area, 16.9 sq. ft.; tank capacity, 3,000 gallons, and coal capacity, five tons. The consolidation locomotives will weigh 108,500 lbs., with 95,000 lbs. on drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 50 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; 195 iron tubes, 2 in. in diameter and 13 ft. 5 in. long; steel firebox, $73^{11}/_{16}$ in. x 42⅞ in.; tank capacity, 3,500 gallons, and coal capacity, five tons. The special equipment for both types includes: Eames vacuum brakes, Golmar bell ringer, magnesia boiler lagging, Sterlingworth brake-beams, Perfecto brake-shoes, Washburn couplers, Rushmore acetylene headlights, Monitor injectors, Baldwin journal bearings, United States metallic piston and valve rod packings, Crosby safety valves, and Nathan sight-feed lubricators.

CAR BUILDING.

The Chicago & Eastern Illinois has ordered 250 dumping box cars, 750 plain box cars and 1,400 National coal dump cars, all of 80,000 lbs. capacity, from the American Car & Foundry Co., to be delivered in October and November, 1905; and 100 dumping coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co. for January delivery. The dumping box cars will be 36 ft. long, 9 ft. 3½ in. wide and 8 ft. high, inside measurements, and 37 ft. 4 in. long, 10 ft. 5 in. wide and 13 ft. 2 in. high over all, with wooden frames and underframes. The special equipment, aside from that common to all these cars, includes: Vanderbilt brake-beams, National malleable door fastenings, Security doors and Hutchins outside roofs. The plain box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 38 ft. long, 9 ft. 10 in. wide and 14 ft. high over all, with steel frames and underframes. The special equipment includes: Security and Smith doors and McCord dust guards. The National coal dump cars will be 34 ft. 8 in. long, 9 ft. 9 in. wide and 4 ft. 2 in. high, inside measurements, and 36 ft. 4 in. long, 10 ft. wide and 9 ft. 1 in. high over all, with wooden frames and steel underframes. The special equipment includes Simplex brake-beams. The dumping coal cars will be 40 ft. long, 9 ft. 3 in. wide and 4 ft. 3⅝ in. high, inside measurements, and 41 ft. ½ in. long, 10 ft. 2 in. wide, and 8 ft. 10 in. high over all, with steel frames and underframes. The special equipment includes Pressed Steel bolsters and McCord journal boxes. All these cars will have Hewitt brasses, Chicago couplers and Miner draft rigging.

BRIDGE BUILDING.

Fort Hunter, N. Y.—Plans are being made by the West Shore to build a railroad bridge over the Scoharie at this place, to consist of three spans like the present structure, but much heavier.

Germantown, Md.—The Baltimore & Ohio will build a new stone bridge over Big Seneca creek, east of this place. It will consist of three 65-ft. semi-circular arches.

Intercolonial Railway.—This company will spend $150,000 in strengthening bridges at a number of points on its lines.

LISTOWEL, ONT.—A new steel bridge, to cost $16,000, will be built at Elma street.

MARLIN, TEX.—Two iron bridges will be built over the Brazos river in Falls County.

MEXICO CITY, MEX.—Official announcement has been made that the National of Mexico and the St. Louis, Brownsville & Mexico will jointly build a bridge over the Rio Grande between San Miguel, Mex., and Fordyce, Tex.

MOOREHEAD CITY, N. C.—The Atlantic & North Carolina is reported to be preparing plans for a bridge over Newport river at this place, to cost $200,000.

NORRISTOWN, PA.—Bids are wanted August 19 by the Commissioners of Montgomery County for putting up a single-span steel highway bridge over Zacharias creek, in Worcester township. John H. Dager is engineer in charge.

ORTIZ STATION, MEX.—The Mexican Central, it is said, is planning to build a bridge to consist of seven spans of 250 ft. each over the San Pedro river at this place.

RIPLEY, W. VA.—Bids are wanted by August 9 for a 60-ft. iron bridge over Sand creek, Jackson County, W. Va. G. B. Crow, County Clerk.

SIOUX CITY, IOWA.—The Chicago, St. Paul, Minneapolis & Omaha has given a contract to the Foundation Co., of New York, for putting up a steel viaduct to carry two tracks. Construction work is to be commenced next month.

Permission has been asked of the State Railroad Commissioners by the Sioux City Traction Co. to build a viaduct over the tracks on Wall street, the expense to be jointly borne by the traction company, the various railroads and the city.

TUXPAN, MEX.—On the extension of the Mexican Central from this place to Colima, now under construction, there will be 12 tunnels and several bridges.

Other Structures.

BIRMINGHAM, ALA.—The Birmingham Terminal Co., which was recently organized to build a union passenger station, is preparing plans for a new station and other improvements, which will cost $1,500,000. This station will be used jointly by the Southern, Alabama Great Southern, Central of Georgia, St. Louis & San Francisco and the Seaboard Air Line.

CLARION, IOWA.—Contracts have been let by the Chicago Great Western for a new passenger station at this place. It will cost $15,000, and work will be begun at once.

GUTHRIE, OKLA. T.—The Denver, Enid & Gulf has plans ready for putting up a brick freight house 200 ft. long, to cost $30,000.

INDIANAPOLIS, IND.—The Southern Indiana will build new terminals and shops on the site of the Inter-State stockyards, which it owns.

KANSAS CITY, MO.—The Missouri, Kansas & Texas is buying a large plot of ground to be used as a site for new yards.

The Missouri, Kansas & Texas, to comply with the new 28-hour law governing the shipments of live stock, is building a number of stock yards at various points along its line. They are to be provided with cleaning and disinfecting plants.

KNOXVILLE, TENN.—The Louisville & Nashville will at once rebuild the station recently destroyed by fire.

NEW HAVEN, CONN.—The Consolidated Railway has given a contract for building additions to its shops at Fairhaven; also for putting up a new building three stories high, 32 x 60 ft.

PORT ARTHUR, ONT.—The Canadian Northern has let the contracts for a new passenger station to W. Brown and C. & W. Plaxton, of Winnipeg.

SCRANTON, PA.—Plans have been made by the Delaware & Hudson for putting up a large roundhouse near Parsons, on which work is to be commenced during the present month. It is also proposed to lay out a large coal yard in the neighborhood of Wilkesbarre.

SMITHVILLE, TEX.—The Missouri, Kansas & Texas will enlarge its roundhouse and shops at this place.

SPRINGFIELD, OHIO.—Press reports state that the Pennsylvania Lines West and the Big Four have completed arrangements to build a joint passenger and freight station, which will cost $350,000.

SUSPENSION BRIDGE, N. Y.—The New York Central has commenced work on foundations for a new roundhouse which will have 34 stalls.

SYRACUSE, N. Y.—The Delaware, Lackawanna & Western has bought several acres of ground to be used in enlarging its freight yards.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—Contracts have been let to the Chesapeake Construction Co., Baltimore, for double tracking the Metropolitan branch from Gaithersburg to Germantown, Md., 4 miles, and from Barnesville to Dickerson, Md., 2 miles, to F. H. Clement & Co., Philadelphia. The line between these points will be relocated and several heavy grades and curves will be eliminated Work will be begun at once, and it is estimated will cost $600,000.

CANADIAN PACIFIC.—The contract for double-tracking the main line between Winnipeg and Fort William, 427 miles, has been let to Foley Bros., St. Paul, Minn. The work is to be completed in three years, and will be carried on east and west from Rat Portage.

CANADIAN VALLEY & WESTERN.—Dorsett Carter, President of this proposed road from Lehigh to Chokasha, Ind. T., about 125 miles, announces that grading will begin next month at Lehigh. (June 23, p. 206.)

CHICAGO & ALTON.—Work has been commenced on the Iles-Murrayville cut-off in Illinois. It will run under the tracks of the electric interurban road at Iles and above it at Carlinville. The new road will shorten the distance between Chicago and Kansas City about 16 miles.

CHIHUAHUA & PACIFIC.—The Guerrero Valley extension, which is about 53½ miles long, extending from La Junta, on the main line of this road, which runs from Chihuahua to Minaca, down the Guerrero Valley to Temosiachic, passing through a rich agricultural district, was opened for traffic on July 29.

CLEVELAND SHORT LINE.—According to reports from Cleveland, a company under this name has been incorporated in Ohio to build a belt line railroad from Fairport, on the east side of Cleveland, to Lorain, on the west, to cost approximately $10,000,000. It is said that New York and local bankers are back of this project, and that they plan to have work begun soon.

ERIE.—The ordinance providing for the vacation of streets and parts of streets in Jersey City, N. J., in order to enable the Erie to carry out its open cut project, has been settled, and it is said that work will begin at once. President Underwood says that work is to be begun at once on the extensive improvements of the Jersey City and New York Terminals, which were planned many months since.

FULTON COUNTY NARROW GAGE (CHICAGO, BURLINGTON & QUINCY).—This road, which was recently sold to the Chicago, Burlington & Quincy, and which operates about 62 miles of narrow-gage road in Illinois, will be changed to standard gage from Galesburg to Houston, a distance of 50 miles. The remaining 12 miles of the road may be operated as narrow gage, or it may be abandoned.

GILPIN & CLEAR CREEK DISTRICT.—A certificate has been filed by this company in Colorado amending its incorporation papers, changing the capital stock from $50,000 to $1,250,000. The proposed road will be about 17 miles long, to the mines in Gilpin County. It will be a competitor of the Colorado & Southern. John C. McShane is President; Bennett E. Seymour, Secretary, and R. H. Carpenter, Central City, is Chief Engineer.

GLENFIELD & WESTERN.—It is reported that this company is building a five-mile lumber road extension west from Monteala, N. Y.

GREAT NORTHERN.—Work is to be commenced at once by the contractors, Grant, Smith & Co., on double tracking this road from Seattle, Wash., to Everett, about 27 miles. For 22 miles of the distance a retaining wall will have to be built. The cost of the work is approximately $1,250,000.

ILLINOIS CENTRAL.—This company is making surveys for a line to shorten the Memphis and Louisville line. It is to be built from Mayfield northeast to Grand Rivers, Ky., about 30 miles. When completed it will shorten the distance about 25 miles over the present route via Paducah.

INTERSTATE (VIRGINIA).—A contract has been given by this company to J. E. Rodes & Co., of Knoxville, Tenn., for building an extension from Appalachia to Norton, Va., a distance of 10 miles, and from Kelleyview to Roaring Fork, six miles, the work to be finished during the present year. (See Construction Record.)

JALISCO & MICHOACAN.—At a recent meeting of the stockholders the capital stock of this company was increased from $1,500,000 to $10,000,000. Construction work, it is said, will soon be begun in the state of Michoacan. The company is planning to build several hundred miles of road, and has been given a concession by the Mexican Government for this purpose. The company is backed by American capitalists.

LOUISVILLE & NASHVILLE.—This company is reported to have completed a survey for a cut-off for a distance of about 30 miles from La Foleite, Tenn., northeast up the Powell valley to its Corbin-

Norton branch at Cumberland Gap. The projected line would be about 80 or 90 miles shorter than the present route.

Mexican Roads.—A company of Mexican capitalists of Tlachichilco, state of Vera Cruz, is planning to build a railroad from that place southeast through La Perla, Aztecan and Coscomatepec, in the state of Vera Cruz, a distance of about 75 miles.

Michigan Central.—The new double-track line of this company has been completed between Kalamazoo and Mattawan, 12 miles, and train service begun over it. The old line has been abandoned.

New York Central.—This company has bought the Grand Central Palace block for extending its new terminal improvements in New York City. The price paid for the property was $355,000.

North Carolina & Ohio.—A charter has been granted this company in North Carolina to build a railroad from Raleigh, N. C., east through Wilson and Greenville to Washington, approximately 90 miles. The directors include: C. O. Haines and Adam Tredwell, of Virginia; John S. Cunningham, Steven C. Bragaw, L. J. Moore, C. M. Brown, W. Bragaw and others, of North Carolina.

Norway & Western.—This company, which was recently incorporated in Maine, has been granted permission by the town of Norway to locate its line at that place, and it is said that the road is to be completed during the present year. (June 23, p. 207.)

Omaha, Lincoln & Beatrice (Electric).—A contract has been given by this company to J. H. Piper, of Ashland, for grading its proposed road from Ashland, Neb., to the Platte river, and the work is now under way. (March 31, p. 102.)

Oregon Railroad & Navigation.—A contract has been given by this company to Erickson & Peterson, contractors, of San Francisco, for building the proposed extension of this road from Raparia, Wash., east along the north bank of the Snake river to Lewiston, Idaho, a distance of about 78 miles. The work includes the removal of a great amount of rock. The cost of the work will be between $1,700,000 and $2,000,000. (June 16, p. 199.)

Overton County R. R.—The contract for building 19 miles of this road from Algood, Tenn., north to Livingston has been let to the Cumberland Construction Co., of Livingston, Tenn. (See Construction Record.)

Southern.—Bids will soon be asked by this company for grading its proposed new line from Chattanooga, Tenn., to Stevenson, Ala., a distance of 42 miles. (April 28, p. 144.)

Texas Roads.—A syndicate of capitalists of Cincinnati, Ohio, in connection with Mayor T. W. Perkins, of McKinney, Tex., is planning to build a railroad from McKinney to Decatur.

Toledo, Defiance & Southern.—This company has been incorporated in Ohio with a capital of $10,000,000, to build an electric road from Toledo to Cincinnati.

Wallowa Valley.—Incorporation has been granted this company in Oregon, with a capital of $500,000, to build a railroad from Elgin, Ore., down the Grand Ronde to the mouth of the Wallowa and up that river to the valley of the same name in eastern Oregon. It is proposed to extend the road eventually to Joseph, a total distance of 35 miles. Surveys are now being made, and it is said that the rights of way have been secured as far as the Wallowa river. The incorporators include T. S. Potter, George F. Heusner and Robert Bell.

Western Maryland.—Surveys, it is said, will shortly be made by this company to locate a low-grade line from some point on the main line above Westminser, Md., to Williamsport. Two routes are under consideration. One, starting at Westminster, runs direct to Frederick, thence west to Catoctin and South Mountains, where it is proposed to pierce a tunnel about two miles long. The other route begins on the main line near Monocacy and traverses a level section, striking the South Mountain at about the same point as the other route.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—The passenger trains of the Ohio River division of this road, running through to and from Pittsburg, which, under an arrangement made long before the B. & O. acquired the division, have hitherto been run over the Pittsburg, Cincinnati, Chicago & St. Louis, are now run over the Pittsburg-Wheeling line of the Baltimore & Ohio.

Beaver Valley Traction (Electric).—The control of this company has passed into the hands of the Pittsburg Railways Company, which in turn is controlled by the Philadelphia Company, of Pittsburg, Pa., these interests having bought the bulk of the $1,075,000 stock. J. D. Callery has been elected President.

Chicago & Western Indiana.—Harvey Fisk & Sons, of New York, are offering at 100 and interest $500,000 consolidated mortgage 4 per cent. gold bonds of 1952. These bonds are a part of an authorized issue of $50,000,000.

Cincinnati, Flemingsburg & Southeastern.—This Kentucky company, successor to the Covington, Flemingsburg & Ashland, has executed a mortgage for $30,000 to secure that amount of 5 per cent. 20-year gold bonds, dated June 1. Provision is made for a sinking fund into which $1,500 is to be paid yearly. The President of the company is Attilla Cox, Louisville; Vice-President, C. D. Lanier, New York. (June 19, p. 192.)

Erie.—A dividend of 4 per cent. has been declared upon the $16,000,000 of second preferred stock, 2 per cent. payable in October, 1905, and 2 per cent. in April, 1906. This is the first dividend ever declared on the second preferred stock. The usual semi-annual dividend of 2 per cent. on the first preferred stock was also declared.

La Fayette.—This railroad, 22 miles long, extending from La Fayette, Ala., to Opelika, is being torn up. According to a press despatch from Opelika the road has been idle for several months, pending litigation as to what should be done with it, and the officers of the road finally began tearing up the track, though against the protest of citizens along the route. An injunction was secured restraining the officers, but it appears that the persons who secured the injunction have been satisfied in some way, and the work of destruction is going on. The road was built ten years ago, largely by subscriptions of citizens, for the purpose of securing a competing line to relieve the people from alleged extortionate freight rates. The President of the road is G. E. McGehee.

Lehigh Valley Transit (Electric).—This is the name which is to be given to the new company to be organized to take over and operate the lines of the Lehigh Valley Traction Co. and the Philadelphia & Lehigh Valley Traction Co., recently sold at foreclosure sale, as outlined in the *Railroad Gazette* of May 19, page 168. The President of the new company will be H. C. Trexler, of Allentown, Pa., who is President of the three companies now in possession of the properties as a result of the purchases in the foreclosure proceedings. It is said that the new company will have $3,000,000 of common stock and $5,000,000 preferred stock, and will issue $7,500,000 of 4 per cent. bonds.

Missouri, Kansas & Texas.—This road has withdrawn the suit which was filed to secure possession of land in the Indian Territory valued at $40,000,000, which the road claimed under a grant made by the government about 30 years ago.

Morris County Traction (Electric).—This New Jersey Company has executed a mortgage to the Trust Company of America (New York) to secure an issue of $3,000,000 5 per cent. thirty-year bonds, redeemable at 110. The company has $3,000,000 capital stock, of which $400,000 is outstanding. It has in operation seven and a half miles of road, extending from Wharton, N. J., via Dover to Rockaway, and expects to build 60 miles of new line.

New York, New Haven & Hartford.—This company has acquired a controlling interest in the stocks and bonds of the Newburgh, Dutchess & Connecticut, which runs from Dutchess Junction, N. Y., northeastward to Millerton, 57 miles. The majority in interest of the $500,000 common stock and the $600,000 preferred stock was bought for $6 a share, and of the $1,164,500 6 per cent. income bonds of 1977 and the $226,000 collateral trust 5 per cent. bonds of 1921, at 50.

Pittsburg, Shawmut & Northern.—The Central Trust Co., Trustee under the first mortgage, has applied for the appointment of a receiver for this road, and under orders of the United States District Court in Pennsylvania and the Supreme Court of the State of New York, Frank Sullivan Smith has been appointed receiver. His office is in New York, and he took charge of the road's affairs on August 1. The length of the road owned by this company is 122 miles, and it leases the Clarion River and the Rochester, Hornellsville & Lackawanna, making a total (including 11 miles of trackage rights) of 168 miles. The capital stock outstanding June 30, 1903, was $11,700,000; funded debt, $6,583,600; car trust notes and other liabilities, $723,730.

Western Maryland.—It is announced in Baltimore that this company is to amalgamate with itself all of the eastern roads controlled by the Wabash, which form a part of the Tidewater line. The roads concerned are the Western Maryland, the Potomac Valley of Maryland and the Potomac Valley of West Virginia; the Western Maryland Tidewater, the Piedmont & Cumberland of Maryland and the Piedmont & Cumberland of West Virginia; the West Virginia Central of Maryland and the West Virginia Central of West Virginia, and the Coal & Iron. The lines in Pennsylvania controlled by the Western Maryland will not be affected by the merger, and it is only proposed at this time to unite those which will be directly concerned in forming the East and West Wabash trunk line to Baltimore.

GENERAL NEWS SECTION

NOTES.

At Broken Arrow, Ind. T., the Missouri, Kansas & Texas is burning 4,000,000 cu. ft. of clay for ballast.

The new ferry terminus of the Delaware, Lackawanna & Western at West Twenty-third street, New York City, is to be opened for business on August 20.

The passenger traffic of the Richelieu & Ontario Steamboat Company on the St. Lawrence River is this summer more than 40 per cent. heavier than last year.

A press despatch from Portland, Ore., says that, the State Circuit Court having finally sustained the anti-scalping law, passed by the legislature of Oregon this year, the 19 ticket brokers of that city have agreed to shut up shop and leave.

The Attorney-General of Nebraska has filed a suit asking to have the Nebraska Grain Dealers' Association dissolved, on the ground that the elevator companies, and others composing it, have combined to force the railroads to grant rebates to members. The association is said to control the handling of 9-10 of the grain sold in that state.

Press despatches indicate that the striking telegraph operators of the Northern Pacific and the Great Northern have been vanquished by the companies. The reports published day by day during the past week have contained a good deal about delays to trains and the probable dire results of the strike, but these statements have all born the marks, more or less distinct, of the fiction mongers. It would appear that the delays to passenger trains were at no time very serious, and that delays to freights lasted only a short time.

On August 5 a passenger on an excursion train of the Chicago & Alton was shot and killed while the train was crossing the Mississippi river at Louisiana, Mo.; a second passenger was wounded, and a third was robbed; all by a man afterward arrested. The reporters seem to be in doubt whether he was a lunatic, an ordinary train robber, or a drunken man. The first victim was shot almost on sight, after having told the robber that he was not armed. A passenger who tried to overpower the robber was knocked senseless, but other passengers soon rallied from their fright, and the robber was turned over to the authorities.

The autumn meeting of the Iron and Steel Institute will be held at Sheffield, Eng., on Tuesday, Wednesday, Thursday and Friday, the 26th, 27th, 28th and 29th of September, 1905. Papers have been offered on the Metallurgical Department of Sheffield University, the Thermal Transformation of Carbon Steels, the Nature of Troostite, the Occurrence of Copper, Cobalt and Nickel in American Pig Irons, Pipe in Steel Ingots, Steel for Motor-Car Construction, the Presence of Greenish-colored Markings in the Fractured Surface of Test Pieces, Over-heated Steel, Segregation in Steel Ingots, A Manipulator for Steel Bars, Machinery for Breaking Pig Iron, and The Influence of Carbon on Nickel and Iron. B. H. Brough, 28 Victoria street, London, S. W., is Secretary.

The Lehigh Valley has adopted regulations for the transportation of explosives which are the same as those recently adopted on the Pennsylvania, and described in the *Railroad Gazette* of July 14, page 43. The transportation of explosives is the subject of an article by Senator Elkins of West Virginia, recently published in *Leslie's Weekly*. It will be remembered that Senator Elkins a year or two ago introduced a bill in Congress to regulate this matter. He has now and then found that his private car, while he was sleeping in it, was left standing on a side-track in a busy yard adjacent to cars loaded with dynamite—a circumstance which lends anything but a pleasant character to one's feelings in the morning. Mr. Elkins says that in Germany trains carrying explosives are run under special precautions, with red signal flags and other things to give suitable warning to everybody. When the announcement is made that a train bearing explosives is approaching, there is "a general withdrawal from the railroad." Mr. Elkins says that the bill which he introduced in Congress met with much opposition, largely from manufacturers of cartridges.

Passenger Rate War Settled.

A press despatch from Chicago says that the war on passenger differential rates from Chicago to eastern points has been settled and that normal rates will be restored on August 20. The Michigan Central agrees to forego its right to any differential to Buffalo and not to apply any differential rate out of Chicago on through tickets to New York reading over New York Central lines east of Buffalo. It will continue selling tickets at differential rates out of Chicago reading over lines other than those of the New York Central east of Buffalo, and also continue using differential rates as basing rates by New York Central and other routes east of Buffalo on tickets sold from points west of Chicago.

English Railroad Accidents in 1904.

The Board of Trade has issued its general report on railroad accidents for 1904. The total length of railroad in the United Kingdom at the end of the year was 22,600 miles; length of main track, 37,255. In this report the figures are compared, not with the accidents of the previous year, but with the average of a series of previous years; this with a view to securing a fairer exhibit of the tendency to increase or diminish. The report says:

On the whole record of 1904 compares favorably with those of previous years. The total number of accidents is still large, but no conclusions can be drawn from gross totals, and it is only when the figures come to be considered in detail that their significance becomes apparent. Putting aside such causes as suicide and foolhardiness, the bulk of the accidents which occur upon railways are traceable either to pure misadventure, to want of ordinary caution on the part of the sufferers, or to errors of judgment and breach of rules on the part of railway servants. It is not always possible to assign a definite cause to an accident, because the origin of some is obscure, and others are contributed to by more than one cause, but such cases are not sufficiently numerous to disturb the general conclusions to which the figures point. It is further to be observed that the numerous accidents which occur on railway premises otherwise than by the movement of vehicles are not, as a rule, specially incidental to railway working, but are common to all forms of industrial occupation. It is only when these deductions have been made that we reach the class of accidents in which improvement is likely to occur. No enactments, rules, or administrative action can affect accidents which owe their origin to human imperfection or to misadventure, and large as the totals are, no considerable diminution in the number of accidents of this character can be reasonably looked for. The utmost that can be done is to exercise ceaseless vigilance over the limited class of preventable accidents, tracing them to their causes, and prescribing such remedies as they appear to call for. Much has already been done in this direction, and the improvement which appears in the gross figures of which preventable accidents form but a small proportion, would be much more apparent if it could be shown in relation to the limited class in which it has mainly taken place.

The danger of railway traveling has been reduced to such a point that in 1904 the chances against a passenger being killed in a train accident in the course of a given journey were more than 200,000,000 to 1. The risks incurred by railway servants—especially those concerned with the movement of traffic—are, of course, much greater. In their case there is an element of danger which cannot be eliminated, though its effect may be minimized by the adoption of suitable appliances and safeguards. The increasing use of such appliances is having an appreciable effect, but the confidence engendered by familiarity with dangerous conditions appears to be responsible for so many more accidents than the want of appliances, that it is, perhaps, unreasonable to hope for any marked reduction in the total number.

The principal totals in the report are given in Table 1, which is condensed as follows:

	—1904.—		—1903.—	
	Killed.	Injured.	Killed.	Injured.
Passengers, in train accidents	6	534	25	769
Other causes	109	2,135	123	1,912
Employees, in train accidents	7	114	9	146
Other causes	409	3,807	446	3,659
Other persons, in train accidents	1	13	0	4
At highway crossings	67	28	73	39
Trespassers	425	132	442	144
All others	49	126	41	112
Total	1,073	6,889	1,159	6,785

The number of collisions and derailments during the year was exactly equal to the average of the previous 24 years, during which time there has been, of course, a large increase in train mileage. It is estimated that, taking this into account, train accidents have decreased 18 per cent., which is attributed mainly to improvements in roadway and signaling and to the use of continuous brakes. The list of causes of the 29 train accidents which were investigated shows one due to fracture or loosening of couplings; one to defective construction of road, and all the rest (46) to negligence, long hours, ignorance, excessive speed, etc. This list of causes, however, foots up more than the number of accidents (29), because in some cases more than one cause contributed. Accidents to employees not due to train accidents are now investigated, and out of 4,216 of this class 675 were investigated. Of the total of 4,216, 102 were due to defects of roadway or works; 22 to want of appliances or safeguards, insufficient staff, or unsatisfactory system of working, and 21 were due to neglect or non-observance of

rules under the Prevention of Accidents act. It will be observed that these three items, aggregating 145, cover only about one-thirtieth of the total number of accidents; the other 29 out of each 30 being due to "misadventure," want of caution or misconduct; or, want of caution, etc. on the part of a fellow employee. Eight grades of employees contributed 280 killed and 3,008 injured to this class. The proportions of casualties to number employed are compared with the averages of the previous eight years, as follows:

	1904	1896-1903
Freight trainmen	1 in every 29	1 in every 17
Trackmen	1 " " 252	1 " " 233
Engine drivers	1 " " 73	1 " " 59
Firemen	1 " " 47	1 " " 41
Shunters	1 " " 19	1 " " 14
Porters	1 " " 98	1 " " 82
Passenger guards	1 " " 62	1 " " 59
Laborers	1 " " 320	1 " " 275

In 306 investigations the inspectors made recommendations, which in 219 cases were adopted; in 60 cases they were not adopted, and 27 cases are not yet settled. A long list is given of the causes of these accidents. For example, among those due to defects of apparatus four were due to capstans not in working order; one from the failure of a coupling link; one from want of proper appliances on a tender for watering coal; one from want of a mechanical tablet-exchanging apparatus; one from smoke in a tunnel obscuring the view, owing to want of ventilation; one from want of proper sprags and the use of a bar of pig iron for the purpose; one from the exposure of a point-rod crank; one from unprotected (temporary) signal wires, and so on.

A table occupying six pages gives particulars of a number of accidents at highway grade crossings.

The report contains the usual condensation of the inspecting officers' reports on train accidents which have been published quarterly.

Collecting Demurrage in Ohio.

The railroads of Ohio and the Ohio Shippers' Association have made an agreement to have a committee—three members named by the railroads and three named by the Shippers' Association—to adjust appeals against demurrage bills; and the agreement says:

(1.) Car service charges will not be enforced where fault primarily is with the railroad company, for example: (a) Failure to furnish within reasonable time empty cars upon order from shipper when suitable cars are available. (b) Failure to place for unloading within reasonable time cars in yard, for which order for disposition has been received. (c) Failure to move within reasonable time from industry track a car upon which car service has accrued while being loaded. (d) Car service managers will not enforce car service rules where charges accrue due to bunching of cars or the placing of embargoes by railroads. Where consignee is located on other than the carrier line, and cars that may have been bunched or embargoed by one or several of the carrier lines, accumulate in excess of the normal facilities of such consignee, then deliveries shall be so regulated between agents of lines interested, that the fault of the railway shall not re-act against consignee.

(2.) Car service managers will arrange for the prompt examination of all disputed claims for car service charges so that, as far as practicable, only legitimate charges will be collected.

(3.) Car service managers will arrange with the agents of the railroads to provide prompt payment of all refunds to which shipper may be entitled.

(4.) Car service associations will arrange to change car service rules so as to grant uniformly throughout the state ninety-six hours free time for unloading bituminous coal, coke, fruit and vegetables, and seventy-two hours free time for the unloading of lumber, when such lumber is received in closed cars. When received in open cars, forty-eight hours free time will be allowed as heretofore.

(5.) Car service managers will require agents to notify consignees, who have telephones, of the placing of cars consigned to, or ordered by them, on team tracks, after such cars have been placed.

(6.) Car service managers in the state will arrange to meet quarterly, or oftener if desired, with a committee from the Ohio Shippers' Association for the purpose of hearing appeals from the decisions of car service managers, and other complaints, and adjusting the application of car service rules under these instructions.

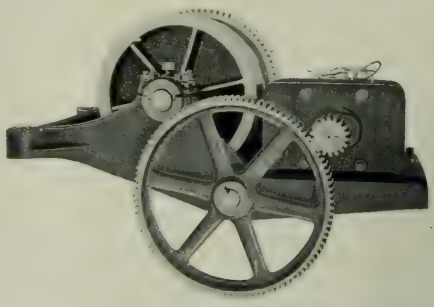
(7.) It is recommended to all railroads in the state that instructions be issued by their traffic department to all agents that bills of lading shall be furnished to all consignors on demand.

Interchangeable Tickets on Electric Lines.

Several of the interurban railroads near Chicago have adopted a new interchangeable passage ticket good over all their lines. Five electric railroads already use these tickets and 15 others in Illinois have already made application for their use. The roads now using them are the Aurora, Elgin & Chicago; Elgin, Aurora & Southern Traction; Joliet, Plainfield & Aurora; Chicago & Joliet and Rockford Interurban. As soon as the roads which have applied for membership are included, a central clearing house is to be established which will do away with the present individual monthly settlements. Though popularly called a mileage book, the new interchangeable ticket is really not a mileage book at all. Each coupon instead of standing for a certain number of miles, is good for five cents' worth of transportation. This arrangement is made necessary by the fact that the roads using the books have different rates of fare per mile. The whole book calls for $5 worth of travel and is sold at a discount of 16⅔ per cent.

Electric "Mule" for Turntabies.

The device of the Case Manufacturing Company, Columbus, Ohio, for the electric operation of locomotive turntables is shown



Electric Mule for Working Turntables.

herewith. The designers call it an "electric mule." It is quite simple, consisting of a heavy cast-iron frame with gearing connecting a series-wound motor to the traction wheel. The usual size of motor is 10 h.p., although a 15 h.p. machine is supplied

Electric Mule in Position, Mattoon, Ill.

when desired. The company's F type of controller is furnished with the mule. The installation made for the Big Four at Mattoon, Ill., is illustrated, showing the overhead arrangement for taking care of the wires.

A Bouquet from Louisiana.

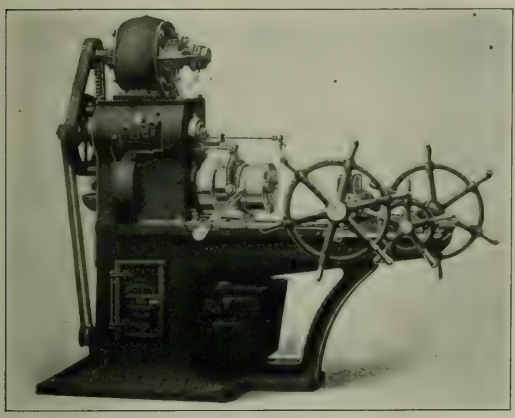
Colonel J. Kemp Ridgely, Division Passenger Agent of the Louisville & Nashville, has again demonstrated himself a very resourceful railroad official. He will not only keep out all mosquitoes possessed of the fever transmitting qualities, but he will saturate the atmosphere inside the Pullman sleepers on the Ellen En with an odor that will outrival that used centuries ago by the ancient rulers of the world. A powder which emits the most delightful odor and which in addition will be a thoroughly medical disinfectant has been prepared for Mr. Ridgely specially for use on the

Louisville & Nashville trains by Dr. A. L. Metz, the noted chemist of this city, and it will be used on all trains leaving New Orleans in the future.

The powder is made by a formula which owes its invention to the science of Dr. Metz. It is unknown to the great majority of people and up to this time has been little used except in the household of the city chemist and in the premises of a few of his friends. The delightful scent imparted by this powder will be wafted through the sleepers by breezes which are to be constantly kept moving by great rotary fans which are now being installed in all the L. & N. sleepers here. The fans are to be set in motion hours before the time of departure in order to free the sleepers of all vestige of the mosquito. After the cars have been thoroughly rid of the disease-carrying insect screens will be adjusted on the doors and windows and the inside of the cars will be proof against the stegomyia.—*New Orleans States.*

Bolt Threading Machine with Motor Drive.

The accompanying illustration shows the latest type of bolt threading machine used by the National Machinery Company, Tiffin, Ohio, which is arranged for a motor drive with a suitable speed changing device so that the proper cutting speeds can be obtained even though the motor used is of the constant speed type. As these machines are often placed in forge shops or other isolated places power from shafting is not easily available, the motor-driven type is in demand. The machine shown will take bolts up to 1½ in. in diameter. The gearing in the speed box provides four changes of speed, enabling the machine to handle work of all



A Motor-Driven Bolt-Threading Machine.

sizes within its capacity at the proper cutting speed. It is not necessary to use a variable speed motor, but if the utmost refinement is desired, by using a motor having a speed variation of from 1 to 1.4 a great range of cutting speeds can be secured, as the total speed variation will be as 1 to 5½.

In designing these machines the aim has been to combine effectiveness with simplicity. A minimum number of gears are employed in the speed box, and all of the movements of the gears and the various speed changes are secured by the shifting of one hand lever only. The gears are of large size, and wide face, and there are no gears or pinions sliding on feathers, nor are prong clutches employed. The illustration shows the motor connected to the speed box by a silent running chain, but a raw hide idler and a gear drive direct from the motor can also be used. By placing the motor over the head spindle of the machine the floor space is reduced to a minimum, and the motor is out of the way of oil and dirt, and in addition all of the driving gears are incased. These machines are built in all sizes from 1-in. to 6-in. capacity, each size having a proper number of cutting speeds to handle the work for which it is designed.

Vacuum Car Cleaning.

The Vacuum Cleaner Company, of New York City, has contracted to put in Vacuum car cleaning apparatus for the Delaware, Lackawanna & Western at Hoboken, N. J. The apparatus is the Kenney patent, and power enough is to be furnished to clean 500 cars a day.

United States and Nicaragua Co.

Edwin W. Trimmer, recently United States representative at Bluefields, Nicaragua, has been appointed Consul at Port Deitrick. The city is named after James Deitrick, managing director of the syndicate whose concessions for the construction of railroads and the development of the mineral resources of the country embrace nearly one-third of the republic. Mr. Deitrick is now in New York. Prospecting and developing has been carried on quietly by mining experts. It is said $10,000,000 will be expended for railroads and mining equipment. The United States & Nicaragua Company is the name of the concern which will carry out the work. Subsidiary to the United States & Nicaragua Co. is the Central Railway Company, with a capital of $10,000,000. Among those interested in these enterprises are James H. Lockhart, Alexander D. Peacock, Thomas B. Riter, John R. McCune, Robert Pitcairn, Dwight W. Pardee and L. J. Rees.—*Journal of Commerce* (New York).

Transportation Courses at the Brooklyn Polytechnic.

The Polytechnic Institute of Brooklyn offers a series of evening courses in transportation, beginning next October and extending through April. These lectures cover a large field and are given by thoroughly competent men, including B. B. Adams, George R. Henderson and Lawford H. Fry, among others who are well known to readers of the *Railroad Gazette.* The fee for the course in transportation is $15, and the complete list of lectures in this course is as follows:

Oct. 10.—How to Route the Line and Determine the Most Suitable Service.—Professor Lardner.
Oct. 24.—Legal Points as to Franchises, Organization, Eminent Domain and Liability—R. Burnham Moffat, Esq., Member of the N. Y. Bar.
Nov. 7.—Problems in the Electrification of Steam Roads.—Professor Young.
Nov. 14.—The Compound Locomotive: Its Design and Development.—Professor Fry.
Nov. 28.—The Future Compound Locomotive.—Professor Fry.
Dec. 12.—The Hauling Capacity of the Locomotive—Professor Henderson.
Dec. 20.—The Fuel and Water Consumption of the Locomotive.—Professor Henderson.
Jan. 9.—The Strematograph and its Revelations.—Professor Dudley.
Jan. 16.—Where to Locate the Power House.—Professor Barstow.
Jan. 23.—Fixed Signals.—Professor Adams.
Feb. 6.—Block Signals.—Professor Adams.
Feb. 13.—How to Design the Power House.—Professor Stott.
Feb. 20.—The Gas Engines for Central Station Service.—Professor Mershon.
Feb. 27.—How to Organize the Operating Force of the Power House.—Professor Stott.
Mar. 6.—The Steam Turbine for Central Station Service, its Sensibility as Compared with the Gas Engine.—Professor Mershon.
Mar. 20.—Problems in Train Despatching.—Professor Ketchum.
Apr. 3.—Maintenance of Way Problems.—Professor Paine.
Apr. 17.—The Scandinavian Railroads under Government Ownership.—Professor Ihlseng.
Apr. 24.—How to Operate the Complete Plant.—Professor Calderwood.

A Few Expense Items.

At Cleveland last week Mr. G. J. Grammer, vice-president of the Lake Shore, told the reporters that Cleveland would have a $5,000,000 union station, $3,000,000 of which will be the share of the New York Central lines as a part of an appropriation of $60,000,000 for improvements to be made within the next three or four years. Other New York Central improvements already started, said Mr. Grammer, include the opening of the Clearfield coal district and the double tracking of the Big Four Railroad. The money has also been appropriated for the construction of the tunnel under the Detroit River for the Michigan Central, for which $10,000,000 has been set aside. One of the other items is an expenditure of $10,000,000 for additional terminals at Chicago.

Chicago Pneumatic Tool Company.

The Chicago Pneumatic Tool Company has issued an income statement for the half year ending June 30, 1905, showing that profits amounted to $413,942. From this sum, $57,705 was written off for depreciation, etc.; interest on bonds absorbed $57,000, and $25,000 was taken for sinking fund reserve; leaving $273,737 as profit available for dividend. Out of this, dividends were paid at the rate of 4 per cent. per annum, at a cost of $122,276; leaving $151,461 as balance carried to surplus. After adding the surplus brought over from 1904, and making sundry deductions, a total surplus of $376,898 was carried forward.

The Steel Rail Industry.

Consul H. W. Harris, at Mannheim, Germany, takes from the *Deutsche Bergwerks-Zeitung* the following table of rail exports, with the accompanying comment:

Exports of Rails from England, Germany, and the United States for 15 *Years.*

Year.	Tons. England.	Germany.	United States.
1889-1891	681,000	128,000	11,000
1892-1894	390,000	107,000	13,000
1895-1897	512,000	120,000	51,000
1898-1900	443,000	130,000	286,000
1901-1903	531,000	255,000	185,000

The vast concentration in the manufacture of American steel rails has rendered the United States able to enter into the sharpest competition with England and Germany in the export of rails. Prior to 1890 the export of rails from the United States never amounted to more than 8,000 tons in any one year; in fact, the country had large imports of rails. For example, in 1881, the imports were 296,000 tons; in 1882, 118,000 tons; in 1887, 77,000 tons; in 1888, 137,000 tons. With the year 1890 the United States began gradually to become a factor in the export of rails. These exports were in 1890, 10,000 tons; 1895, 12,000 tons; 1900, 348,000 tons; 1904, 161,000 tons.

The record in the export of rails during the last ten years was made by England in 1903 with 604,000 tons, by Germany in 1903 with 379,000 tons, and by the United States in 1901 with 375,000 tons. It will be seen how the United States, which in the eighties

imported at times 100,000 tons and more of rails per year, has now become an important factor in the export trade. This has been due in part to the low price made by Americans for rails as well as to concentration, the low price being in fact partly the result of competition. From 1875 on, the duty on rails was fixed at $28 per ton, and was by further reductions made, respectively, $17, $13.50, and in 1894 $7.75 per ton, the latter being since that date unchanged.

Transverse Strain in Brake-beams.

The above is the subject of a circular letter issued by the Chicago Railway Equipment Company relative to some experiments on vertical stresses in brake-beams made for that company several years ago. The assumption having lately been made that the tests referred to proved the existence of undue vertical stresses, the letter states that as a matter of fact they established the contrary. This fact was known to the company in advance, however, so the tests were made to learn why solid types of brake-beams were so often found to be buckled up or down. The investigations showed that while beams were often loaded much higher than the calculated load, the excess stress was in the line of normal pull. The real difficulty with the buckling of the solid beams was found to be in the fact that the I or T sections used were too light and therefore unsuited to the purpose for which used.

Altoona Yard.

The Pennsylvania now has at Altoona one of the largest railroad yards in the world. The yards extend a distance of seven miles, contain 205 miles of tracks and 1,050 switches, and have storage room for 10,500 cars. There is a daily average movement of through cars, east and west, aggregating 4,800, and an interchange of shop and track delivery at Altoona alone, of 1,500 cars. An average of 1,600 cars are shifted daily at the Juniata scales, and 2,400 cars at WN tower, in the east end of the yards. At these two points alone a daily average of 40 men is employed in dropping the cars.

The Master Painters' Convention.

The officers and executive board of the Association of Maintenance of Way Master Painters of the United States and Canada urge every one interested in the roadway, bridge or building painting of railroads, whether he be a foreman painter, an engineer of maintenance of way, a manufacturer, or even though he have no actual connection with railroad work, to send as early as possible to the Secretary, H. J. Schnell, 100 William street, New York City, suggestions for suitable practical subjects for discussion at the Cincinnati convention, Nov. 13 and 14.

An Extemporary Drawbridge.

The engineers of the Chicago & North-Western recently performed an unusual mechanical feat on the Peoria Branch of the road, by raising a 70-ton steel bridge about 30 ft. in the air to allow a dredge to pass under on its way down Five Mile creek, in Whiteside county, Illinois. In accordance with its contract the company is obliged to remove bridges across drainage ditches on the Peoria branch once in two years to allow dredges to pass, and the work must be done at the company's expense. This is the fifth time it has been done; but heretofore the bridge, 68 ft. long, has been swung to one side, and traffic delayed from two to three days. The job was accomplished this year so as to delay trains only five hours. The scheme was devised by F. H. Bainbridge, Assistant Chief Engineer of the road.

An Emigrant Railroad Station.

It is said that the railroads which carry emigrants from New York City to the West have agreed to join in building a union station near Ellis Island, to which emigrants can go directly from the Government immigrant station without being exposed to the tricks and crimes of the "sharks" who mislead and rob them in the city. Ellis Island is in the harbor near the New Jersey shore, south of the station of the Central of New Jersey, and the plan appears to be to build the station on a dock to be built in the shallow waters of the Bay at that point. A connection with the Central of New Jersey would permit the running of trains to all the other lines, including the West Shore division of the New York Central.

Law and Justice.

If the state's attorney, to prove a murder, were required to produce a witness who had ridden on the bullet from the assassin's pistol to the victim's heart, his task would be parallel to that imposed on the prosecutor who tries to enforce anti-saloon laws. So say the anti-saloon lawyers. From an account printed in the New York *Tribune* it would appear that a similar state of things prevails in a Long Island court. Says the *Tribune:*

"Three smoke cases were thrown out of court in rapid succession in the Court of Special Sessions, Long Island, yesterday because the Corporation Counsel did not prove that the particular smoke for the creation of which the arrests were made had been detrimental to the health of residents of the city. Justice Forker presided. Associated with him were Justices Fitzgerald and Keady. Albert Hastings, Augustus Von Nostrand and Everett Hubbard, firemen employed by the Long Island Railroad Company, were arrested for burning soft coal and making a smoke which, Officer Riley said, blew from the railroad yard in Long Island City toward Borden Ave. Riley did not see the smoke hit anybody in the face, nor did the expert medical man, who was placed upon the stand by Joseph J. Matthews, Assistant Corporation Counsel, possess any knowledge as to whether that particular smoke was injurious, not having seen it."

Strict Orders.

The following notice was observed posted in the engine despatcher's office at the roundhouse in a neighboring town on one of the railroad lines running out of Albany: "Trainmen on passenger trains must not go through the coaches with overalls on, without first taking them off."—*Albany Journal.*

Manufacturing and Business.

The offices of the Power Specialty Company, formerly at 126 Liberty street, New York, have been moved to 111 Broadway, New York.

The D. F. Holman Tracklayer Co., Chicago, recently sent one of its standard tracklayers to Havana, Cuba. The sale was made through a New York house.

J. R. McColl, recently Associate Professor of Steam Engineering at Purdue University, has accepted a position in the engineering department of the American Blower Co., Detroit, Mich.

The National Tube Co. has placed a large order for immediate execution, with the American Blower Co., Detroit, Mich. The contract embraces complete heating equipment for the five new Butt Weld Mills at Lorain, Ohio.

Wallace M. Probasco is now Vice-President of the Search-Light Publishing Company, which issues a paper called the Search-Light, weekly. It follows the publishing and advertising interests of important manufacturers and engineering firms; keeps an information library, and publishes books.

The Ingersoll-Rand Company moved to its new offices on the fourteenth floor of the Bowling Green Building, 11 Broadway, New York, on August 1. The offices of the Rand Drill Company at 128 Broadway and the Ingersoll-Sergeant Drill Company at 26 Cortlandt street have been given up.

The Pratt & Whitney Co., of Hartford, Conn., has made arrangements with the C. T. Patterson Co., Ltd., of New Orleans, La., to represent its small tool department in the southwest territory. The Patterson Co. has a very complete line of small tools, and is in a position to fill orders from its New Orleans establishment.

The Sullivan Machinery Company, Chicago, is making some important additions to its manufacturing plant at Claremont, N. H., in order to keep pace with the rapid growth of its business in air compressors, coal cutters, rock drills and other mining and quarrying machinery. The improvements comprise six new buildings, practically doubling the present plant.

The United States Reclamation Service has awarded to J. G. White & Co. the contract for irrigating the Yume Desert. A dam a mile long will be built across the Colorado River valley about 12 miles above Yuma, Ariz., which is on the Southern Pacific, and the irrigating canals will be supplied from sluiceways at either end of this dam. Work has already begun and the dam is expected to be finished within a year.

The Chicago & North-Western announces the establishment of an Industrial Bureau which is to furnish reliable information about desirable locations for new manufacturing enterprises along the North-Western Line. Water power, lumber, coal and other minerals, as well as an excellent supply of labor, are among the attractions mentioned. The Bureau is also anxious to co-operate with commercial organizations of communities along the company's lines.

Mr. C. H. Bowers, the General Sales and Purchasing Agent and New York representative of the Georgia Car Company, of Atlanta, Ga., has asked us to clear up the confusion caused by the conflicting reports that have been published in the railroad papers of the disposition of the plant of the Georgia Car & Manufacturing Company, of Savannah, Ga., recently sold in bankruptcy proceedings. As stated in these columns last week, it is this plant that has been acquired by the South Atlantic Car & Manufacturing Company, of Waycross, Ga., and not, as elsewhere reported, that of the Georgia Car Company. Plans are now under consideration to double the facilities of the Georgia Car Company, made necessary by the growth of the company's business.

In connection with the opening to settlement on August 28 of the lands of the Uintah Indian Reservation, the North-Western Line also sends a brief description of the reservation, which is in the north central portion of Utah, in Uintah and Wasatch counties. It extends from Green river on the east to Heber, the county seat of Wasatch county on the west and to the crest of the Uintah mountain range on the north. The reservation is reached by the Uintah Railway, which runs from Mack, Col., on the Denver & Rio Grande, to

Dragon, Utah. Thence the trip is by stage across the White river to Vernal. The suggestion is made that home seekers from the east can best reach the reservation by the Chicago, Union Pacific & North-Western line to Denver.

The Oriental Hotel, Manhattan Beach, Long Island, which was the headquarters of the June conventions of the Master Mechanics' and Master Car Builders' Associations, is having installed a private telephone exchange in the hotel. There will be a long-distance telephone in each room and at other convenient points throughout the hotel, the system comprising something like 400 stations, said to be the largest private branch exchange in a resort hotel in the world. Service will be through a common-battery private switchboard, representing the latest advancement in such telephone practice. It was expected to have the work practically completed by August 1st. Outside service will be rendered through the Coney Island central office of the New York & New Jersey Telephone Company.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Iron and Steel Institute.

The autumn meeting will be held at Sheffield, Eng., on the 26th, 27th, 28th and 29th of September. B. H. Brough, Sec., 28 Victoria street, London, S. W.

The Railway Signal Association.

The next meeting of this Association will be held at the Great Northern Hotel, Chicago, September 12, beginning at 10.30 a.m. Committee No. 9 will submit a number of new definitions and a number of tentative definitions to be discussed. Committee No. 8 on "Standard Specifications for Mechanical Interlocking and Material for Construction Work," will offer for discussion the specifications printed in the 1904 proceedings beginning with paragraph 40 and ending with paragraph 81.

The meeting will also be asked to discuss "What is the best method for adjustment of cost of maintenance, operation and inspection of joint interlocking plants?"

PERSONAL.

—Mr. David B. Howard, the retiring Auditor of the Wabash, has been in railroad service for 45 years. He was born in Moulmein, Burmah, where his father was a missionary, and he spent his early years there. He entered the service of the Chicago & Alton in 1860 as clerk in the Treasurer's office, and he remained in that office till 1865. He was Paymaster for two years and was Secretary and Treasurer of the St. Louis, Jacksonville & Chicago until 1873, when he became Auditor. He came to the Wabash as Auditor in 1879 and has filled that position since that time. Mr. Howard has been in poor health for two years.

—Mr. James Agler, who on June 1 of this year was appointed General Manager of the California Northwestern and the North Shore Railroads, was born in 1849 at Columbus, Ohio. He entered railroad service in 1865 as an operator on the Chicago & North-Western. In 1871, he went to the Union Pacific as operator and later became train despatcher. In 1872, he went to the Southern Pacific as operator, becoming later agent and trainmaster. He was appointed Superintendent of the Truckee division on Feb. 12, 1891, and in September of that year was transferred to the Shasta division. In 1896, he was Division Superintendent at Ogden, Utah, and in March, 1898, was transferred to the same position on the Western division. Here he remained until 1901, when he was appointed Manager, holding this position until his present appointment.

James Agler.

—Mr. A. C. Watson, who has been appointed Assistant Engineer of the Indianapolis Terminal and Vincennes divisions of the Pennsylvania Lines West of Pittsburg, was born at Canton, Ohio, in 1881. He graduated from Washington and Jefferson College in 1902 and immediately began railroad work on the Pennsylvania as assistant in an engineer corps at Newcastle, Pa. In April of the next year he went to the Illinois Central as instrument man on location surveys. In July and August, 1903, he was in charge of a location party on this road, and on September 1 was appointed Assistant Engineer of the New Orleans division of the Yazoo & Mississippi Valley. He went to the Vandalia Railroad in May, 1904, and for the last six months has been in charge of preliminary and location surveys on that road. On July 22 he was appointed to his present position.

—Mr. F. B. Scheetz, who has been appointed Engineer of Bridges and Buildings of the Missouri Pacific and the St. Louis, Iron Mountain & Southern, was born in 1867 at Monroe City, Mo. He took the first three years of the Civil Engineering course in the State University of Missouri, leaving there in 1887 to begin railroad service in a location party of the St. Louis & San Francisco in Indian Territory. In 1888 he became rodman and levelman on the Kansas City, El Paso & Northeastern, going to the Missouri Pacific in 1889 as rodman. In 1890 and 1891, he was transitman on the construction of drawbridges over the Arkansas river, and in 1892 was engineer in charge of the construction of a drawbridge over the Little river in Louisiana. In the latter part of this year he left the Missouri Pacific and took charge of construction on the Missouri division of the Missouri, Kansas & Texas. From 1893 to 1896, he was engaged in maintenance work on the St. Louis, Iron Mountain & Southern, going, in the spring of 1896, to the bridge and building department of the Missouri Pacific and the St. Louis, Iron Mountain & Southern. From 1896 to 1905, he was Assistant Engineer of Bridges and Buildings. He was appointed to his present position on July 10.

F. B. Scheetz.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—J. B. Elliott has been appointed Master Mechanic at Newcastle Junction, Pa., succeeding J. Kirkpatrick, transferred.

Beaumont, Sour Lake & Western.—R. C. Wells has been appointed General Manager, with office at Beaumont, Tex.

Birmingham & Atlantic.—J. F. Fleetwood, Auditor and Superintendent, has resigned as Auditor, and has been succeeded in that office by George Dunglinson.

Chicago & North-Western.—G. W. Dailey, Acting Superintendent of Telegraph, has been appointed Superintendent of Telegraph.

Chicago, Burlington & Quincy.—Conrad E. Spens, Assistant General Freight Agent, has been appointed General Freight Agent of the lines west of the Missouri river, succeeding D. O. Ives.

Chicago, Cincinnati & Louisville.—See Great Central Route.

Chicago, Rock Island & Pacific.—J. B. Smalley, Superintendent of the Iowa division, has been appointed Superintendent of the Kansas division, with headquarters at Topeka, Kan.

J. O. Crockett, General Superintendent of the Southwestern District, has resigned. F. T. Dolan, formerly General Superintendent of the Fort Worth & Denver City, succeeds Mr. Crockett.

C. E. Shields, heretofore Superintendent of Police, has been appointed Chief Special Agent of the Central and Northern districts, with headquarters at Chicago, and the title "Superintendent of Police" has been abolished.

Colorado & Southern.—James D. Welch, Chief Despatcher of the Wabash, has been appointed Superintendent of the Trinidad division, succeeding George Cotter, promoted.

Flint River & Northeastern.—J. F. Sikes, Trainmaster, has been appointed Superintendent. The office of Trainmaster has been abolished.

Grand Trunk Pacific.—B. B. Kelliher, Acting Chief Engineer, has been appointed Chief Engineer.

Great Central Route.—G. A. W. Dodge has been elected Secretary and Treasurer, with office at Cincinnati, Ohio, succeeding R. M. Allen.

F. J. Wheeler has been appointed Freight Claim Agent, with office at Cincinnati, Ohio, succeeding F. V. Davis.

International & Great Northern.—E. G. Bryant, Division Foreman, has been appointed Master Mechanic of the Fort Worth division, with headquarters at Mart, Tex. C. M. McLain, Division Foreman, has been appointed Master Mechanic of the San Antonio division, with headquarters at Taylor, Tex. Division Master Mechanics will have charge of all employees in the locomotive and car departments on their divisions, and foremen and others will report direct to them, B. F. Ackerman, Road Foreman of Engines and Cars, having resigned and the office having been abolished.

Lake Erie, Alliance & Wheeling.—E. A. Handy has been appointed Assistant General Manager. Samuel Rockwell has been appointed Chief Engineer, succeeding Mr. Handy. G. C. Cleveland has been appointed Assistant Chief Engineer, succeeding Mr. Rockwell. The headquarters of all these officers are at Cleveland, Ohio.

Lake Shore & Michigan Southern.—G. N. Dow, Master Car Builder at Collinwood, Ohio, has been appointed General Mechanical Inspector, with headquarters at Cleveland, Ohio. The office of Master Car Builder at Collinwood has been abolished and S. K. Dickerson, Master Mechanic, and M. D. Franey, Superintendent of Shops, have assumed the duties lately performed by the Master Car Builder.

Litchfield & Madison.—L. P. Atwood has been appointed Superintendent, with office at Edwardsville, Ill., succeeding T. C. Moorshead, resigned.

Louisville & Nashville.—W. E. Knox, formerly Superintendent of the Alabama Mineral division, has been appointed General Agent in charge of traffic in the Alabama railroad territory, with office at Anniston, Ala. W. E. Smith, Roadmaster at Birmingham, Ala., has been appointed Assistant Superintendent in charge of maintenance of the South & North Alabama Railroad, Birmingham Mineral and Alabama Mineral divisions, with headquarters at Birmingham, Ala. The jurisdiction of E. J. Haylow, Assistant Superintendent at Birmingham, and of James Ashworth, Master Mechanic at Birmingham, has been extended over the Alabama Mineral division. D. D. Briggs, heretofore Master Mechanic of the Alabama Mineral division, has been appointed Assistant Master Mechanic at Boyle's, Ala.

Missouri & Louisiana.—J. S. O'Flaherty has been appointed Chief Engineer.

Missouri, Oklahoma & Gulf.—F. T. Taylor has been elected Secretary, with office at Kansas City, Mo., succeeding J. C. Duffin, resigned.

Missouri Southern.—The officers of this company are as follows: John H. Coulter, President, with office at Chicago; C. W. Greer, Vice-President, with office at Leeper, Mo.; J. R. Lindsay, Secretary and Treasurer, with office at Chicago; L. F. Dinning, Attorney, with office at De Soto, Mo.; A. E. Yardley, General Manager; C. M. Phelps, Superintendent, and Walter Newman, Auditor, all with offices at Leeper, Mo.

Northern Pacific.—W. E. Alair, Division Freight Agent for Montana and Idaho, and J. O. Dalzell, Division Freight Agent for Minnesota and Dakota, have been appointed Assistant General Freight Agents, with offices at St. Paul, Minn.

Pontiac, Oxford & Northern.—Robert R. Lounsbury, Receiver, acts as General Manager, W. C. Sanford, General Superintendent, having resigned. F. H. Carroll has been appointed General Freight and Passenger Agent and Acting Superintendent.

St. Louis, El Reno & Western.—R. L. Jones, Auditor, has resigned. W. S. Wells, Commercial Agent, has been appointed Acting Auditor in addition to his other duties, with office at Guthrie, Okla. T.

St. Louis, Watkins & Gulf.—George J. Gould has been elected President, with office at New York; C. S. Clarke, Vice-President; F. W. Ireland, Secretary; D. S. Smith, Treasurer; S. B. Schuyler, General Auditor; all with offices at St. Louis, Mo. W. E. Lee has been appointed Auditor, and P. E. Chavanne, Assistant Treasurer, both with offices at Lake Charles, La.

San Pedro, Los Angeles & Salt Lake.—P. M. Sloan has been appointed Assistant General Freight Agent, succeeding H. B. Worden, resigned.

Texas Short Line.—L. P. Marnell is Auditor, with office at Grand Saline, Tex.

Trans-Continental Railway Commission (Canada).—The Hon. S. N. Parent has been appointed Chairman.

Trinity & Brazos Valley.—R. H. Baker has been elected President, with office at Austin, Tex.

Wabash.—L. J. Ferritor, Superintendent of the Western division, has been appointed Superintendent of the Middle division, with headquarters at Decatur, Ill., succeeding Stephen E. Cotter, promoted to be General Superintendent. J. C. Sullivan, Chief Despatcher of the Eastern division, has been appointed Superintendent of the Eastern division, with headquarters at Peru, Ind., succeeding Mr. Ferritor.

West Side Belt (Pittsburg).—H. B. Henson has been elected Secretary and Treasurer, with office at New York.

W. P. Schaufele has been appointed Superintendent of Car Service with office at Pittsburg, Pa.

LOCOMOTIVE BUILDING.

The Appalachicola Northern has ordered three locomotives from the F. M. Hicks Co.

The State Railway of Chile has ordered one locomotive from the Baldwin Locomotive Works.

The Chicago, Burlington & Quincy will build four switching locomotives at its Havelock (Neb.) shops.

CAR BUILDING.

The Mexican Railway has ordered 50 coal cars from the Pullman Co.

The Chicago Great Western has ordered one mail car from the Pullman Co.

The Buffalo & Susquehanna has ordered 15 dump cars from the Rodger Ballast Car Co.

The Florida East Coast has ordered 100 dump cars from the Rodger Ballast Car Co.

The Hill Lines are reported to have ordered 8,000 freight cars from the Haskell & Barker Co.

The Arms Palace Horse Car Company, of Chicago, has ordered 10 horse cars from the Pullman Co.

The Atlantic Coast Line has ordered 150 flat cars from the South Atlantic Car & Manufacturing Co.

The Omaha, Lincoln & Beatrice is reported to have ordered eight passenger cars for interurban service.

The Chesapeake & Ohio has ordered 500 box cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Japanese Government is reported to have ordered six passenger coaches from the Harlan & Hollingsworth Co.

The Colorado & Southern has ordered 200 Ingoldsby automatic dump cars from the Pullman Co. and also two dining cars.

The New Orleans & Northeastern has ordered 60 Hart convertible (class C. S.) dump cars from the Rodger Ballast Car Co.

The Kansas City Southern has ordered 100 dump cars and 200 National coal dump cars from the American Car & Foundry Co.

The Middletown Car Works have received an order from Hugh Kelly & Co., of New York, for 150 20-ton steel-frame cane cars, for use in Cuba.

The Gulf Refining Company, of Pittsburg, has ordered 100 steel underframe tank cars of 8,000 gallons capacity from the Standard Steel Car Co.

The F. M. Hicks Co. has booked orders for 40 flat cars for McArthur Bros., Chicago; four 40-ft. flat cars for the Marysville & Northern, and 15 flat cars for the Appalachicola Northern.

The Tidewater has ordered 110 box cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co. in addition to orders recently reported, and 20 dump cars from the Rodger Ballast Car Co.

The Pennsylvania Refining Company, of Oil City, Pa., has ordered two three-compartment tank cars of 8,000 gallons capacity from the Bettendorf Axle Co. They will have steel underframes, Bettendorf trucks and Miner draft rigging.

The Archer-Daniels Linseed Co., Minneapolis, Minn., has ordered two steel tank cars of 60,000 lbs. capacity from the Bettendorf Axle Co. These cars will weigh 30,000 lbs., and measure 31 ft. long, 9 ft. wide and 13 ft. high, all outside measurements. The special equipment includes: Bettendorf bolsters, brake-beams and trucks; Walsh brake shoes, Westinghouse air-brakes, Tower couplers, Miner friction draft rigging, Harrison dust guards, Camel journal boxes and Griffin Wheel Co.'s wheels.

The Harriman Lines, as reported in our issue of July 28, have ordered 1,250 box and 300 stock cars for the Southern Pacific, 1,100 box cars for the Union Pacific, 300 stock cars for the Chicago & Alton, and 200 box and 100 stock cars for the Oregon Railroad & Navigation Co. from the Western Steel Car & Foundry Co., and 100 flat cars for the Oregon Railroad & Navigation Co., 100 box cars for the Southern Pacific, and 100 drop bottom gondola cars for the

Union Pacific from the American Car & Foundry Co. They have also ordered 300 gondolas for the Chicago & Alton from the Pressed Steel Car Co. This is in addition to orders recently reported.

BRIDGE BUILDING.

ASHLAND, KY.—The Ashland & Ironton Bridge Co. has been organized, with a capital stock of $1,500,000, to build a bridge over the Ohio river, connecting Ashland with Ironton, Ohio. O. E. Fischer has been appointed Chief Engineer with office in Cincinnati. The Cincinnati, Hamilton & Dayton is interested in this bridge project.

BOSTON, MASS.—The following bids were received by the City Engineer for the stone work on the Northern avenue and Atlantic avenue bridges: For the Northern avenue bridge: Metropolitan Construction Co., $178,000; W. L. Miller, $172,765; J. J. Coughlin Construction Co., $157,450; P. McGovern, $157,000; Holbrook, Cabot & Rawlins, $155,000; Lawler Bros., $145,630; W. H. Ellis, $137,790. For the Atlantic avenue bridge: Lawler Bros., $75,000; W. L. Miller, $73,671; W. H. Keyes, $69,580; Globe Construction Co., $44,768; J. J. Coughlin Construction Co., $43,500; P. McGovern, $41,400.

BROWNSVILLE, TEX.—A concession has been granted to Timoteo Castaneda by the Mexican Government to build a bridge over the Rio Grande at this place. It is proposed to induce the Gulf Coast Line Railroad to use the bridge.

BUFFALO, N. Y.—The Lackawanna has begun the erection of a four-span steel bridge over the tracks of the Erie. This bridge will be 800 ft. long and the superstructure will weigh 3,000 tons. It will cost $250,000. A number of other bridges in Buffalo are to be strengthened.

CHICAGO, ILL.—The Board of Trustees of the Sanitary District of Chicago has advertised for bids on a Scherzer rolling lift bridge over the Chicago river at Dearborn street. The bids will be received up to October 4.

CORNWALL, ONT.—Bids will soon be asked for five steel bridges to be built in connection with the River Aux Raisins drainage scheme in the townships of Osnabruck and Cornwall.

DAYTON, OHIO.—Proposals will be received up to August 26 for building the superstructure of the bridge over Big Twin creek, to consist of two spans each 150 ft. long. T. J. Kauffman, County Auditor.

DECATUR, ILL.—A reinforced concrete bridge will be built over the Sangamon river at South Monroe street. Bids have not yet been advertised for.

HILLSBORO, ORE.—Contracts have been let to Wakefield & Jacobsen for building four bridges on the line of the Portland, Nehalem & Tillamook.

GLOUCESTER, MASS.—A Scherzer lift bridge of 40-ft. span will be built over the canal. The bridge will be used by the Boston & Northern Street Railway.

GREAT FALLS, MONT.—The Great Northern will build a new bridge over the Missouri river at this place, to replace the present wooden structure. The new bridge will be 1,045 ft. long and will cost $100,000.

MANITOWOC, WIS.—The contract for the foundations for a bridge 900 ft. long on the Green Bay extension of the Chicago & North-Western has been let to Adolph Green, for $75,000.

MENOMINEE, WIS.—The contract for building the new bridge over the Red Cedar river has been let to the Minneapolis Steel & Machinery Co., for $12,300.

MONTCLAIR, N. J.—A steel viaduct will be built over the Lackawanna tracks at Bloomfield avenue. The cost is estimated at $60,000. James Owen, County Engineer, Montclair.

MUSKOGEE, FLA.—Bids will be received until October 1 for building a steel bridge over the Peridido river. A. N. McMillan, Clerk of the Board of County Commissioners, Pensacola, Fla.

OWEN SOUND, ONT.—A new steel bridge to cost $11,000 will be built by the city at Poulett street.

PEORIA, ILL.—The City Council has authorized the building of a bridge over the Illinois river. Plans have not yet been prepared.

PITTSBURG, PA.—Press reports state that the Pittsburg & Lake Erie is negotiating for a charter to build a bridge over the Monongahela at lock No. 4, between Charleroi and Monessen.

TUNKHANNOCK, PA.—The Lehigh Valley has let a contract to S. B. Mutchler & Son for the foundations of a new steel bridge to be built over Tunkhannock creek. The new bridge will have four spans and will be a deck truss structure.

VAN BUREN, ARK.—The Fort Smith & Van Buren Bridge & Traction Co. has been incorporated, with a capital stock of $50,000. It is proposed to build a bridge over the Arkansas river at Van Buren. H. E. Kelly is President.

VANCOUVER, B. C.—The Canadian Pacific has let a contract to the British Columbia General Contracting Co. for replacing the wooden piers of the company's main line bridge over the Pitt river with concrete piers. The contract price is $40,000.

WOODWARD, OKLA. T.—Bids are wanted August 28 for building three steel bridges near this place. They will be 180 ft., 60 ft. and 330 ft. long, respectively. C. C. Hoag, County Clerk.

YORK, PA.—The York Furnace Bridge Co. has been incorporated to build a highway bridge over the Susquehanna river at York Furnace.

Other Structures.

BARING CROSS, ARK.—The St. Louis, Iron Mountain & Southern, it is reported, will build a new coach shop here.

BEATRICE, NEB.—The Chicago, Burlington & Quincy will begin work this month on a new passenger station at this place, to cost $50,000.

BEAVER, PA.—The Pittsburg & Lake Erie has let a contract to the Nicola Construction Co., of Pittsburg, for building a new roundhouse to cost $50,000.

CHATTANOOGA, TENN.—The Central of Georgia, it is reported, will build a new freight and passenger station on Market street.

CLEVELAND, OHIO.—It has been announced by the Lake Shore that a new union depot to cost $5,000,000 will be built as soon as plans can be prepared. The work will include track elevation entirely across the city. The expense will be borne by the Pennsylvania.

DAVENPORT, IOWA.—It is reported that the Chicago, Burlington & Quincy and the Chicago, Milwaukee & St. Paul have agreed to build a union station to cost $200,000.

GRAND RAPIDS, MICH.—Contracts will soon be let for the new Grand Trunk passenger station at this place. The building will be 90 x 100 ft. and will cost about $70,000.

INDIANAPOLIS, IND.—A new power plant to cost $50,000 will be built for the Indianapolis Union Station. Other improvements to cost $25,000 will also be made.

LORAIN, OHIO.—The Baltimore & Ohio is rebuilding its roundhouse and machine shop which were burned last winter. The new roundhouse will be of brick, with a slate roof, and will have 14 stalls.

LOUISVILLE, KY.—The Louisville & Nashville has let the contract for rebuilding its passenger station which was burned two weeks ago, to the Selden-Breck Construction Co., of St. Louis, Mo. Work was begun on August 1 and the contract calls for the completion of the station by December 1. The cost is $200,000.

MCKEES ROCKS, PA.—The Pittsburg & Lake Erie has begun work on a new car shop, which will cost $100,000.

PHILADELPHIA, PA.—H. B. Shoemaker & Co., general contractors for the new Gray's Ferry shops of the Pennsylvania, are asking bids on the sub-contracts which will be let.

SAVANNAH, GA.—The Seaboard Air Line will build two new warehouses and two new cotton sheds here. These, with other improvements, will cost $150,000.

STAUNTON, VA.—John Wilson, Richmond, Va., has the contract to erect a new passenger station for the Chesapeake & Ohio at this place. The station will cost $30,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—The engineering department is making estimates for double tracking the road from East Fort Madison to Stronghurst, Ill., 20 miles.

BALTIMORE & OHIO.—Plans are being made by this company for extensive improvements in Wheeling, W. Va., which will cost about $2,000,000. The work includes the eliminating of grade crossings and the building of a new station.

BEAUMONT, SOUR LAKE & WESTON (ST. LOUIS & SAN FRANCISCO).—Contracts, it is said, will shortly be let for building the western extension of this road, which was recently sold to the St. Louis & San Francisco. The proposed line will run to Houston instead of to a connection with the Trinity & Brazos Valley. (See Construction Record.)

BUCK CREEK & CATAWBA RIVER.—A charter has been granted a company under this name in North Carolina, with a capital of $500,000, to build a railroad from a point in McDowell County, N. C., near the mouth of Buck Creek, down the valley of the Catawba river to the North Toe river to a point where it crosses the state line of Tennessee, passing through McDowell, Mitchell and Yancey counties,

a distance of about 100 miles. C. Boice, of Abbington, Va.; G. W. Edwards, of Winston-Salem; J. Crawford Biggs, of Durham; L. D. Heart, W. B. Jones and S. J. Hinsdale, of Raleigh, are interested. The line described quite nearly coincides with that of the Johnson City Southern, the chartering of which was reported in the *Railroad Gazette* of June 30 last.

Chicago, Cincinnati & Louisville.—This company, it is said, has extensive improvements under way in West Marion, Grant County, Ind. The work includes the eliminating of a number of grade crossings at a cost of over $200,000, the grade being raised about 20 ft. Hickey & Hannon are the contractors.

Crittenden Railroad.—This company has been incorporated in Arkansas, with $150,000 capital, to build from Earl to Heth, St. Francis County, 15 miles. The incorporators are: R. E. Stonbrake, N. H. Walcott, C. C. Gardiner, H. C. Hawley and J. R. Blair.

Deckerville, Hydrick & Western.—This company has been incorporated in Arkansas, with $216,000 capital stock, to build from Deckerville, Poinsett County, through Poinsett, Crittenden and Cross Counties, 27 miles. The incorporators are: G. W. Patterson, S. A. Austin, E. B. Smith, F. H. Farnham, Charles Patterson, W. E. Reichardt, N. B. Metcalf, of Earl; C. B. Bailey, of Wynne, and Earl Hannan and T. E. Hare, of Vandale.

Erie.—The contract has been awarded to Bennett & Talbot, of Greensburg, Pa., for building the first section of 12 miles of the Guymard cut-off, extending from Howells to Guymard, N. Y. This section includes a 5,300-ft. double-track tunnel through the Shawangunk mountains.

Erie, Cambridge, Union & Corry (Electric).—This Pennsylvania company proposes to build a railroad from Erie to Corry, Pa., with a branch to Cambridge Springs, 42 miles in all. It is proposed to have private right of way throughout the line, except in cities and towns. The capital stock of the company is $1,000,000, and an issue of $1,000,000 in first mortgage 5 per cent. 30-year gold bonds has been authorized. The bond issue is being underwritten by H. P. Taylor & Co., of Pittsburg. It is estimated that the cost of building the road, including the right of way, will be $900,500.

Grand Trunk Pacific.—Plans for the location of the line from Portage la Prairie westward for a distance of 275 miles, have been approved. From Portage la Prairie to a point just west of Macgregor, the line will nearly parallel the Canadian Pacific, and then it will run west to the Assiniboine river, with a branch about 14 miles south into Brandon. The road will then cross the Arrow river, near Crandell; thence west to the Assiniboine river near Crewe, in Marquette, Manitoba, and thence up the valley of the Big Cut Arm creek to a point a little north of Sumner, Assiniboia.

Lake Shore & Michigan Southern.—This company intends to build a line between Franklin and Clearfield, Pa., 76½ miles, and is receiving bids for the construction of the portion between Franklin and Brookville, Pa., 42½ miles.

Lehigh Valley.—This company, it is said, has bought a strip of land about a mile long, which is to be used in making additions to its yards at Coxton, Pa.

Mexican Central.—This company, it is said, will extend its Paredon line north, from the coal fields to which it is now being built, to San Antonio, Tex., if permission is granted by the Mexican Government. Surveys for this line were made about two years ago.

Mobile & West Alabama.—An officer writes that this company, which has completed the location of its line from Mobile to Florence, Ala., and also a branch into Birmingham, holds options on lands for terminals in Mobile, Birmingham, Tuscaloosa, Demopolis and Florence. Rights of way have been secured from Mobile to Demopolis. The company controls the Dauphin Island Dock & Railway Company's lines and property, including all of the Big and Little Dauphin Islands, except such land as is occupied by the United States Government. The road will have a maximum grade of .6 per cent. and a maximum curvature of 6 degrees. A heavy traffic is expected in coal, pig iron, coke and export freight. From Tuscaloosa the grade is light, but there are some deep cuts. There will be several long trestles. Above Tuscaloosa the work is heavy, with rock cuts, several tunnels and several high viaducts.

Morelia & Tacambaro.—A. J. Peyton & Co., New York, have underwritten $1,200,000 of bonds to provide funds for building the first 55 miles of this proposed road. The capital stock of the company is $11,000,000, of which $5,000,000 is in first mortgage 5 per cent. bonds and $6,000,000 in stock, in shares of $50 each. (See Construction Record.)

Nashville, Chattanooga & St. Louis.—This company is reported making preliminary surveys to build a line in Tennessee to the Pryor Ridge coal fields.

New York Central & Hudson River.—A committee of citizens who are trying to secure the elevation or depression of the tracks of the New York Central in Tenth and Eleventh avenues, New York City, announce that the company has promised to lay before the next legislature a plan for the removal of the tracks from the surface of the streets. These tracks, which are used almost exclusively by freight trains, and over which the speed is restricted to a very low rate, extend from Sixtieth street southward to St. John's Park, about 3 miles.

Northern Pacific.—It is reported that this company will build from Detroit, on its main line, to Bemidji, 60 miles.

Ontario Power Development Company.—This company has decided to build an electric road from Niagara Falls, Ont., to Toronto, via Brantford, London, Paris and Ingersoll, a distance of about 100 miles.

Pennsylvania.—The contract for the construction of an extension of 14 miles from Brownsville, Pa., to Rice's Landing has been let to S. M. Green, of Uniontown, Pa. Keller & Crossan, of Philadelphia, will do the grading.

Portland, Nehalem & Tillamook.—The Atlas Construction & Supply Co., of San Francisco, which has the contract for laying the first 20 miles of track, has awarded to Clark & Dixon, of Forest Grove, the contract for clearing the right of way and to Thompson Bros. the contract for grading the first three miles from Hillsboro.

St. Louis, Iron Mountain & Southern.—An officer confirms the report in our issue of July 28 that a contract has been given to Johnston & Grommet Bros. for the clearing, grading and bridging of the new line from Eudora, Ark., to Gilbert, La., 78 miles. The work is not heavy, the maximum grade being .3 per cent. and the maximum curvature 1 per cent., without any important steel bridges, trestles or tunnels.

South Side Coal & Railway.—This company has been incorporated in Arkansas, with $1,250,000 capital, to build from Paris, Logan County, to Dardanelle, Yell County, 38 miles. The incorporators are: T. D. Kinman, A. Hall, H. Strother and William Allen, Jr., of Dardanelle; D. E. Bradshaw, of Little Rock; George D. Locke, of Jerseyville, Ill., and A. R. Smart, of Chicago.

Toledo & Lima (Electric).—E. L. Myers & Co., of Chicago, have been awarded the contract for the grading and concrete bridge work of this company, and will begin work at once.

RAILROAD CORPORATION NEWS.

Chicago Union Traction.—An issue of receiver's certificates maturing February 1, 1906, has been authorized to refund the $400,000 first-mortgage bonds of the Chicago Passenger Railway Co., which matured August 1, 1903.

Cleveland, Cincinnati, Chicago & St. Louis.—The New York Stock Exchange has been asked to list $1,000,000 additional general-mortgage 4 per cent. bonds of 1993. This makes the total amount listed $20,749,000.

Hocking Valley.—The New York Stock Exchange has listed $2,479,000 Columbus & Toledo extended first-mortgage 4 per cent. bonds of 1955.

Kansas City, Fort Scott & Memphis.—The New York Stock Exchange has listed $957,000 additional guaranteed refunding-mortgage 4 per cent. bonds, making the total amount listed $17,810,000. The additional bonds were issued for retirement of equipment and other underlying bonds, for improvements and extensions.

Lake Shore & Michigan Southern.—The New York Stock Exchange has been asked to list $10,000,000 additional 4 per cent. debenture bonds of 1928, making the total amount listed $50,000,000.

Philadelphia Rapid Transit.—The total gross income for the year ending June 30 was about $16,400,000, an increase of $470,000 over the preceding year.

Seaboard Company.—The $18,000,000 5 per cent. first preferred stock of this company issued under the accepted plans for the reorganization of the Seaboard Air Line, have been all subscribed for by the stockholders of the Seaboard Railroad Co. (June 9, p. 119.)

Trinity & Brazos Valley.—The outstanding bond issue of $1,850,000 has been canceled, and a new first mortgage at $30,000 per mile, on road now owned or hereafter acquired, has been made to the Old Colony Trust Co., of Boston, as trustee, to secure an issue of 6 per cent. bonds.

Wilkesbarre & Hazleton.—Rudolph Kleybolte & Co., of New York, are offering at 101 and interest $500,000 5 per cent. gold bonds of 1951. This is part of an authorized issue of $2,500,000, of which $1,900,000 are outstanding and $600,000 reserved to retire Lehigh Traction bonds.

Wisconsin & Michigan.—A mortgage has been filed with the Equitable Trust Co., of Chicago, as trustee, to secure $2,500,000 bonds.

GENERAL NEWS SECTION

NOTES.

According to a press despatch from Reno, Nev., the Southern Pacific is to erect, at Sparks, in that state, a building to be used as a school for instructing apprentices for the company's shops, the school to be conducted by the Nevada State University.

The gradual evolution by which the electric railroad and the steam railroad may some time become assimilated and indistinguishable has lately progressed one degree; the motormen of the San Bernardino Valley Traction Company, in Southern California, have been ordered to wear overalls and jumpers instead of blue uniforms.

The new Canadian Railway Commission has begun to perform its rate-making function with a vigorous hand, the Grand Trunk and the Canadian Pacific having been ordered last week to reduce the rates on export grain from points in Ontario, to Montreal, to a level with those charged from points in the United States to the seaboard under similar circumstances.

At Truckee, Cal., recently a car loaded full with dynamite escaped control while being switched, and, while running about 10 miles an hour, collided with an oil tank car, breaking in the end of the box car and allowing the dynamite to be scattered around on the ground, some of it as far as 40 ft. away from the track; and yet there was no explosion.

The Michigan Central, the Pere Marquette and the Union Pacific have notified the Interstate Commerce Commission that their contracts with the Swift and Armour companies for the use of refrigerator cars will not be renewed; and that it is the intention of the roads to furnish their own refrigerator cars and reduce the charges for icing. This action follows the investigation into the Michigan refrigerator traffic which was made by the Interstate Commerce Commission last year. (*Railroad Gazette*, Aug. 19, 1904, and July 7, 1905.)

A press despatch from Chicago says that the east and west trunk lines and those from New Orleans to the Missouri river have settled their fight concerning rates on sugar to Kansas City and St. Paul. The all-rail rate from New York to Kansas City, etc., will be 44 cents, and from New Orleans 34 cents; to St. Paul, from New York 33 cents; from New Orleans 30 cents. During the rate war, which has been going on for the past few months, the rate has been 10 cents from New Orleans to Kansas City, etc., and 15 cents from New York.

The complaint of the Gulf Refining Company, of Texas, that the railroads charge much higher rates on Texas oil carried northward than on similar oils carried southward from Chicago, Louisville, and other places, appears to have had satisfactory effect without being brought to a hearing, for the Illinois Central and the Louisville & Nashville have now announced that their freight tariffs have been revised and the rates on crude and refined petroleum made as low from New Orleans to northern points as those enjoyed by shippers of petroleum from northern points to New Orleans. It will be remembered that in the complaint, filed about a month since, it appeared that the rate per 100 lbs. from Louisville to New Orleans was 18 cents, while the rate in the opposite direction was 35 cents.

Enola.

To accommodate its employees who are compelled to move from Harrisburg across the Susquehanna river to the big new freight yards and shops, the Pennsylvania Railroad has literally built the town of Enola. Forty families are already moving into handsome cottages built for them by the railroad company. These cottages are built in pairs, with fine lawns in front and side yards, and with 30-ft. drives in the rear. The houses are well finished in the latest style, with bathrooms, hot and cold water and front and side porches. All the streets are macadamized, and a fine water supply is provided from three artesian wells, the water plant including pumping engines and a big stand pipe for pressure. The Enola Inn also has been put up and a handsome public school building will be ready for occupancy in the fall.—*Philadelphia Inquirer.*

Railroad Taxes in the State of Washington.

Washington has no uniform method for the assessment of railroad property. The matter is entirely in the hands of county assessors and county boards of equalization to fix the values within their respective jurisdictions. There is a state board of equalization, but it was shorn of its powers to a large degree by the legislature several years ago. It can equalize only taxes which the counties have to pay to the state. For example, if the county taxing authorities should assess a railroad at $5,000 a mile, and the state board should raise the assessment to $7,500 a mile, that increase would apply only upon the taxes the county paid to the state. The railroad would pay its taxes to the county treasurer on the basis of $5,000 a mile, and the county must remit to the state on the basis of $7,500 a mile. The county, not the railroad, pays the increase.

The practical effect of this law has been to cause county officials to appear before the state board of equalization and protest against any increase in their valuations of railroads. The only attempt at uniform assessment all over the state has been made by holding assessors' conventions, and agreeing upon uniformity of valuation. The last time this was attempted the assessors were unable to agree, and as a result assessments are not now uniform. The state board of equalization took the figures of that faction which favored the higher assessment, and, as a result, counties which made the low assessment were mulcted for the difference.

The last legislature created a state tax commission, but its powers are wholly advisory. The commissioners are directed by statute to inquire into the valuation of property, corporate or otherwise, and to render all possible assistance to county taxing officials in arriving at true valuations; but they have no power to enforce one of their decisions, and assessors or county boards of equalization are at liberty to ignore their advice.

The tax commissioners are ex officio members of the state board of equalization, but their addition to that board in no way increases its powers. It merely makes the membership of the board six instead of three. The Secretary of State, the State Auditor and the Commissioner of Public Lands are the other members of the board. —*Spokane Spokesman.*

To Make Honest Conductors?

Some years ago an enterprising street railroad man in a paper read at a meeting of the Street Railway Association proposed as a means of insuring the collection of fares on street cars that each passenger be given a receipt which should entitle him to a chance in a lottery. It appears that in the City of Mexico this simple and ingenious scheme has now been put in use. The street railway company of that city has lately issued a circular, printed in Spanish, English and French, explaining the plan to the public and assuring passengers of a chance every month to draw a valuable prize worth from $2.50 to $1,000. The fares on the company's lines range from 3 cents to 30 cents, according to class and distance, and a 30-cent ticket gives a chance to a more valuable prize than a ticket costing less. The circular says:

> There will be 209 cash prizes each month, representing a minimum total value of $2,000, and a maximum total value of $10,000, the exact amount depending upon the respective values of the checks drawing the prizes. The numbers of the winning checks will be announced in the winning cars and in various other ways immediately after the drawings, which will take place under government supervision at the company's offices at Indianilla within the first five days of the month following that during which the tickets are issued. In view of the benefits offered to its patrons under the new plan, the company requests their co-operation in carrying out its regulations.
>
> The check issued by the conductor is not good for passage, but is intended solely as a receipt for the amount paid by the passenger, and will only be honored as such for a single trip on the car upon which it is issued. Failure on the part of the passenger to preserve the check and show it to the inspector upon demand will result in his being obliged to pay his fare a second time.

Taking Chances.

In watching the various accident reports issued by the Interstate Commerce Commission, it seems surprising, modern safety appliances being considered, that the accident and death list should continue so high.

Undoubtedly chance in one form and another will continue to be taken by railroad employees. The engineer will not fail to be in evidence who will take a chance to run for water or who may take a narrow chance to go one station farther to meet an opposing train, or may know that something has gone wrong with his engine but thinks she will hold together until he makes the next station.

In the days of the link and pin chances were continually taken by train and switchmen who would jump in front of a moving car to take out or insert a link. These men during switching service had a habit of waiting at the switch stand; after giving a "kick" signal for car or cars to reach them where cut was to be made, and while cars were moving anywhere from six to ten miles an hour, would run in between the cars and lift pin, jump out and signal engine men to stop or back up. It frequently happened that they never came out. Switchmen prided themselves on standing between the rails to mount an approaching car by grabbing the brake staff with their hands and stepping on brake beam.

Laws have been enacted compelling the adoption of modern safety appliances. The railroads at an enormous expense have adopted the vertical plane coupler, grab irons and the air-brake and the results are what? Go into a large yard to-day and watch present methods. If you have not followed the business since the

adoption of the safety devices you may look for a radical change. You may think that the cause which tempted men to take chances in past days could not possibly be in evidence now; and what do you find? * * * Watch those cars coming, there is a coupling to make, both knuckles are closed, one at least must be opened; see the switchman—for some reason he does not want the knuckle on the standing car opened but must have the one on the moving car adjusted. See, he runs almost backward in front of the car in motion while he raises knuckle pin with his left and pulls out knuckle with his right. You instinctively shudder at the chance he is taking and would not be surprised in the least to see disaster overtake him.

Here is another crew—let us watch operations. Cars have pulled over switch, "kick" and signal is given; when the proper place for cutting train arrives, switchman grabs pin lifting lever and finds it out of order; and then regardless of the fact that the cars are now moving anywhere from six to ten miles an hour, he jumps in between the moving cars and raises by hand one or the other of the knuckle pins. The adoption of the vertical plane coupler has removed only partially the causes which led men to trifle with fate. Our boys continue to go down and under, the greater number of the disasters being directly due to the want of prudence and common sense on the part of the employees themselves.

I make it a rule to never allow a trainman to take any chances, if in my power to prevent it. I never would take a "kick" signal until I was positive the pin was pulled, and my fireman was so instructed; no man ever got the chance to show off by stepping on the footboard of my locomotive, if I saw him in time to reduce speed.

I may be egotistical in mentioning this, but there is nothing in my past life that I am quite so proud of, and my object in mentioning it here is to influence some of my Brothers who are not doing what they might to prevent injury and death to their brother workmen.

The various brotherhoods should make united effort to prevent needless sacrifice of life and limb. Why not have something like the following in our obligations:

"I promise fealty to the company that gives me employment and will not at any time take a needless, reckless risk, * * * *"

If the trainmen and switchmen will pardon the suggestion, I would advise that they incorporate something similar to the following:

"I promise that I will do all in my power to promote the best interests of the company; under no consideration will I run in front of a moving car to adjust coupler, nor for any other purpose; nor will I run between moving cars to lift a pin. * * *"—*J. W. Reading in Locomotive Engineers' Journal.*

Ginger on the B. & O.

The Baltimore & Ohio has a new press agent. It has also a ginger jar, whether new or old is not stated. The trains by which the company takes freight from New York to Chicago in 60 hours are now making their time with the regularity of a clock; and the press agent says that "the ginger jar of the management is large enough to afford intermediate cities the same despatch, so that Baltimore, Washington, Pittsburg, Wheeling, Columbus, Cleveland, Cincinnati and St. Louis share in the benefit enjoyed by New York shippers."

All these beneficiaries are greatly elated, he says. On westbound shipments this hilarity may be all right; or, at any rate we shall find no fault; but if the traffic men, or the shippers, are inclined to joyousness in connection with fast time eastbound we beg them to consider the interests of the slow freight. One agent, bewailing the costliness of 60-hour trains and the needlessness of such strenuous life, asserted recently that whole train loads of valuable slow freight (secured by himself, no doubt) had to languish unnumbered hours on side tracks for no other purpose than to let "a cheese and a side of beef rush by."

New Express Locomotive for the L. & N.-W.

The London & North-Western Railroad, under the sway of Mr. F. W. Webb, was the home, if not the cradle, of the compound locomotive. But now all is changed. His successor, Mr. George Whale, now Chief Mechanical Engineer, has quickly swung the pendulum the other way. Compounds are being scrapped by the score, and, in the case of some mineral engines, have been converted to simple locomotives.

On taking office Mr. Whale promptly produced express locomotives of the 4-4-0 type, simple in steam expansion and of a simple, straight design. These at once proved themselves a great success, and have been and are being multiplied rapidly—to the greater punctuality of the services and to real economy—since they are beginning to take away that old reproach of the L. & N.-W., that all its principal trains were double-headed. Mr. Whale has now gone a step further and tackled the problem of the northern division of the main line, whereon the heavy West Coast expresses climb over Shap to the frontier city of Carlisle. This section of 141 miles between Preston and Carlisle is almost of mountain grade in character. Hitherto, from time immemorial, the express trains in both directions hereon have been piloted. Mr. Whale, determining to stop this wasteful method, has designed a locomotive of the 4-6-0, or 10-wheel type, with simple 19-in. x 26-in. cylinders, moderate driving wheels, and a large boiler, so as to get a good tractive effort and ample staying power. The first of this class has been undergoing severe tests with marked success.

Passes.

Members of the Cabinet, Senators and members of the House of Representatives do not take kindly to the manner in which Secretary of the Navy Bonaparte announced that he would not accept railroad passes. The announcement was made in a formal manner at the Navy Department, as if it were a radical departure for a government official to refuse free transportation from railroads. It is regarded by some as a reflection upon government officials generally. The fact is that in recent years few government officials have been accepting railroad transportation. The pass evil does not exist to anything like the extent the public at large believes. Members of the Cabinet rarely accept transportation, even when it is proffered by railroad companies.—*New York Globe.*

Sioux City, Iowa, July 23.—Shippers and business men who declined to go to Washington last spring and testify for the railroads in the congressional hearing on railroad rates are now being punished. A general wail is arising from Missouri valley points that all transportation "courtesies" have been cut off from those who did not manifest satisfactory interest in the welfare of the railroads. Until two months ago railroads were unusually liberal. Passes were obtained by all shippers of consequence and others influential in their communities, many being issued through the legal departments. But now those who openly favored railroad legislation or took a neutral stand have received requests to return annuals, if they possessed them, or have received curt refusals to issue transportation.—*Press Despatch.*

The Hall Road Collision.

In the accident at this place on the Liverpool-Southport branch of the Lancashire & Yorkshire July 27 (reported in General News Section, Aug. 4, page 35), 20 persons were killed and three injured. The 6.30 p.m. express from Liverpool to Southport, after passing through Hall Road Station, was, owing to an error on the part of the signalman, diverted on to a siding in which stood a train of five empty cars. The bodies of the last car of the standing train, and the front car of the express were completely demolished. The trucks of the leading (motor) car of the express were driven under the frames of the rear (motor) car of the standing train, and the trucks of this car were, in their turn, forced beneath the next car of the same train. The rolling stock of both trains was, apart from the leading car of the express and the last car of the standing train, practically intact.

The confession of Signalman Boote removes any doubt as to the cause of the accident. Immediately before the passing of the express, an empty train had been run on to the middle siding. Through forgetfulness, the signalman omitted to reset the switch for the main track. The station is controlled by two home and two distant signals, worked by levers numbered consecutively from 37 to 40, and the lever giving admittance from the main line to the middle siding is numbered 23. On the approach of the express, the signalman lowered the outer home signal, but found the inner home signal (lever 37) immovable, owing to its being interlocked with the siding lever. Forgetting that the latter (lever 23) was still in position to admit an incoming train to the siding, he came to the conclusion that lever 37 was out of order, and signalled with a green flag for the train to come on, thus bringing about the collision. Boote had been a signalman 18 months and an employee of the company 17 years.

English Motor Omnibuses.

On July 28th the North Eastern Railway bill authorizing, among other things, running powers for motor omnibuses, coaches, etc., for the conveyance of passengers, luggage, parcels, merchandise and goods, and providing that the local authority may from time to time prescribe the route to be taken, was passed by the Select Committee of the House of Lords for third reading. Sir George Gibb, General Manager, showed that there was a considerable demand for the proposed service.

Atmosphere Damaged by Bill Gates.

Engineer William H. Gates tore some holes in the atmosphere as he neared Fort Wayne yesterday, hauling No. 28, the Pennsylvania Special eastbound. This train has had a wonderful record between Chicago and Fort Wayne. It has come into the station here one or two minutes ahead of time each day without exception since it was put on the road nearly two months ago. Gates is not the man to let such a record as this spoil on his hands. At Larwill, only 28 miles from Fort Wayne, circumstances over which the engineer had no control, caused the train to be four minutes behind its schedule. This with a schedule of 60 miles an hour and so short a distance to run, might seem hopeless, but Gates "turned her loose" and the 28 miles were covered in 23 minutes, and the Pennsylvania Special hit the Calhoun street crossing exactly two minutes ahead

of time. From CU tower, west of Larwill, to Coesse, 5.2 miles, the time was three minutes. When asked about his fast run, Mr. Gates' reply was characteristic. "Well, I came in on time, didn't I? That's all I'm there for. I'm not looking for any records. Couldn't tell you anything about it, anyhow, because I lost my watch in Chicago." —*Fort Wayne Journal*, July 27.

Increase of Wages on the Burlington.

The locomotive firemen of the Burlington road have received an increase in wages, and, according to the *Dubuque Journal*, the rates are now the best in the United States. Following the meeting with the officers of the road at which the increase was granted, the Chairman of the Firemen's Brotherhood received from his fellow members the present of a diamond shirt stud. The schedule as published by the *Dubuque Journal* is as follows:

The scale of wages on the Class A engines was increased from $2.40 to $2.60 per hundred miles; Class K-3 and K-7 engines from $2.80 to $2.95 per hundred miles. All group four freight engines when run in the passenger service have been increased from $2.55 to $2.75 per hundred miles. Watching engines will pay $2.40 for 10 hours' work instead of $1.55.

Firemen running on construction trains instead of receiving $2.40 a day regardless of class of engines, will receive pay according to the class of engine on which they run. Group one will pay $2.40 a day, group two $2.60, group three $2.75, and group four $3.05. When more than a hundred miles is made in a day freight rates will be paid.

A new rate when operating unloading machines of 30 cents an hour was established; also a rate of 21 cents instead of 20 cents an hour for running on the large class switch engines. A new rule for helper service is established in which firemen on helper engines shall be paid according to rate and classification on the basis of a 12 hour day.

Manufacturing and Business.

The Lackawanna Bridge Co., of Scranton, Pa., capital $200,000, has been chartered in Pennsylvania. W. L. Connell, of Scranton, is president.

Mr. W. V. Kelley has been elected President of the American Steel Foundries, succeeding General Charles Miller, who continues Chairman of the Board of Directors.

Mr. Charles Parsons, of Chicago, well known in the pneumatic tool business, is now associated with the Independent Pneumatic Tool Co., and will travel out of Chicago.

The Watson-Stillman Co., New York, state that they are now making upwards of 300 different styles of hydraulic jacks, the cylinders and rams of which are all made from solid forgings.

The Sullivan Machinery Co., Chicago, has recently shipped to the Isthmian Canal Commission at Colon, Canal Zone, Panama, 25 3¾-in. rock drills fitted with the new Sullivan tappet valve.

The M. Mitshkun Co., Detroit, Mich., have just completed a combination car for the New Orleans, Natalbany & Natchez R. R. It has three compartments, one for baggage, one for colored people and one for white people.

The Morse Chain Company, Trumansburg, N. Y., is now building at Ithaca, N. Y., a plant of about five times the present capacity. The plant was originally started in 1898, to make bicycle chains. In 1901 it brought out the present high speed silent running chain, and since that time has had a rapidly growing business. In the line of power transmission The Morse Company has in service chains transmitting over 75,000 h.p., and is furnishing drives up to 500 h.p. for a single transmission. F. L. Morse is Treasurer and General Manager.

Iron and Steel.

The Pennsylvania Steel Co. has been awarded the contract for the superstructure of the new Manhattan bridge over the East river, which calls for about 43,000 tons of steel.

The Harriman Lines have ordered 10,000 tons of rails from the Carnegie Steel Co. in addition to the 16,000 tons recently bought in Colorado. Other large inquiries for rails are in the market for both 1905 and 1906 delivery, aggregating about 200,000 tons. The Tidewater Railroad, which recently inquired for 20,000 tons of rails, is about to buy 500 tons.

PERSONAL.

—Mr. H. B. Hunt, who recently resigned as Assistant Mechanical Superintendent of the Erie, has become General Inspector with the American Locomotive Co., with office at Schenectady, N. Y.

—Mr. C. H. Prescott died in Portland, Ore., on August 7. Mr. Prescott was born in 1839 and since 1869 has filled various railroad offices, having been Auditor and Cashier of the Missouri River, Fort Scott & Gulf; Manager of the Oregon Railroad & Navigation Company, and Second Vice-President of the Northern Pacific. When the last named road went into the hands of a receiver in 1893, Mr. Prescott was appointed Receiver of the Western division.

—Mr. W. S. Wilson, President of the Philadelphia, Germantown & Norristown, died on August 3. Mr. Wilson was born in 1825 and has spent most of his life in railroad work. In 1853 he was made Superintendent of the Chester Valley, and in 1858 Secretary and Treasurer of the Philadelphia, Germantown & Norristown, later becoming Superintendent of that railroad. In 1870 he was appointed Purchasing Agent of the Philadelphia & Reading, holding that position for 15 years.

—Mr. H. P. Meredith, who has been appointed Assistant Engineer of Motive Power of the Pennsylvania at Altoona, began railroad service on that road in 1897 as an apprentice in the Sunbury shops. He completed his course as an apprentice in July, 1901, and in the latter part of that year inspected locomotives being built for the Pennsylvania Company. In January, 1902, he became Motive Power Inspector of the Buffalo & Allegheny Valley division, and a year later was appointed Assistant Master Mechanic at Altoona, being promoted to his present position on July 1, 1905.

—Mr. Eliot Sumner, Assistant Engineer of Motive Power of the United Railroads of New Jersey division of the Pennsylvania, at Jersey City, began railroad service as a special apprentice in the Altoona shops in September, 1896. He was made inspector of the West Philadelphia shops on Feb. 1, 1901, and Assistant Master Mechanic of the Renovo shops in October of that year. In December, 1902, he was appointed Assistant Engineer of Motive Power of the Buffalo & Allegheny Valley division, at Buffalo, and in November of the next year, Assistant to the General Superintendent of Motive Power at Altoona, where he remained until appointed to his present position.

—Mr. George P. Smith, who has been appointed Chief Engineer of the Lake Erie & Western and the Indiana, Illinois & Iowa, with headquarters at Indianapolis, Ind., was born March 7, 1859, at South Deerfield, Mass. He graduated from the Institute of Technology at Worcester, Mass., in 1885, and entered railroad service in 1886 with the Burlington & Missouri River as draughtsman in a locating party. In April, 1887, he went to the Boston & Maine, where he remained nine years. He then entered private business as draughtsman, returning to railroad service in 1897 as Chief Engineer on the St. Joseph & Grand Island. He held this position until October, 1900, when he went to the Lake Shore & Michigan Southern as Principal Assistant Engineer. In April, 1902, he was promoted to be Engineer of Maintenance of Way on the Indiana, Illinois & Iowa, which position he held until appointed to his present post.

—Mr. B. B. Kelliher, who has been appointed Chief Engineer of the Grand Trunk Pacific, with office at Montreal, Que., was born in Ireland, Dec. 26, 1862. He attended Dublin University and then served as apprentice to a civil engineer in Dublin. His principal work in Ireland consisted of surveys for the Mitchelstown & Fermoy and the Galway & Clifton railroads and improvements of the Barrow river. In 1886 he came to the United States and entered the employ of the Union Pacific. He remained with that company for four years and then went to the Northern Pacific as Assistant Engineer, remaining with that company until 1896, the greater part of the time being in charge of the Cascade and Pacific divisions. He then went to the Anaconda Copper Company's mines in Butte, Mont., as Mining Engineer, and in 1897 went to the Oregon Short Line, where he remained until 1903 as Division Engineer, when he resigned to become Resident Engineer, in charge of location, on the Denver, Northwestern & Pacific. He went to the Grand Trunk Pacific in January, 1904. He was soon made Division Engineer at Winnipeg, where he remained until appointed to his present position.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—W. C. Barrett, Assistant Engineer of the Monongahela division, has been transferred to the same position on the Newark division, with headquarters at Newark, Ohio. F. H. Koppes, assistant on the engineering corps of the Pittsburg division, succeeds Mr. Barrett, with headquarters at Grafton, W. Va.

Boston & Maine.—S. R. Arey, General Foreman of the Salem shops, has resigned, effective September 1.

Central Vermont.—Robert F. Burnap has been appointed General Freight Agent, with headquarters at St. Albans, Vt., succeeding J. E. Dalrymple, resigned.

Chicago & North-Western.—E. E. Betts is now Car Service Agent. He succeeded W. P. Marsh.

Chicago Great Western.—W. E. Pinckney has been appointed General Freight Agent, succeeding S. E. Stohr, resigned.

Chicago, Milwaukee & St. Paul.—J. R. Bryce has been appointed Freight Auditor, succeeding F. B. Warner, resigned.

Chicago, Rock Island & Pacific.—C. W. Jones has been appointed

Superintendent of the Iowa division, succeeding J. B. Smalley, transferred.

F. T. Dolan has been appointed General Superintendent of the Southwestern District, with headquarters at Topeka, Kan., succeeding J. O. Crockett, resigned.

Cincinnati, Hamilton & Dayton.—J. W. Connaty, Master Mechanic at Indianapolis, has resigned. E. E. Chrysler succeeds Mr. Connaty.

Columbia River & Northern.—Marcus Talbot, Assistant General Agent of the Pacific Coast Steamship Co., has been appointed Vice-President and General Manager of the C. R. & N., succeeding H. C. Campbell.

Detroit, Toledo & Ironton.—W. L. Greenhalgh, formerly Auditor and Assistant Treasurer of the Ann Arbor, has been appointed Assistant Treasurer, with headquarters at Toledo.

Grand Trunk.—John Pullen has been appointed Assistant Freight Traffic Manager, with headquarters at Montreal. J. E. Dalrymple, General Traffic Agent of the Central Vermont, has been appointed General Freight Agent of the G. T., with headquarters at Montreal.

Hocking Valley.—C. A. Seydam, Paymaster, has resigned to become Secretary and Treasurer of the Sunday Creek Coal Co. John M. McFadden succeeds Mr. Seydam.

International & Great Northern.—George D. Hunter, City Passenger and Ticket Agent, has been appointed Assistant General Passenger Agent, with office at Palestine, Tex.

Minneapolis & St. Louis.—John I. Dille, Assistant General Counsel of the Chicago, Rock Island & Pacific, has been appointed General Attorney for the Minneapolis & St. Louis and the Iowa Central, succeeding A. E. Clarke.

Minneapolis, St. Paul & Sault Ste. Marie.—Edmund Pennington, Second Vice-President, has been elected First Vice-President, succeeding John Martin, deceased. W. L. Martin, Freight Traffic Manager, has been elected a Director and Second Vice-President.

Mississippi Valley & Gulf.—W. I. Allen has been elected President; Theodore Rockenfeller, Vice-President, and E. L. Cochanour, Secretary and Treasurer of this new road.

Missouri Pacific.—Captain Wilkie Woodard has been appointed Chief Assistant Construction Engineer.

New York State Railroad Commission.—John S. Kennedy, of Corning, has been appointed Secretary of the commission.

Northern Pacific.—James N. Hill has been elected Vice-President, succeeding Daniel S. Lamont, deceased.

Pullman Company.—E. G. Kirk has been appointed District Superintendent at Buffalo, succeeding J. K. Bennett, deceased. Mr. Kirk formerly was assistant to Mr. Bennett.

St. Louis, Iron Mountain & Southern.—Hugh Wilson has been appointed Superintendent of the White River division, with headquarters at Aurora, Mo., succeeding O. M. Sewell, resigned.

San Pedro, Los Angeles & Salt Lake.—A. Waldbauer, formerly City Passenger Agent in New York for the Grand Trunk, has been appointed Traveling Freight and Passenger Agent, with headquarters in New York.

Southern Pacific.—C. C. Mallard, Assistant Superintendent of the Louisiana Western division, with headquarters at Lafayette, La., has resigned. G. C. Scarlett, Chief Dispatcher, succeeds Mr. Mallard.

Thomas Ahern, Roadmaster of the Oakland division, has been appointed Assistant to the District Engineer of Maintenance of Way at San Francisco. He will act as General Track Superintendent and have supervision of important track improvements, betterments and additions.

Wabash.—T. J. Tobin, Assistant Auditor, has been appointed Auditor, with headquarters at St. Louis, Mo., succeeding D. B. Howard, resigned on account of ill health.

LOCOMOTIVE BUILDING.

The Pittsburg, Cincinnati, Chicago & St. Louis is in the market for some consolidation locomotives.

The Kansas City Southern has ordered 12 freight and eight switching locomotives from the American Locomotive Co.

The New York Central & Hudson River has ordered 35 electric locomotives from the General Electric Co. and the American Locomotive Co. jointly.

The Lehigh & New England has ordered three simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works, for August delivery. These locomotives will weigh 70 tons, with 60 tons on the drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 50 in.; straight boiler, with a working steam pressure of 200 lbs.; 248 tubes, 2 in. in diameter and 13 ft. 4½ in. long; firebox, 96 in. x 66 in.; grate area, 44 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, 10 tons. The special equipment includes: Westinghouse air-brakes, Gould couplers, Star headlights, Ohio injectors, Brady journal bearings, Crosby safety valves and steam gages, Leach sanding devices, Nathan sight-feed lubricators and Baldwin springs and wheel centers.

The Norfolk & Western has ordered five simple Pacific (4-6-2) locomotives from the American Locomotive Co. These locomotives will weigh 194,000 lbs., with 126,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 68 in.; radial stay wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,474 sq. ft.; 280 charcoal iron tubes, 2¼ in. in diameter and 20 ft. 1 in. long; firebox, 8 ft. 3 in. long and 5 ft. 4¼ in. wide; grate area, 45 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The special equipment includes: Westinghouse air-brakes, Pyle-National electric headlights, Monitor injectors, U. S. metallic piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashton steam gages and Latrobe driving and truck wheel tires.

The Lehigh Valley has ordered four simple eight-wheel switching (0-8-0) locomotives from the Baldwin Locomotive Works. These locomotives will weigh 172,000 lbs.; cylinders, 21 in. x 28 in.; diameter of drivers, 55½ in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 2,248 sq. ft.; 274 charcoal iron tubes, 2 in. in diameter and 14 ft. 6½ in. long; wide carbon steel firebox, 114½ in. x 96 in.; grate area, 76.3 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, eight tons. The special equipment includes: Westinghouse air-brakes, Snow bell ringers, Diamond special brake-beams, Tower couplers, Glazier headlights, Hancock injectors, Magnus Metal Co.'s journal bearings, U. S. metallic piston and valve rod packings, Consolidated safety valves, Leach sanding devices, Detroit sight-feed lubricators, Ludlum springs, Asheroft steam gages and Latrobe driving wheel tires.

The Newton & Northwestern has ordered one simple eight-wheel (4-4-0) locomotive and one simple 10-wheel (4-6-0) locomotive from the American Locomotive Co. The eight-wheel locomotive will weigh 43 tons, with 27½ tons on the drivers; cylinders, 17 in. x 24 in.; diameter of drivers, 62 in.; wagon top boiler, with a working steam pressure of 160 lbs.; heating surface, 1,232 sq. ft.; 186 tubes; firebox, 72 in. x 34 in.; grate area, 17 sq. ft.; tank capacity, 3,500 gallons, and coal capacity, eight tons. The 10-wheel locomotive will weigh 55 tons, with 44 tons on the drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 50 in.; wagon top boiler, with a working steam pressure of 160 lbs.; heating surface, 1,500 sq. ft.; 218 tubes; firebox, 96 in. x 34½ in.; grate area, 23 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, eight tons. The special equipment for both includes Westinghouse air-brakes.

CAR BUILDING.

The Erie is in the market for 500 box cars.

The Southern is in the market for 300 dump cars.

The Georgia Central has asked bids on 500 box cars.

The Dominion Coal Company has ordered 150 steel coal cars.

The Texas Central has ordered two passenger cars from F. M. Hicks & Co.

The Cuba Company has ordered 300 flat cars from the Middletown Car Works.

The Alabama & Vicksburg has ordered 60 ballast cars from the Rodger Ballast Car Co.

The Great Northern is reported to have ordered one sleeping car from the Pullman Co.

The Seaboard Air Line is in the market for 500 plain box cars and 500 ventilated box cars.

The Muncie & Portland Traction Company, of Portland, Ind., is in the market for 10 passenger cars.

An Argentine Railroad has ordered from the Middletown Car Works 10 steel underframe ballast cars.

The Spokane & International has ordered 102 freight cars for construction work from Haskell & Barker.

The United Railways of Havana is in the market for 325 freight cars. G. Amsinck, of New York, is the agent.

The New York Central & Hudson River has ordered 175 electric steel cars from the American Car & Foundry Co.

The Panama is reported to have ordered 600 box cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Georgia, Florida & Alabama is in the market for 40 flat cars and 50 box cars. These cars are to be of wood.

The Kansas City Southern is in the market for 600 box cars of 80,000 lbs. capacity and 100 stock cars of 60,000 lbs. capacity.

The Lake Shore & Michigan Southern is reported to have ordered three combination coach and dining cars from Barney & Smith.

The Carnegie Steel Company has ordered 100 Summers dump cars from the American Car & Foundry Co. Barber trucks will be used.

The Nipe Bay Company, Cuba, has ordered 150 20-ton sugar cane cars from the Middletown Car Works. The order came through Hugh Kelly & Co.

The DeQueen & Eastern has ordered 18 logging flat cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will be 40 ft. long and 9 ft. wide, outside measurements. The special equipment includes: Damascus brake-beams and Tower couplers.

The Deepwater Ry. has ordered 110 box cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co. The special equipment includes: Bettendorf bolsters, Major couplers, Westinghouse draft rigging, McCord journal boxes, Murphy roofs and Griffin wheels.

The Richmond, Fredericksburg & Potomac has ordered four 60-ft. baggage and express cars from the American Car & Foundry Co. for December delivery. The special equipment includes: Westinghouse air-brakes, Gold steam heating system and Pintsch gas light.

The Missouri, Oklahoma & Gulf has ordered 10 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. for October delivery. The inside dimensions of these cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high. Special equipment consists of Diamond brake-beams, Miner draft rigging and Chicago roofs.

The Boston & Maine has ordered 40 American R. R. Association standard box cars of 60,000 lbs. capacity from the Laconia Car Co. The special equipment includes: Simplex bolsters, Westinghouse air-brakes, Gould couplers, Miner draft rigging, Sherwin-Williams paint, Murphy roofs, Fox pressed steel trucks and Laconia wheels.

The Central of New Jersey has ordered 100 refrigerator cars of 60,000 lbs. capacity from the Standard Steel Car Co., for immediate delivery. These cars will weigh 45,000 lbs., and measure 36 ft. long, 8 ft. 4 in. wide and 7 ft. 5⅜ in. high, all inside measurements. The special equipments include: Westinghouse air-brakes, Kelso couplers, Miner draft rigging and Hutchins roofs.

The Chesapeake & Ohio, as reported in our issue of August 11, has ordered 500 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. These cars will weigh 36,000 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment includes: Monarch brake-beams, Westinghouse air-brakes, Miner tandem draft rigging and Murphy roofs.

The Lehigh Valley has ordered 100 refrigerator cars of 50,000 lbs. capacity from the Standard Steel Car Co. These cars will weigh about 45,000 lbs., and measure 36 ft. long, 8 ft. 4 in. wide and 7 ft. 5⅜ in. high, all inside measurements. The special equipment includes: American Steel Foundries bolsters, Standard Steel Car Co.'s brake-beams, Westinghouse air-brakes, Kelso couplers, Miner draft rigging, Hutchins roofs and Diamond arch-bar trucks.

The Atlantic Coast Line has ordered 75 self-clearing hopper bottom drop covered gondola cars of 80,000 lbs. capacity from the Middletown Car Co. These cars will weigh 45,000 lbs., and measure 32 ft. 2 in. long and 9 ft. ½ in. wide. The special equipment includes: American Steel Foundries bolsters, Atlantic Coast line standard brake-beams, Christie brake-shoes, Westinghouse air-brakes and draft rigging, Tower couplers and Harrison dust guards.

The Harriman Lines, as reported in our issue of August 11, have ordered 1,250 box and 300 stock cars for the Southern Pacific, 1,100 box cars for the Union Pacific, 200 box and 100 stock cars for the Oregon R. R. & Navigation Co. from the Western Steel Car & Foundry Co.; 1,000 box and 100 flat cars for the Southern Pacific, 500 box cars for the Union Pacific, and 100 flat cars for the Oregon R. R. & Navigation Co. from the American Car & Foundry Co.; 300 gondola cars for the Oregon Short Line and 250 gondola cars for the Union Pacific from the American Car & Foundry Co. and the Pressed Steel Car Co. All box cars will be of 100,000 lbs. capacity, will weigh 40,339 lbs., and measure 40 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. All gondola cars will be of 100,000 lbs. capacity, weigh 40,170 lbs., and measure 40 ft. 4 in. long, 9 ft. 5 in. wide and 4 ft. 6 in. high, all inside measurements. All stock cars will be of 80,000 lbs. capacity and measure 36 ft. 6 in. long, 8 ft. 5⅛ in. wide and 8 ft. high, all inside measurements. All flat cars will be of 100,000 lbs. capacity, weigh 34,500 lbs., and measure 40 ft. 10 in. long and 9 ft. 5⅛ in. wide. The special equipment for all includes: Simplex Railway Appliance Co.'s bolsters, Damascus brake-beams for box and stock cars, Christie brake-shoes, New York air-brakes, Hewitt Manufacturing Co.'s brasses, Climax couplers, Miner tandem draft rigging, National Malleable Castings Co.'s journal boxes and Railway Steel Spring Co.'s springs for stock and flat cars.

BRIDGE BUILDING.

BANGOR, ME.—A contract has been given by the Maine Central to the American Bridge Co. to build a steel bridge over the Kenduskeag river.

BERWICK, PA.—A contract has been given to M. H. Stebbins at about $45,000 for work on the substructure of the bridge to be built between this place and Nescopeck.

BESSIE, OKLA. T.—Bids are wanted September 1 by W. B. Tharrington, County Clerk, Cordell, Okla. T., for building a steel bridge 100 ft. long over the Washita river, in Washita County.

ELRENO, OKLA. T.—The Chicago, Rock Island & Pacific is locating the site for a new iron bridge over the Canadian river near this place.

KANSAS CITY, MO.—An officer writes that work has been postponed on the proposed steel bridge to be built by the Chicago, Rock Island & Pacific over the Caw river at Kansas City avenue in Armourdale.

MAIDEN, VA.—The Chesapeake & Ohio, it is reported, will build a bridge over the James river at this place.

MIFFLINVILLE, PA.—Bids will soon be asked for building the new State street bridge at this place, to cost about $45,000.

NASHVILLE, TENN.—A bridge will be built over the Cumberland river at this place. Albert B. Tavel is Chairman of the bridge committee.

NEOSHO, MO.—Bids are wanted September 4 by John M. Sherwood, Bridge Commissioner, for putting up a two-span steel bridge with a total length of 148 ft. over Indian Creek road, in Newton County.

NEW YORK, N. Y.—Bids for the steel work of the Manhattan bridge to be built over the East river betweeen the boroughs of Manhattan and Brooklyn, were opened last week by Commissioner of Bridges George E. Best. The bids were as follows: Pennsylvania Steel Co., $7,284,739; John Pierce Co., $7,486,491; Milliken Bros., $7,893,970; R. H. Hood Co., $7,956,712; King Bridge Co., $9,312,940. The contract, which calls for the furnishing and placing of 43,000 tons of steel has been let to the Pennsylvania Steel Company. The work is to be completed by January 1, 1909.

PEORIA, ILL.—The City Council has decided to ask competitive plans for a low level bridge over the Illinois river at Bridge street. The bridge will be built of steel or reinforced concrete and will be 40 ft. wide, with 6-ft. sidewalks and with either a bascule, trunnion or lift span. D. H. Roberts is Assistant City Engineer.

PROVO, ARK.—The De Queen & Eastern Railroad, which is building a road between this place and Hot Springs, will shortly begin the construction of a large bridge over the Saline river.

SHAMOKIN, PA.—A bridge is proposed to be built over Carbon Run creek in Coal township.

SHERMAN, TEX.—An officer writes that the Houston & Texas Central will build, with its own forces, the following steel bridges at an aggregate cost of $50,000, between the towns of Palmer and Trumbull over Red Oak creek, 100 ft. long; one between Howe and Sherman over the east fork of Trinity river; one over Post Oak creek and one about 129 ft. long over Choctaw creek.

STANISLAUS, CAL.—Plans are being made by County Surveyor A. L. Finny for building a concrete bridge to consist of two arches each 100 ft. long, to cost about $24,500, for which bids will be asked as soon as plans are completed.

Other Structures.

BELLEFONTAINE, OHIO.—The Cleveland, Cincinnati, Chicago & St. Louis will, it is said, increase the size of its shops at this place.

CORBIN, KY.—The Louisville & Nashville will spend about $200,000 in improving its facilities at this place. The work includes the building of a roundhouse to hold 28 locomotives.

CROOKSTON, MINN.—The Great Northern has plans ready for putting up a brick and stone building. 32 x 92 ft., to hold its division offices.

Harrisburg, Pa.—The Pennsylvania has secured 51 acres of land as a site for additions to its shops and a new roundhouse, for which contracts have been let to J. N. Bastress & Co. and H. E. Aherns & Bro.

Lexington, Ky.—The Chesapeake & Ohio and the Louisville & Nashville, it is said, will jointly build a union passenger station to cost $20,000.

Maricopa, Ariz.—The Southern Pacific is having plans made for putting up a brick station to cost about $50,000.

Mingo Junction, Ohio.—The Cleveland & Pittsburg is planning to spend about $25,000 in improvements to include a roundhouse to hold 40 locomotives.

New Philadelphia, Ohio.—A contract has been given by the Baltimore & Ohio to the Pittsburg Construction Co., of Pittsburg, Pa., for building a brick passenger station 20 x 70 ft.

Oklahoma City, Okla. T.—The Oklahoma Terminal Association has been formed with a capital of $150,000 to build a union passenger station to be used by all the roads entering the city.

Owensboro, Ky.—The Louisville, Henderson & St. Louis, the Illinois Central and the Louisville & Nashville have agreed to jointly build a brick union passenger station.

Palatka, Fla.—The Atlantic Coast Line and the other roads entering this city will enlarge the present passenger station or put up a new union station.

Roanoke, Va.—The Norfolk & Western, it is said, will increase its shops at this place to double their capacity.

St. Thomas, Ont.—The Michigan Central is to spend $100,000 improving its shops at this place.

Turcot, Que.—The Grand Trunk is putting up a 40-stall roundhouse with its own forces at this place.

Winchester, Ky.—The Louisville & Nashville and the Chesapeake & Ohio, it is said, will jointly put up a $16.000 union passenger station this fall.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Canadian Pacific.—An officer writes, in connection with the extensions of present lines, that a contract has been let to J. D. McArthur, of Winnipeg, for the extension of the Teulon branch 10 miles north from Teulon towards Icelandic river. It is expected that this work will be completed within two or three months.

Cananea, Yaqui River & Pacific.—The concession which has been granted this road by the Mexican Government, has been amended so as to authorize the building of a number of branch roads. The most important branches proposed are those to connect with the Sonora branch of the Southern Pacific, with the Mexican Central and with the Rio Grande, Sierra Madre & Pacific. (May 26, p. 174.)

Chicago & Alton.—An officer writes that this road has closed a contract for the grading of a new line from Springfield to Murrayville. The line will be known as the "Air Line" and will extend from the junction of the Wabash at Iles, just south of Springfield, for 35 miles towards Murrayville, shortening the distance to Kansas City about five miles. The ruling grade is .3 per cent. The company has also just closed the contract for 50 miles of second track from Bloomington to Sherman, Ill., which will complete the double tracking as far as Springfield.

Chicago Great Western.—This company has secured options for a right of way from Talmage, a point on its Kansas City division in Union County, Iowa, west to Creston, a distance of about 14 miles. For a part of the distance the old Chicago, Burlington & Quincy roadbed, which was abandoned, can be used.

Chicago, Rock Island & Pacific.—It is reported that the survey recently made for about half of the distance between San Diego, Cal., and El Paso, Tex., was made by this company and that a road will be built between these points and operated in connection with the El Paso & Southwestern.

Cedar Creek.—A charter was granted at Harrisburg, Pa., last week to this company with a capital of $60,000, to build six miles of railroad in Fayette and Westmoreland Counties. Charles Marshall Johnston, of Pittsburg, is President.

Central Railway Co., (Electric.)—This company was organized recently in Iowa with a capital stock of $25,000, and with headquarters at Des Moines, for the purpose of constructing an electric line from Des Moines to Ames, Iowa, distance 37 miles, to parallel the line of the Northwestern between these two points. T. J. Wilcox, of Clinton, Ia., is president; L. E. Miley, of Chicago, Vice-president; B. S. McCully, of Princeton, Ia., Treasurer; D. L. Wilcox, of Des Moines, secretary, and George H. Carr, of Des Moines, Attorney. Surveyors are now in the field locating the route for the proposed line. It is understood that arrangements have been made with the Interurban and the Des Moines City Railway Company for entrance into Des Moines over the tracks of the two companies.

Colorado, Texas & Mexico.—This company, which was projected some time ago and which graded about 25 miles of road, has, by vote at a recent meeting of its stockholders, decided to complete the road. The proposed route is from Washburn, in Armstrong County, Tex., southeast to Comfort, Tex., on the San Antonio & Aransas Pass, a distance of about 400 miles. The Chicago, Rock Island & Pacific, it is said, is largely interested in this project. (July 21, p. 23.)

Columbus, Marion & Buckeye Lake.—This company has been incorporated, with a capital of $500,000, to build from Marion, Ohio, through the counties of Marion and Crawford to Bucyrus, Ohio, 17 miles. The incorporators are: John G. Webb, James B. Gormly, Frank L. Hopley, Oscar M. Gottschall and George Whysall.

Gainesville & Athens Construction Company.—Under this name, a company has been chartered in Georgia with a capital of $150,000 to build railroads. It is understood that the company intends to build a railroad from Athens southwest to Gainesville, 30 miles. The headquarters of the company will be at Savannah. The incorporators include: T. M. Cunningham, Jr., W. V. Davis and W. M. Farr.

Gainesville, Whitesboro & Sherman.—Under this name, a company has been granted a charter in Texas with a capital of $500,000 to build a railroad from Sherman, Tex., east via Whiteside to Gainesville, a distance of 32 miles. The incorporators include: G. A. Hassinger, H. H. Lazarus, of New Orleans; H. G. Stinnett, of Sherman; S. B. Cowell, of Whitesboro, and John King, of Gainesville.

Grand Trunk Pacific.—The company is asking for bids at its Montreal office for the construction of 275 miles of railroad west of Portage la Prairie. The surveys run across practically level prairie. (August 11, p. 28.)

Green Bay, Oshkosh, Madison & Southwestern.—The Government has approved the application of this company for a right of way through the Menomonee, Stockbridge and Munsee Indian reservation, and construction will soon begin, it is reported. The revised route extends from Madison through Oshkosh to North Crandon, and not to Green Bay, as originally projected. (See Construction Record.)

Gulf & Northwestern.—An officer writes that this company, which was incorporated in Texas some time ago, is now in a position to begin the early construction of its proposed road, and that contracts will shortly be let. The question of using steam or electricity has not been definitely decided. The proposed route is from Waco, Tex., northwest via Meridian and Stephenville to Thurber, a distance of 110 miles. The work includes the building of seven bridges, one 400 ft. long and the others ranging from 50 to 100 ft. each, for which contracts will be let as soon as the surveys are completed. N. R. Morgan, Meridian, Tex., is Secreatry. (See Construction Record.)

Knoxville & Augusta (Southern).—Announcement has been made by W. J. Oliver, of Knoxville, Tenn., who has the contract for building the entire 68 miles of this proposed road from Bushnell, N. C., to Maryville, Tenn., that work will be begun at once at Bushnell. Rights of way are being secured from that place to the Little Tennessee River. The proposed route extends west from Bushnell along the north fork of the Little Tennessee River for about 50 miles, thence northward to a connection with the Knoxville & Augusta at Maryville. About three miles of the line from Bushnell were graded two years ago. This extension will be a low-grade line and does not present any difficult features of construction. The surveys out of Bushnell, however, call for several tunnels.

Lexington Southern.—A charter has been granted this company in Kentucky to build an electric railroad from Lexington, Ky., south to Nicholasville, as distance of 15 miles; also to operate a line to Camp Nelson and High Bridge. The headquarters of the company will be at Lexington, Ky. J. W. Stoll is President, and E. B. Ellis, Secretary and Treasurer.

Louisville & Nashville.—This company, it is said, has given a contract to Dunno & Lelland, of Birmingham, Ala., to build an extension 20 miles long from the Northern Alabama to the Vulcan mines in the Warrior field (Ala.) at an approximate cost of $500,000. Work is to be commenced at once.

Minidoka & Southwestern (Oregon Short Line).—This branch of the Oregon Short Line, running from Twin Falls northeast to Minidoka, Idaho, about 45 miles through a rich agricultural country, has been opened for traffic.

MINNEAPOLIS & ST. LOUIS.—This company has completed a preliminary survey for a line from Des Moines, Iowa, in a southerly direction to Seymour, Iowa, where connection can be made with the Iowa Central. The route runs through Clarkson, Santa Fe, Dallas and Promise City, and the surveyors are now working south of Seymour with St. Louis as their objective point.

MISSOURI, KANSAS & TEXAS.—This company, it is said, has bought a large plot of ground near Rosedale, Kansas City, Mo., as a site for a new terminal yard. The proposed yard will have 14 tracks each 3,000 ft. long. A 10-stall brick roundhouse will also be built.

NEW JERSEY ROADS (ELECTRIC).—Plans are being made by a number of Essex County capitalists to build electric roads from Millville, paralleling the West Jersey & Seashore, through Port Elizabeth, Dorchester, Leesburg, Delmont, Eldora, Dennisville, Seaville and Oceanview to Sea Isle City, with a branch from Dennisville to Goshen, Cape May Court House, Green Creek, Bennett and Cape May City; also for a road from Millville to Mauricetown, Haleyville, Dividing Creek and Port Norris.

NEW YORK, NEW HAVEN & HARTFORD.—A contract has been given by this company to T. Stuart & Son, of Newton, Mass., for building the new West Roxbury and Needham extension of the Woonsocket branch. The work, which includes some heavy excavations, will be completed in about one year.

NEW YORK, WESTCHESTER & BOSTON (ELECTRIC).—This company appears to have nearly or quite won its contest with its rival, the New York & Port Chester, regarding rights in the Borough of the Bronx, New York City, and work on grading the line has been going on in a small way for two or three months; and this week a contract has been let to James P. McDonald, 42 Broadway, New York City, for the building of the line from 177th street, New York, northward to the city boundary, about 4¼ miles. An officer of the company says that the defects in the charter of this road, which was incorporated in 1872, were fully cured by an act passed in 1903. The company has now been authorized by the State Railroad Commission to increase its capital from $1,000,000 to $20,000,000. The necessary right of way through New York City has also been granted. The proposed line is from a point on the Harlem river at 129th street, in New York City, north through West Farms, Westchester, Bay Chester, Pelham Manor, Pelham, New Rochelle, Larchmont, Mamaroneck, Harrison and Rye to Port Chester on the New York-Connecticut state line, with a branch from or near Pelham through Mt. Vernon, Alameda Park, Fairview Park, Tuckahoe, Arthur Manor and Scarsdale to White Plains, N. Y., a total length of 38 miles. A branch is proposed also from West Farms east to Throggs Neck on Long Island sound. William L. Bull is President, and William A. Pratt, Chief Engineer, 30 Broad street, New York. (See page 164.)

OKLAHOMA CITY TERMINAL.—A charter has been granted this company in Oklahoma to build a terminal railroad from a point two miles northwest of Oklahoma City through the city to South Oklahoma, a distance of about six miles, at an estimated cost of about $300,000; also to build side tracks, spurs and freight and passenger stations. The directors include: T. D. Turner, J. H. Wheeler, J. L. Wilkin, R. D. Edwards and others, of Oklahoma City.

PENOBSCOT CENTRAL (ELECTRIC).—This road, which extends from Bangor, Me., northwest to Charleston, a distance of about 26 miles, and which was sold last November by the bondholders for $174,000, has been resold to a syndicate of Bangor and New York capitalists, who will improve the road.

PITTSBURG, BINGHAMTON & EASTERN.—A contract has been given by this company to John R. Lee & Co., of New York, for building its line from Binghamton, N. Y., southeast to Ansonia, Pa., a distance of 140 miles. The contractors expect to commence work early next month. The contract calls for the completion of the work in 18 months. (July 21, p. 23.)

PITTSBURG RAILWAYS (ELECTRIC).—This company will immediately begin extensions on the north and south sides of the Ohio river to connect Pittsburg with the Beaver Valley Traction Company's system, which it recently purchased.

PLANT CITY, ARCADIA & GULF.—This company, which bought 12 miles of railroad out of Plant City, is building an extension of its road from Keysville, Fla., south to Fort Green, a distance of 30 miles. (See Construction Record.)

QUINNESEC & WESTERN.—This company has been incorporated in Michigan with a capital stock of $120,000 to build a railroad in Menominee County about 15 miles long, connecting with the Wisconsin & Michigan. The incorporators are W. T. Fitzgerald and S. N. Harrison, Peshtigo, Wis.; E. C. Eastman, Marinette; J. B. Barton, Hinsdale; and O. A. Koss, J. C. Fitzgerald and T. M. Butters, Chicago.

ST. PAUL & DES MOINES.—This company, which was organized in Iowa to build an extension of the Des Moines, Iowa Falls & Northern from Iowa Falls north to Mason City, has surveyors locating the line northeast from Iowa Falls half way to Hampton. Construction work will be started shortly by the contractors, the Iowa Construction Co., organized by the officers of the Des Moines, Iowa Falls & Northern. (July 7, p. 8.)

SHORT LINE DEVELOPMENT & CONSTRUCTION COMPANY.—A company under this name has been chartered in Washington with a capital of $3,000,000, and headquarters at Seattle, to build railroads in Alaska. The incorporators include Thomas Flammer and Martin Bosworth, of Seattle, and Grant Hamilton, of Denver.

SIOUX CITY & IRETON (ELECTRIC.)—Articles of incorporation have been filed by this company in Iowa. The authorized capital stock is $500,000, and Sioux City will be headquarters. The company proposes to build a line from Sioux City north to Ireton, Iowa, 38 miles. Electric power will probably be used. The directors are James Ahrens, D. Montgomery, M. A. Karr, Henry Meinen, H. D. Eilers, J. G. Grabner, Wm. McAuliffe, L. Borschers and Thomas Stinton. The company has already been granted a franchise to construct and operate its lines on the streets of Ireton. Arrangements will probably be made with the Sioux City Traction company for entrance into Sioux City over the lines of the latter company.

SOUTHEASTERN RAILROAD.—An officer writes that surveys have been completed and rights of way are being secured for its proposed railroad to be built from Leslie, Ark., southeast to Garner, 105 miles, and thence to Little Rock. The proposed road will have a ruling grade of .6 per cent. and curves of 8 degrees. Contracts for the work will soon be let. George L. Sands is President and S. W. Lee, Chief Engineer. (See Southeastern Arkansas, July 28, p. 32.)

SOUTHERN RAILWAY.—An officer writes in regard to the proposed line of this company to be built from Chattanooga to Stevenson, Alabama, that the contracts for the tunnel through Lookout Mountain and for masonry in connection with Tennessee River Bridge have been let. Bids have been asked for doing the grading, but no date has been named for the letting of the contract. The proposed line will be built from Chattanooga to Stevenson, Ala., in a southwesterly direction for a distance of 42 miles. W. J. Oliver & Company, Knoxville, Tenn., have taken the contract for the tunnel, and B. H. Hardaway for the bridge masonry at the Tennessee River. The contractors are now working on the tunnel but no grading has been done or track laid. The tunnel and bridge are the most important work, and until this work is well advanced the contract for grading will not be awarded. The maximum east bound grade is 33 ft. per mile. Maximum west bound grade 1 per cent. with a maximum curviture of 6 degrees. This new line will involve the construction of draw bridge across Tennessee River about 15 miles west of Chattanooga, and several bridges of no importance and also one small tunnel about seven miles from Chattanooga; and a very light amount of trestle.

SOUTH SIDE COAL & IRON COMPANY OF ARKANSAS.—An officer writes that the construction of this proposed road will be begun October 1. The route is from Paris, Ark., east to Dardanelle, a distance of 38 miles, with branches aggregating 12 miles. George D. Locke is Vice-President, Missouri Trust Building, St. Louis.

TENNESSEE RAILWAY.—The Burgin Construction Co., of North Carolina, has been awarded the contract for the construction of the extension of this road for 14 miles from a point seven miles from Oneida, Tenn.

TEXAS ROADS.—A road, which has been under consideration for some time, and of which Ed. Kennedy is said to be a promoter, is to be built at once under the supervision of the Houston, Beaumont & Red River Construction Co., which has given the contract for the first 40 miles to P. R. Turney. The proposed route is from Houston, Tex., northeast through North Dayton, Perryman, Batson, Saratoga, Kountz, Jasper and Leesville to Alexandria, La., a distance of about 200 miles, crossing the Sabine River at a point 80 miles north of the Southern Pacific and 100 miles south of the Houston East & West Texas, passing through a rich agricultural section of southeast Texas. Contracts for the balance of the route will be let as soon as the surveys have been completed.

TIDEWATER RAILROAD.—This company has commenced the construction of the line connecting Norfolk, Va., with Seawell's Point. It is the intention of the company to build the first 100 miles of its road from the Tidewater terminal west as early as possible. (May 26, p. 175.)

TRINITY & BRAZOS VALLEY.—A contract has been given by this company to Johnson Bros., of St. Elmo, Ill., for building 180 miles of its road from Mexia, Tex., to Houston. The contract calls for the completion of the work within one year, and it is said that when finished the road will be turned over to the Colorado & Southern and operated as a part of that systeem.

WEST MICHIGAN.—Articles of incorporation have been filed by

this company in Michigan with a capital stock of $700,000 to build a railroad from Benton Harbor and St. Joseph to Dowagiac, Cassopolis, Paw Paw and Kalamazoo, a distance of about 85 miles. The directors are D. L. Browne, Pittsburg, Pa.; A. P. Cady, H. D. Deam, E. J. Stevens and A. H. Deam, Benton Harbor.

Wyoming Central (Chicago & North-Western).—Amended articles of incorporation have been filed by this road in Wyoming increasing its capital stock to $13,500,000. The increase is necessitated by the change in the plans so as to extend the Casper-Lander line beyond its original destination. It is proposed to build into Idaho and thence to Salt Lake City and possibly to the Pacific coast. The contract let about a month ago provided for an extension from Casper only as far as Poison Spider creek, at the eastern end of the Indian reservation. It is now intended shortly to build 35 miles beyond Poison Spider creek.

Yule Creek.—Incorporation has been granted this company in Colorado to build a railroad from Bryant, in Garfield County, through Pitkin and Gunnison counties, following the Crystal river to its confluence with Yule creek, and thence along this creek to its source. The cost of the road will be about $200,000. G. W. Bowen, S. I. Heyn, Pope Clerk, A. E. Davis and R. E. Black, of Denver, and J. B. Bowen and W. R. Jewell, of Redstone, are interested.

RAILROAD CORPORATION NEWS.

Alberta Railroad & Irrigation.—The lines taken over by this company include the Alberta Railroad & Coal Co., 66 miles; the St. Mary's river, 19 miles and a Cardston branch of 48 miles. Several extensions have been authorized. The entire line is now being made standard gauge.

Bangor & Northern.—This company has been organized to take over the property and franchises of the Penobscot Central, which runs from Bangor to Charleston, Me., 26 miles. The new company is capitalized at $150,000 and the following officers have been elected: John R. Graham, President; F. D. Oliver, Treasurer; and John R. Graham, C. D. Stamford, Charles V. Lord and Franklin A. Wilson, directors.

Buffalo & Susquehanna Railway.—Application has been made to the New York Stock Exchange to list $2,216,000 additional first refunding 4½ per cent. bonds of 1951, making the total amount $6,521,000.

Buffalo, Rochester & Pittsburg.—The report of this company for the year ending June 30 shows gross earnings of $8,161,079, an increase of $631,121 over the preceding year. Net earnings were $3,102,266, a decrease of $18,885, and charges, taxes, etc., were increased by $107,108, leaving $126,000 less than the previous year to be applied to the payment of dividends and for improvements. The ton miles were the greatest in the history of the road. The road hauled 6,234,260 tons of bituminous coal, an increase of 1,326,000 tons, and freight tonnage showed an increase of 1,647,000 over the previous year.

Chesapeake & Ohio.—Gross earnings for the year ending June 30 increased $1,426,846, or 7.4 per cent., and net earnings, $959,070, or 14.7 per cent., over the preceding year.

Chicago Great Western.—This company has absorbed the Mason City & Clear Lake (electric), which runs from Mason City to Clear Lake, Iowa, 18 miles, and the Waterloo, Cedar Falls & Northern (electric), which runs from Waterloo through Cedar Falls to Sumner, 56 miles, and which operates a steam line from Sumner to Waverly, 33 miles, under lease from the Chicago Great Western.

Chicago, St. Paul, Minneapolis & Omaha.—This company has declared semi-annual dividends of 3½ per cent. each on the preferred and common stocks. A semi-annual dividend of 3½ per cent. on these stocks was declared last January, before which time the following dividends had been declared: 2 per cent. annually in 1898 and 1897, 3½ per cent. annually in 1899, 5 per cent. annually from 1899 to 1902 and 6 per cent. annually since 1902.

Chicago Southern.—This company is about completing its road, and expects by the first of next year to have it in operation from the state line between Illinois and Indiana to a connection with the Chicago Terminal Transfer Co., of Chicago, a distance of 114 miles. It is as an extension of the Southern Indiana. The company is offering through King, Hodenpyl & Co., of New York and Chicago, at par $4,000,000 in two-year 5 per cent. gold coupon bond notes. The Southern Indiana guarantees these bond notes unconditionally. The notes are further secured by a deposit with the trustee of all the capital stock of the Southern Indiana Railway Co., $11,000,000, and of the capital stock of the Chicago Southern Railway, $600,000. The capitalization of the latter is: Common stock, $1,500,000; gold coupon bond notes, $4,000,000; bonded debt, none. No mortgage can be made prior to the payment of these notes. The Girard Trust Co., of Philadelphia, is the trustee.

Central of Canada.—At a recent meeting of the shareholders it was decided to issue mortgage bonds on account of construction and also to increase the capital stock of the company.

Central of Georgia.—This company has declared 5 per cent. interest payable on each of the following classes of bonds: $4,000,000 first, $7,000,000 second and $4,000,000 third income bonds. The first income bonds have received 5 per cent. since 1903, having received 3 per cent. in 1902, 5 per cent. in 1901 and 3¼ per cent. in 1900. Before that the rate varied from 1½ per cent. to 2¼ per cent. The only interest ever paid on the second income bonds was 2 per cent. in October, 1904, and no interest has ever been paid on the third income bonds until now.

Cleveland, Cincinnati, Chicago & St. Louis.—This company has filed a certificate in Ohio increasing its common stock (as authorized by the directors on June 21 last) from $28,700,000 to $40,000,000.

This company has listed on the New York Stock Exchange $1,000,000 additional general-mortgage 4 per cent. bonds of 1903, making the total listed $20,749,000.

Colorado & Southern.—This company has issued a call through Hallgarten & Co. for 40 per cent. of the subscription to the issue of $15,000,000 refunding and extension 4½ per cent. mortgage bonds, of which $100,000,000 were authorized several months ago. The proceeds will be used for extending the road to the Gulf of Mexico.

Galveston, Harrisburg & San Antonio.—The stockholders of the Gulf, Western Texas & Pacific and the New York, Texas & Mexican have authorized the sale of these roads to the Galveston, Harrisburg & San Antonio. (July 21, p. 24.)

Hartford Street Railway (Connecticut).—A meeting of the shareholders will be held on September 6 for the purpose of acting upon a proposition to sell the property to the Consolidated Railway Co. Permission has been ganted the Hartford Street Railway Co. by the Connecticut Legislature to increase its capital stock from $2,000,000 to $5,000,000 and to the subsidiary East Hartford & Glastonbury Street Railway Co. to increase its capital stock to $1,000,000.

Lake Shore & Michigan Southern.—This company has listed on the New York Stock Exchange $7,500,000 additional 4 per cent. 25-year debenture bonds of 1928 and has been granted permission to list an additional $2,500,000 when sold and delivered.

Mexican Central.—The net earnings of this company for the month ending June 30 show an increase of $86,525, and for the year, an increase of $1,058,096. This large increase is practically due to a decrease in expenses, and also to the operation of the Monterey line from Monterey to Tampico, Mex., which commenced operation on June 1, 1904, but was not satisfactorily run as a through line until the beginning of the last fiscal year.

Michigan Central.—This company has absorbed the Charlevoix & Detroit, a logging road running from Frederic, Mich., to East Jordan, 43½ miles, with a branch from Blue Lake Junction to Blue Lake, eight miles.

Missouri, Kansas & Texas.—H. W. Poor & Co., of New York and Boston, are offering at 89½, $3,000,000 first and refunding mortgage 4 per cent. M., K. & T. gold bonds, due September 1, 2004. This is part of an authorized issue of $40,000,000, of which $1,484,000 are already issued, and they are to be used for the acquisition of additional real estate and rolling stock. The balance of the authorized issue is to be used as follows: $12,037,000 for refunding outstanding bonds; $23,479,000 for future issue for new line at the rate of $25,000 a mile, and for terminals and rolling stock as required.

St. Louis Southwestern.—A meeting of the shareholders will be held on October 4 to vote on authorizing the guarantee of an issue of first-mortgage 5 per cent. fifty-year gold bonds of the Shreveport Bridge & Terminal Co. to an amount not exceeding $500,000 principal; also to authorize an agreement with the same company providing for the use and occupancy of its bridge and other works for a period of fifty years.

Western Maryland.—This company has listed with the New York Stock Exchange $1,402,000 additional first-mortgage 4 per cent. bonds of 1952, making the total amount $31,924,000. The bonds just listed are part of the $14,518,700 (of which $4,436,000 have already been issued) reserved for the construction of branches and extensions, equipment and improvements and for the completion of the Piedmont & Cumberland and the Coal & Iron Railway.

GENERAL NEWS SECTION

NOTES.

The New York Central will close its station at Crane's Village, a small place on the main line near Amsterdam. The passengers formerly using that station, at which six trains stopped daily, have been traveling on the trolley line passing through the village instead of on the railroad. The receipts of the station dropped to $4 a month.

The Long Island Railroad will continue its summer time-table until September 20 instead of substituting a new fall time-table with fewer trains on the first Wednesday after Labor Day, as has been done in previous years. The reason given is that the summer resorts on Long Island promise to have a longer season than ever before and that the residents are planning to stay late into the month. The traffic this year has been very heavy.

Just as the movement of the grain crop is about to begin, the Great Northern announces a large reduction in grain rates throughout its eastern territory as far as the boundary of Montana. This reduction ranges from 5 cents a hundred from the most distant points to ½ a cent from points nearest St. Paul and the head of navigation on the Great Lakes. It will be recollected that considerable reductions were made on the western section of the road three years ago.

According to current estimates, about 250,000 tons of steel in different shapes will be required for railroad cars now building or ordered. Contracts placed for soft steel bars since the first of August are said to aggregate about 130,000 tons. Most of these are contracted for by the United States Steel Corporation, for fall delivery. Since the first of August the Pacific lines are said to have ordered 112,000 tons of rails, while purchases by all other railroads during August have brought the total tonnage up to 213,000.

The Great Central Railway of England, following the example set by a number of other roads, has commenced publication of a journal of its own, designed primarily for employees. The idea is to build up an *esprit de corps* and keep all branches of the service interested in the working of the organization of which they are a part. The first issue contains an illustrated article about the General Manager, Mr. Sam Fay; interviews with Mr. E. A. Clear, Assistant Goods Manager, and Mr. Conradi, District Engineer; district notes, etc.

Secretary of Agriculture Wilson has approved the recommendation of Chief Salmon, of the Bureau of Animal Industry, that the recently adopted regulations under the 28-hour law regarding the shipment of cattle be withdrawn. Until further orders any cars equipped with feeding and watering facilities may be used, without unloading, provided the cattle can and do receive food and water en route. The number of cattle loaded in a car will be left to the shippers, but such loading shall not exceed the minimum weight, as provided in the classification of the transportation companies.

Lecture Course of the Pennsylvania Railroad's Y. M. C. A.

The Pennsylvania Railroad Branch of the Young Men's Christian Association in Philadelphia will give a series of 39 lectures on railroad topics during the coming winter. The course of lectures given last winter on "Railroad Transportation" was so successful that this year's plans have been made along the same but broader lines. The experiment last year showed the value of the course in giving railroad men a broader general knowledge of the location, traffic, policies and methods of operation of the railroads of the country and a more intimate knowledge of the Pennsylvania Railroad, not only as to its history and present status, but especially as to its methods of conducting the business of the various departments.

Among the more important of the lectures to be given this year will be: "Growth and Functions of the Executive Department," by Secretary Lewis Neilson; "Financing the Pennsylvania Railroad," by First Vice-President John P. Breen; "General Accounting," by Comptroller Max Riebenack; "Freight Traffic," by Freight Traffic Manager George D. Dixon; "Development of the Passenger Business," by General Passenger Agent George W. Boyd; "Organization of Motive Power Department in Relation to Road Organization," by Superintendent of Motive Power A. W. Gibbs; "Maintenance of Way Standards," by Chief Engineer of Maintenance of Way Joseph T. Richards; "Purchase of Supplies," by Purchasing Agent D. S. Newhall; "Functions and Growth of the Real Estate Department," by Real Estate Agent B. W. Carskaddon; "Engineering," by Assistant Chief Engineer A. C. Shand; "Functions and Growth of the Legal Department," by Assistant General Solicitor George Stuart Patterson; "Functions and Growth of the Insurance Department," by Superintendent Hugh B. Ely. During the course these general subjects will be sub-divided and treated by other Pennsylvania officials thoroughly familiar with the respective subjects. Colonel Frank N. Barksdale, the advertising manager of the company, will give a talk on advertising.

The Ethics of Cut Rates.

The cut rate is designed to make a competitor, or competitors, lose money, generally on the transportation of some specific commodity. It has never been claimed by the railroad officials that such concessions were a remedy for abuses. The cut rate is simply a form of revenge, designed to cause trouble. When it spreads to commodities, the railroad officials who were responsible for it in the first instance are generally found to "deeply regret" it. There is a great difference between the open cut rate and the "midnight tariff." The former is published and filed in Washington. The latter is an attempt to break the law without being caught, or to evade the law, which requires the filing of all rates at Washington. Both the sugar rate war and the differential rate war were open tariffs, and were not violations of any law. The New Orleans lines filed low tariffs on sugar out of New Orleans against the trunk lines out of New York, and the Michigan Central and Grand Trunk openly filed the low rates between Chicago and New York. There have always been losses on cut rates, but in most cases the published reports are grossly exaggerated. Chicago is talking just now of "millions lost" in the sugar rate war. As a matter of fact, the net loss to all railroads on this tariff was probably below $100,000. The rough estimates of the cost of the "passenger differential war" are similarly padded.—*Evening Post*, New York.

How Ticket Scalpers Are Handled in Texas.

It is not frequently that railroad companies print in book form for public distribution the proceedings in a trial at court in which they are interested, but that is what the passenger department of the Southern Pacific, of which T. J. Anderson is General Passenger Agent, has done in one particular case. The book contains 59 pages and is a complete report of the important portions of the case of the Galveston, Harrisburg & San Antonio Railway et al. vs. Sam Alexander et al., injunction. The voluminous petition of the railroad companies for an injunction in the action against Mr. Alexander and other ticket scalpers is given in full. It sets forth in vigorous English the injuries the railroads suffer from ticket scalping and the infringement on their natural and legal rights by reason of such practices. Also the rulings in full of Judge Norman G. Kittrell, of the Sixty-first district court, in which the cause was heard, including the final decree, are reprinted. This case was the undoing of the scalper in Texas and decision in it has been used as a precedent in the courts of many other states in similar actions. The books are being freely distributed, especially in portions of the country where scalping still flourishes. General Passenger Agent Anderson has been the commander-in-chief in the fight against the scalper. His energetic campaign has not only wiped scalping out of most of Texas, but has been an inspiration for passenger heads of other railroads to take up the cudgel and put on the war paint. The war on the scalper is not yet over, notwithstanding victories have been achieved in the most important centers. Strongholds still exist and there are a few scattered outposts in Texas. The "law reporter" which Col. Anderson has gotten out will undoubtedly hasten the general victory wherein scalping will be no more. The front cover of the book bears the following words: "How Scalpers Are Handled in Texas. Go Thou and Do Likewise."—Houston, Tex., *Chronicle*.

Air Compressor for an Arizona Mine.

The Calumet & Arizona Mining Co., Bisbee, Ariz., is installing a Sullivan Corliss cross-compound steam two-stage air compressor, with a total piston displacement of 3,660 cu. ft., which, on account of the altitude at which the compressor operates, is equivalent to an actual delivery capacity of 2,700 cu. ft. of free air per minute, against a terminal pressure of 100 lbs. per sq. in., while running at 83 r. p. m. This machine is expected to attain a high efficiency, being designed to run condensing, and to operate when carrying its most economical load on 15.2 lbs. of dry steam per i. h. p. per hour. The steam cylinders are 17 in. and 34 in., and air cylinders, 20 in. and 34 in. in diameter, with a common stroke of 42 in. Rolling inlet valves controlled by independent eccentrics are used on both the high and low pressure air cylinders. Rolling discharge valves are also used on the low pressure air cylinder. In addition to these, a number of automatic discharge valves are used on the same cylinder. The high pressure air cylinder is equipped with a full set of removable automatic poppet discharge valves, which act in a direction parallel with the steam piston rod. An interesting feature is the automatic oiling system, which lubricates all the working parts regularly and without the attention of the engineer. The machine

will be used for operating rock drills and other pneumatic tools about the mines. This company already has three class WB-2 Sullivan straight-line compressors, giving a total air supply of about 5,700 cu. ft. per minute. The Sullivan Machinery Co., Chicago, is the builder of these compressors.

Fighting for Right-of-Way in New Orleans.

Press dispatches from New Orleans, La., on August 20, reported a strenuous battle between employees of the Illinois Central and the New Orleans Terminal Company for the possession of a disputed strip of right of way along the Illinois Central's yards. The Terminal Company attempted to lay tracks on the land which it claimed had been granted to it by the City Council. When a force of 45 of the company's men appeared on the morning of August 20 with tools and material to lay track they were met by 500 employees of the Illinois Central and driven off, and their material confiscated. The police were called on, but were ejected in the same unceremonious manner. Work was resumed later under heavy police guard, and then the Illinois Central is reported to have backed in a gravel train and dumped the gravel over on the contested property. It was removed, and the track laying continued. As a last resort an attempt was made to wreck a train of freight cars and block the track-laying operations with the mass of debris by undermining the track alongside of the battleground. The cars left the rails, but did not interfere with the Terminal Company's continuing work. The Illinois Central finally gave up the fight after 90 of its employees had been arrested on various charges of assault and disorderly conduct.

Georges Nagelmackers.

Georges Nagelmackers, the founder and General Manager of the International Sleeping Car Co., which in a small way is the Pullman Co. of continental Europe, died last July in Belgium, at the age of 61. He was born in Liege, where his father was a banker. After finishing engineering studies he spent some time in the United States, and on his return to Europe, interested some friends in the construction of a single sleeping car, which he succeeded in attaching to a train running between Brussels and Cologne. Encouraged by its success, Nagelmackers organized the International Sleeping-Car Co. in 1876, which made contracts for running its cars, and now for a long time entire trains on many of the most important long routes in Europe, and latterly in Asia, as from Paris to Lisbon, Paris to Constantinople, Moscow over the Siberian Railroad to Irkutsk, a line which would have been extended to Port Arthur but for the Japanese war; and many others. The company also built and conducted some of the most luxurious hotels in the world, chiefly at winter resorts—an enterprise which has so far been unprofitable. Nagelmackers left a son, René, who is one of the directors of the company.

New President of the Master Blacksmiths' Association.

Mr. David B. Swinton, the newly elected President of the International Railroad Master Blacksmiths' Association, was born at Hadlow, Ont., and commenced his career in his father's shop at that place. At the age of 18 he began work with the Credit Valley R. R. Co. at Toronto, a few years later entering the service of the Canadian Pacific R. R. at Montreal in the locomotive department, afterward being promoted to the position of Master Blacksmith of the car department, which position he now holds. Mr. Swinton, though young, is a man of broad experience, and is popular with those employed under him.

Tramway Competition in England.

Lord Allerton told the Great Northern Railway meeting on August 11 that electric tramway competition during the half year had been a serious matter for the company. In Yorkshire owing to further extension of tramways, it had carried 350,000 fewer passengers. The new service of tram cars in London had affected its short-distance traffic betwen Hornsey, Wood Green, Harringay and Finsbury Park, at which stations the falling off had been 150,000 passengers.

Performance of an Allfree-Hubbell Locomotive.

Central Railroad of New Jersey locomotive 581, equipped with the Allfree-Hubbell valve gear, was described in the *Railroad Gazette* June 9, 1905, as was its performance in competition with a companion locomotive having the usual valve gear. On July 23d this locomotive hauled a five-car train from New York to Philadelphia, 92.8 miles, in one hour and 58 minutes without taking water. The train made the regular stops and three slow-downs, the average speed being 47.18 m.p.h. The tank holds 5,000 gals. and on arrival at destination still had 6 in. of water in it.

Master Car Builders' and Master Mechanics' Conventions.

The next place of meeting of the annual conventions of the Master Car Builders' and Master Mechanics' Associations convention will be determined by the following committee: A. E. Mitchell, S. M. P., L. V. R. R. Co., with office at South Bethlehem, Pa.; G. W. Wildin, Mechanical Superintendent, Erie R. R. Co., with office at Meadville, Pa.; F. K. Shults, representing the Supply Men's Association, 95 Liberty street, New York City.

The above mentioned committee has appointed Mr. F. K. Shults Chairman, and all communications should be addressed to him, care Camel Company, 95 Liberty street, New York City.

Temporary Hoboken Terminal.

The Lackawanna has practically completed a temporary terminal at Hoboken, N. J., to replace the one destroyed by fire August 7. The estimated cost of this temporary work is about $100,000, and it is understood that this cost, together with that of removing this same structure to make room for the permanent one later on, will represent the chief actual loss from the fire, as the old buildings would have been torn down as soon as possible. It is no doubt a considerable convenience to the company to have them removed in this summary manner.

New Honolulu Record.

The Pacific mail steamship Siberia has made a new record between San Francisco and Honolulu, making the run in 4 days, 19 hours and 20 minutes, which is at the rate of 18.1 knots an hour. The best previous time was 4 days and 23 hours, approximately, made by the Korea, a sister ship of the Siberia, two years ago. These two vessels are both American build.

Coal Production in the United States.

The *Wall Street Journal* prints the following table of coal production in the United States since 1884:

	Bituminous and anthracite combined. tons.	Anthracite. tons.		Bituminous and anthracite combined. tons.	Anthracite. tons.
1904	351,196,953	73,156,709	1894	170,741,526	51,921,121
1903	357,356,416	74,607,068	1893	182,352,774	53,987,543
1902	301,590,439	41,373,595	1892	179,329,071	52,472,504
1901	293,299,816	67,471,667	1891	168,566,669	50,665,431
1900	169,684,027	57,367,915	1890	157,770,963	46,468,641
1899	253,741,182	60,418,005	1889	141,229,513	45,546,970
1898	219,796,267	53,382,644	1888	148,659,657	46,619,564
1897	200,229,199	2,611,680	1887	130,650,511	42,088,197
1896	191,986,357	54,346,081	1886	113,680,427	39,035,446
1895	193,117,530	57,999,337	1885	111,160,295	38,335,974

The production, in tons, of bituminous coal in the principal soft coal states for a series of years compares as follows:

	1904.	1900.	1885.
Pennsylvania	97,916,733	79,842,326	26,000,000
Illinois	35,990,796	25,767,981	11,834,459
West Virginia	32,332,385	22,647,207	3,369,062
Ohio	24,415,054	18,988,150	7,816,179
Alabama	11,163,194	8,394,275	2,492,000
Indiana	10,929,908	6,484,086	2,375,000
Colorado	6,594,295	5,244,364	1,356,062
Kentucky	7,559,940	5,328,964	1,600,000
Iowa	6,542,005	5,202,939	4,012,575
Kansas	6,322,875	4,467,870	1,212,057
Maryland	4,819,171	4,024,688	2,833,337
Wyoming	5,177,381	4,014,602	807,328
Tennessee	4,782,302	3,509,562	1,440,957
Missouri	4,187,197	3,540,103	3,080,000
Virginia	3,576,092	2,393,754	567,000

Manufacturing and Business.

R. S. Cooper, former representative of the Rand Drill Co. at Pittsburg, Pa., has been appointed Manager of the New York office of the Independent Pneumatic Tool Co.

The American Bridge Co. is putting up new works at Athens, Pa., which it expects to have open by the first of October, and which will give employment to about 500 men.

The Canadian Pacific has purchased four large steam shovels from the Locomotive & Machine Co., of Montreal, Que. This is the largest order of the kind ever filled in Canada.

Jas. C. Hain, formerly Engineer of Masonry Construction of the Chicago, Milwaukee & St. Paul, is now connected with J. G. White & Co., Engineers and Contractors, 43 Exchange place, New York.

Announcement has been made that the Continental Iron & Steel Co. will soon build a large plant at East Rahway, N. J., in which, it is said, rails will be made. The Pennsylvania is thought to be back of this project.

P. F. Kobbe, Jr., announces his resignation as Advertising Manager of the Rand Drill Co., to engage in similar work elsewhere. Until October 1 his address will be at 11 Broadway, New York, and after that date at 1 Hudson street.

William T. Simpson, formerly with the Detroit Lubricating Co., and more recently with the American Locomotive Equipment Co., is now with the S. F. Bowser & Co., of Fort Wayne, Ind., maker of the Bowser oil storage systems and oil house equipments.

The Dayton Pneumatic Tool Co. is in the market for new drop forge dies for hammer handles, and will be pleased to hear from drop forge companies equipped for this class of work. All communications in regard to the matter should be addressed to their general offices at Dayton, Ohio.

Mr. Henry W. Toothe has resigned as Manager of the Railroad Department of the Magnolia Metal Co. to take a position with the A. C. Stiles Anti-Friction Metal Co., of New Haven, Conn. Mr.

Toothe will act as Manager of this company's Babbitt Department, with headquarters in New York City.

Walter E. Harrington has severed his connection as Vice-President and General Manager of the New York-Philadelphia Company to become associated with J. G. White & Company, of New York, as Operating Manager, in which position he will supervise all of the railway, electric lighting, gas and other properties operated by it, and will make his headquarters at the New York office of the company, 43 Exchange place.

The Erie Railroad Co. has awarded The Buffalo Forge Company, Buffalo, N. Y., contracts for heating and ventilating its new 42-stall roundhouse at Buffalo, N. Y.; its 43-stall roundhouse at Hornellsville, N. Y.; its 21-stall roundhouse at Galion, Ohio, and its 21-stall roundhouse at Huntington, Ind. The Fan system of heating ventillation will be used, and if the pipe in the heating apparatus of these installations were laid in one continuous length, the distance covered would be practically 6½ miles.

According to reports from Pittsburg, many of the mills and shops of the steel makers are to be enlarged and improved at an expenditure of over $25,000,000. Among the companies building new works are: The Carnegie Steel Co., at Braddock and at Homestead; Jones & Laughlin, at Pittsburg; American Steel & Wire Co., at Pittsburg and at Rankin; National Tube Co., at Pittsburg and at McKeesport; McClintic-Marshall Construction Co., at Pittsburg; Mesta Machine Co., at Pittsburg, and Pittsburg Steel Co., at Monessen.

At the annual meeting of the stockholders of the Locomotive Appliance Co., which was held at their offices, Old Colony Building, Chicago, August 10th, the following directors were elected for the ensuing year: J. H. McConnell, Pittsburg, Pa.; E. B. Lathrop, Frank W. Furry, Ira C. Hubbell, J. B. Allfree, Willis C. Squire and J. J. McCarthy, Chicago; W. J. McBride, Clarence H. Howard, B. F. Hobart and C. A. Thompson, St. Louis, Mo. J. H. McConnell, who succeeds G. W. Cale, Jr., was formerly connected with the Union Pacific for a number of years, and more recently Manager of the Pittsburg Works of the American Locomotive Co.

Iron and Steel.

The Vanderbilt Lines, it is said, have placed orders for rails amounting to 160,000 tons for 1905 delivery.

The United States Steel Corporation, it is said, has arranged to buy between 30,000 and 40,000 tons of Bessemer pig iron for September delivery.

The orders for rails recently placed with the United States Steel Corporation by the Harriman Lines aggregate about 75,000 tons. The contracts recently placed by the Union Pacific and the Southern Pacific aggregate about 86,000 tons. The Chicago, Burlington & Quincy is in the market for 15,000 tons for 1905 delivery, and the Frisco System for 25,000 tons for 1906 delivery.

PERSONAL.

—Mr. John H. Davis, for many years Master Car Builder of the Atlantic Coast Line at Wilmington, N. C., died at that place on August 17 at the age of 47. Mr. Davis was born in Charlotte, N. C., and came to the Wilmington shops of the Atlantic Coast Line as an apprentice in 1875 at the age of 17, becoming, in 1884, Master Car Builder after a series of promotions.

—Mr. George H. Thompson, City Passenger Agent of the Pittsburg & Lake Erie, died in Pittsburg on August 17 at the age of 33. Mr. Thompson was born at Cleveland, Ohio, where he entered the service of the Lake Shore & Michigan Southern. In 1893 he was appointed Traveling Passenger Agent of the Pittsburg & Lake Erie, holding this position until 1902, when he was appointed City Passenger Agent.

—Mr. James B. Smalley, who has recently been appointed Superintendent of the Kansas division of the Chicago, Rock Island & Pacific, with headquarters at Topeka, Kan., began his railroad work with the Chicago, Milwaukee & St. Paul at Muscoda, Wis., studying telegraphy. After a short apprenticeship he went into the general freight office of the same road at Milwaukee and was transferred two years later to become assistant despatcher and later was made train despatcher. Eight years after he was appointed chief despatcher at Dubuque, from which place he was transferred to Marion as chief despatcher of that division and later became Assistant Superintendent of the division. Two years later he was appointed to the position of Superintendent of the Dakota division, with headquarters at Estherville, where he remained only a few months. He was then transferred to Des Moines as Superintendent of the Iowa division, which position he leaves to take charge of the Kansas division.

—Mr. Charles W. Jones, the new Superintendent of the Iowa division of the Chicago, Rock Island & Pacific, was born at Milton, Ind., in 1858, and was educated at the Mitchellville Seminary. His entire railroad career has been spent with the Chicago, Rock Island & Pacific, having started as agent's helper at Mitchellville in 1876. After a short apprenticeship he was appointed operator. He continued this work from 1877 to 1881, and from that time to 1884 he was agent and operator at Atlantic, and from 1884 to 1890 was train despatcher in Des Moines. For two years he was chief despatcher at Davenport, where he also served as trainmaster for three years, and for a short time was Assistant Superintendent until his transfer in 1895 to Herrington, Kan., as Superintendent of that division. When the headquarters were transferred from that place to Topeka, he continued in the same capacity. He now leaves this position to go to the Iowa division of the same company.

ELECTIONS AND APPOINTMENTS.

Canadian Pacific.—See Panama Canal.

J. M. R. Fairbairn has been appointed Acting Division Engineer of the Eastern Division, with headquarters at Montreal, succeeding D. MacPherson, resigned.

Chicago Great Western Railway.—E. E. Watson has been appointed Assistant General Freight Agent, succeeding W. E. Pinckney, promoted.

Chicago, Indianapolis & Louisville.—W. B. Jones has been appointed Superintendent of Transportation in charge of telegraph service, assignment and distribution of power and equipment used in freight and passenger service, with headquarters at Lafayette, Ind. L. H. Parker having resigned to engage in other business, the office of Superintendent is abolished. All matters which do not come within the jurisdiction of the Superintendent of Transportation, will hereafter be handled through the office of the General Superintendent.

Chicago, Milwaukee & St. Paul.—J. J. Harding, hitherto Assistant Engineer in charge of the drafting room of the bridges and buildings department, has been appointed Engineer of Masonry Construction, succeeding J. C. Hain, resigned. J. H. Pryor succeeds Mr. Harding.

Chicago, Rock Island & Pacific.—A. W. Kelso has been appointed Superintendent of the Chicago Terminal Division, succeeding W. G. Bierd, resigned.

C. H. Hubbell, Acting General Superintendent of the Central district, has been appointed General Superintendent of the Northern district, with office at Cedar Rapids, Iowa. H. S. Cable, formerly General Superintendent of the Northern district, has been appointed to the same position on the Central district, with headquarters at Davenport, Iowa.

Cincinnati, Hamilton & Dayton.—F. A. Sweeney, Trainmaster at Cincinnati, has been appointed Superintendent of the Wellston division, with headquarters at Wellston, Ohio, suceeding George Geiger, resigned.

Cleveland, Akron & Columbus.—J. H. Oglesby has been appointed Traveling Freight Agent, with temporary headquarters at Columbus, Ohio, succeeding C. M. Munhall, deceased.

Cleveland, Cincinnati, Chicago & St. Louis.—Charles Krotzenberger, General Agent, Passenger Department, with office at Columbus, Ohio, has been appointed to the newly created position of General Agent, Passenger Department, with headquarters at Cincinnati, reporting to the General Passenger and Ticket Agent. He is succeeded by C. C. Clark, formerly Central Passenger Agent at Cincinnati.

Delaware, Lackawanna & Western.—F. W. Williams, Master Mechanic at Buffalo, N. Y., has resigned.

Denver, Enid & Gulf.—W. B. Blanton, Assistant to the Vice-President and General Manager, has resigned.

Galveston, Harrisburg & San Antonio.—Colonel W. J. Craig has been appointed Division Freight and Passenger Agent, with headquarters at Victoria, Tex.

Lake Shore & Michigan Southern.—Harry F. Smith has been appointed General Car Foreman at the Collingwood, Ohio, shops.

Norfolk & Western.—W. S. Becker, Superintendent of the Norfolk division, with headquarters at Crewe, Va., has been appointed Superintendent of the Pocahontas division, with office at Bluefield, W. Va., succeeding M. J. Caples, resigned. Mr. Becker is succeeded by V. A. Riton, formerly Superintendent of the Shenandoah division. E. A. Blake has been appointed to succeed Mr. Riton as Superintendent of the Shenandoah division, with office at Roanoke, Va. James T. Carey, Trainmaster on the Scioto division, has been appointed Assistant Superintendent of the Pocahontas division.

Panama Canal.—J. G. Sullivan, Division Engineer of the Canadian

Pacific, has been appointed Assistant Engineer of Construction of the Panama Canal.

South & Western.—M. J. Caples, Division Superintendent of the Norfolk & Western, has been appointed General Manager of this company, with headquarters at Bristol, Va.

Tidewater.—F. F. Harrington, who was in the office of the Chief Engineer of the New York Central, has been appointed Engineer of Bridges, with headquarters at Norfolk, Va.

Wabash.—W. C. Maxwell, formerly Assistant General Freight Agent of the Chicago, Burlington & Quincy, with office at St. Joseph, Mo., has been appointed Assistant General Traffic Manager of the Wabash, with headquarters at St. Louis.

Wabash-Pittsburg Terminal.—John T. Walsh, Assistant Auditor, has resigned.

LOCOMOTIVE BUILDING.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 50 locomotives.

The New York, New Haven & Hartford is reported to have ordered 17 freight locomotives.

The Japanese Government has ordered 150 narrow gage locomotives from the Baldwin Locomotive Works.

The Rhaetische-bahn, a narrow gage railroad in Engadine, Switzerland, is reported as being in the market for 13 locomotives.

The Harriman Lines have ordered 72 simple Consolidation, 31 simple Atlantic, 10 simple Pacific and 23 switching locomotives from the Baldwin Locomotive Works.

The South Side Coal & Railway Company, Arkansas, on the completion of its line, will be in the market for three 85-ton freight locomotives. George D. Locke, Missouri Trust Building, St. Louis, is Vice-President of the company.

The Michigan Central is having a number of locomotives built by the Locomotive & Machine Co., of Montreal, Ltd. These engines are duplicates of those recently completed for the Michigan Central at the Schenectady shops of the American Locomotive Co. These are of the 2-8-0 C type, having the following dimensions: Cylinders, 23 in. and 35 in. in diameter x 32 in. stroke; eight drivers, 63 in. in diameter; driving wheel base, 17 ft.; total wheel base, 25 ft. 9 in.; weight on drivers, 175,000 lbs.; total weight, 199,000 lbs.; tank capacity, 14 tons of coal and 16,000 U. S. gallons of water; weight of tender when loaded, 128,000 lbs.

The Bangor & Aroostook has ordered five simple 10-wheel freight (4-6-0) locomotives from the American Locomotive Co., for spring 1906 delivery. These locomotives will weigh 144,500 lbs., with 111,500 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 62 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 2,052 sq. ft.; 277 charcoal iron tubes, 2 in. in diameter and 13 ft. 8 in. long; firebox, 96 in. x 41 in.; grate area, 27½ sq. ft.; tank capacity, 4,000 gallons, and coal capacity, seven tons. The special equipment includes: Westinghouse-American air-brakes, Sterlingworth brake-beams, Tower couplers, Dewey headlights, Hancock injectors, Ashton safety valves, Leach sanding devices, Detroit sight-feed lubricators and Krupp driving wheel tires.

The Louisiana & Arkansas has ordered four simple 10-wheel freight (4-6-0) locomotives from the Baldwin Locomotive Works, for August and September delivery. These locomotives will weigh 149,500 lbs., with 121,500 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 56 in.; straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,306 sq. ft.; 316 charcoal iron tubes, 2 in. in diameter and 13 ft. long; steel firebox, 116¾ in. x 41⅛ in.; grate area, 33.3 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 10 tons. The special equipment includes: Westinghouse-American air-brakes, Tower couplers, Monitor injectors, More-Jones journal bearings, Jerome piston and valve rod packings, Leach sanding devices, Nathan sight-feed lubricators and French springs.

The Chicago, Burlington & Quincy, as reported in our issue of August 11, is building four simple switching (0-6-0) locomotives at its Havelock (Neb.) shops, for October delivery. These locomotives will weigh (estimated) 144,200 lbs.; cylinders, 21 in. x 26 in.; diameter of drivers, 52 in.; radial stay boiler, with a working steam pressure of 180 lbs.; heating surface, 2,366 sq. ft.; 254 Tyler iron tubes, 2¼ in. in diameter and 15 ft. long; steel firebox, 6 ft. x 5 ft.; grate area, 30 sq. ft.; tank capacity, 8,000 gallons, and coal capacity, 16 tons. The special equipment includes Westinghouse air-brakes, Crandall bell ringers, Melrose couplers, Sellers injectors, Economic piston and valve rod packings, Ashton safety valves, Michigan sight-feed lubricators, Crosby steam gages, Latrobe driving wheel tires, and Standard Steel Works tender wheel tires.

CAR BUILDING.

The Jamison Coal & Coke Co. is having 500 of its cars rebuilt.

The Mexican Central has ordered 20 passenger cars from Barney & Smith.

The Winona & Warsaw (*Electric*), Warsaw, Ind., is in the market for six cars.

The Chesapeake & Ohio will have several hundred of its freight cars rebuilt by the Illinois Car Co.

The Florida East Coast is in the market for 10 coaches, six baggage and express cars and one sleeping car.

The Nashville, Chattanooga & St. Louis, it is reported, will build 100 coal and 100 box cars at its own shops.

The Cleveland, Cincinnati, Chicago & St. Louis will have repaired several hundred cars by the Illinois Car Co.

The Green Bay Traction Company, of Green Bay, Wis., has ordered two interurban cars from the St. Louis Car Co.

Swift & Company will rebuild at its own shops 100 produce cars and are reported as being in the market for 100 stock cars.

The Missouri, Oklahoma & Gulf has ordered 10 box cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Havana Central (*Electric*) is reported as being in the market for several hundred cars to be used for general service.

The Orange & Northwestern has ordered 50 logging cars of 60,000 lbs. capacity from the Beaumont Iron Works, of Beaumont, Tex.

The Canadian Pacific intends building a large number of grain cars at its Montreal shops. It will also build 10 passenger coaches and 30 cabooses.

The Atchison, Topeka & Santa Fe has ordered 150 flat cars of 80,000 lbs. capacity from the Pressed Steel Car Co. They will be mounted on Barber trucks.

The Japanese Government has ordered 2,000 steel gondola cars, 1,000 from the Western Steel Car & Foundry Co. and 1,000 from the American Car & Foundry Co.

The Rhaetische-bahn, a narrow gage railroad in Engadine, Switzerland, is in the market for 62 cars of various sorts, and $78,000 has been set aside for their purchase.

The Central of Georgia is in the market for 500 steel hopper cars of 100,000 lbs. capacity, 250 flat cars of 80,000 lbs. capacity, and 250 steel hopper bottom gondola cars of 100,000 lbs. capacity.

The Seaboard Air Line, as reported in our issue of August 18, has ordered 500 plain box cars and 500 ventilated box cars of 80,000 lbs. capacity from the American Car & Foundry Co. The special equipment will include: Westinghouse air-brakes, Tower couplers, Symington journal boxes, Chicago old style roofs and Railway Steel Spring Co.'s springs.

The South Side Coal & Railway Company, Arkansas, will begin building its 50-mile road about October 1. On the completion of its line, the company will be in the market for the following equipment: Five hundred coal cars, 50 box cars, four passenger cars and three cabooses. The Vice-President of the company is George D. Locke, Missouri Trust Building, St. Louis.

The Atlantic Coast Line, as reported in our issue of August 11, has ordered 150 flat cars of 60,000 lbs. capacity from the South Atlantic Car & Manufacturing Co., for September delivery. These cars will be 40 ft. long and 9 ft. 2 in. wide, over all. The special equipment will include: Atlantic Coast Line standard brake-beams and brasses, Christie brake-shoes, Westinghouse air-brakes, Tower couplers, Thornburgh tandem draft rigging and Harrison dust guards.

The Mexican Railway, as reported in our issue of August 11, has ordered 50 gondola cars from the Pullman Co. These cars will be of 60,000 lbs. capacity and are for October delivery. They will weigh about 29,500 lbs., and measure 34 ft. long x 8 ft. 10 in. wide over sills. The special equipment includes: Pullman axles and brake-beams, American Steel Foundries' bolsters and trucks, Christie brake-shoes, Westinghouse air-brakes and draft rigging, Tower couplers and Soule dust guards.

The Atlanta & West Point has ordered four vestibule passenger cars from the St. Louis Car Co., for November delivery. These cars will be 74 ft. long, 9 ft. 8½ in. wide and 14 ft. 6 in. high, over all. The special equipment will include: Diamond special brake-beams, Westinghouse air-brakes, Ajax brasses, Buhoup couplers, National Lock Washer Co.'s curtain fixtures, Pantasote curtain material, Miner tandem draft rigging, Harrison dust guards, Gold heating system, McCord journal boxes, Pintsch light, Hale & Kilburn seats, Railway Steel Spring Co.'s springs, Pullman wide vestibules and Page wheels.

BRIDGE BUILDING.

ALLENTOWN, PA.—The Northampton County Commissioners have instructed County Engineer Cooper to prepare plans for a new bridge to be built over the Saucon creek at Shimersville.

ATLANTA, GA.—A resolution has been introduced in the City Council to authorize an appropriation of $15,000 to start the work on the Washington street viaduct.

BENTON HARBOR, MICH.—The Michigan Terminal Co., to secure an entrance for its proposed road into this place, offers to build a bridge over the Ship canal to cost $40,000.

BENTON, TENN.—The County Court, at a recent session, decided to build six new bridges; one each at Conasarga, Ducktown, and Reliance, and three near Benton, at a total cost of $40,000, on which work is to be commenced at once.

BISMARCK, N. DAK.—Bids are wanted September 5 by J. W. Healy, County Auditor, for building a bridge in Burleigh County.

CHICAGO, ILL.—A contract is reported let for the superstructure and foundations for the North avenue bridge to Jackson & Corbett at $81,000 and Roehmhela & Galley at $112,000, making a totatl of $193,000.

CLEVELAND, OHIO.—The War Department has approved the plans submitted by the Cleveland Terminal & Valley Railroad for its proposed bridge to be built over the old bed of the Cuyahoga river at this place.

EAGLE PASS, TEX.—The Galveston, Harrisburg & San Antonio, it is said, will at once rebuild its trestle bridge 750 ft. long, which was recently destroyed by fire.

FREDERICTON, N. B.—Bids are being received by C. H. LaBillois, Commissioner of Public Works, for rebuilding the Wilson bridge in Carleton County and the Piccadilly bridge over Trout River, in Kings County.

HACKETTSTOWN, N. J.—Bids are wanted by David McClellan, of Hackettstown, for building an iron bridge over the Musconetcong River, near this place.

INGERSOLL, ONT.—The City Council has decided to build a steel bridge over the river at McKeand street.

GERMANTOWN, IND.—A new iron bridge will be built over Plum creek south of this place during the present year.

LA CROSSE, WIS.—A resolution will be introduced in the City Council to authorize the building of a high bridge over the La Crosse river to cost between $40,000 and $50,000.

LAWTON, OKLA. T.—Contracts are to be let by Charles E. Gordon, Chief of the United States Geological Survey, with headquarters at this place, for building about 30 steel bridges in Comanche County.

LEXINGTON, KY.—A vote will be taken next November on the question of issuing $27,000 of viaduct bonds.

MONTREAL, QUE.—The City Council and the Canadian Pacific are reported to have reached an agreement providing for the building of an overhead bridge over the railroad tracks.

NEW YORK, N. Y.—A contract will soon be given for building the Manhattan terminal of the Williamsburgh bridge at the foot of Delancey street, for which plans have been completed by the Bridge Department. The cost of the work will be $1,000,000. The terminal will be entirely below the surface of the ground; it will be 600 ft. long x 180 ft. wide, and will contain eight loops. The work, it is expected, will be completed by next spring.

Surveys have been made by the Bridge Department and plans are under way for building of the Hudson Memorial Bridge over Spuyten Duyvil creek at a cost of $2,000,000. An appropriation of $10,000 for preliminary survey work was made some time ago. (See Construction Record.)

PAISLEY, ONT.—Bids are being received by J. C. Gibson, Town Clerk, for a bridge over Willow creek.

PENSACOLA, FLA.—Bids are wanted October 1 by the joint Boards of County Commissioners of Escambia County, Fla., and Baldwin County, Ala., for building a steel bridge over the Perdido river between these two counties. Plans are on file with A. M. McMillan, Clerk of the Circuit Court of Pensacola, Fla.

ROCHESTER, N. Y.—The New York Central, it is said, has changed its plans for the West Shore bridge over the Genesee river south of this place. It was originally intended to build a pier in the center of the river; the new plans call for a single-span structure.

SAN JUAN, PORTO RICO.—Bids are wanted September 30 by the Bureau of Public Works of the Department of the Interior for a steel truss highway bridge, 226 ft. long, for delivery on the dock at San Juan; also, on the same date, for a steel riveted highway bridge, 100 ft. long. J. J. Jimenez is Superintendent of Public Works.

SPOKANE, WASH.—The Spokane & Inland Electric Railroad Co. is making plans to put up two bridges over the Spokane river with total length of 1,000 ft.

Other Structures.

CENTRALIA, ILL.—The Chicago, Burlington & Quincy has bought a large plot of ground at this place on which it will put up repair shops.

CHICAGO, ILL.—The Chicago & Western Indiana, it is said, has bought a large plot of ground with a frontage of 798 ft., on which it will build a large freight warehouse.

CLEVELAND, OHIO.—The Wheeling & Lake Erie, it is said, has plans ready for putting up a large passenger station at this place.

CORTLAND, N. Y.—The Lehigh Valley, it is said, has decided to put up a new passenger station at this place.

CRANFORD, N. J.—The Central of New Jersey has given a contract to Lammerding & Devine, of this place, for the substructure of a new passenger station to cost about $30,000.

JERSEY CITY, N. J.—The Erie, it is said, will make improvements at various places along its road, to include new roundhouses of 10 stalls each at Hammond, Ind., and Marion, Ohio; one of 15 stalls at Port Jervis; one of 14 stalls at Kent, and one of six stalls at Bradford, Pa. Each house will be provided with new ash handling and coaling plants and cinder pits.

NEW YORK, N. Y.—The Long Island, it is said, has plans ready for putting up a new ferry house at the foot of 34th street. The building will be 400 ft. long and 170 ft. deep and will cover the five new slips the company is now building.

The New York Central & Hudson River has filed plans for a two-story brick electric sub-station to be built at 50th street from Park avenue to Lexington avenue. The new station will have a frontage of 361 ft., a depth of 39 ft., and will cost about $130,000. It will be the most important sub-station supplying power for the operation of trains in and out of its new terminal.

WAYCROSS, GA.—The Atlantic Coast Line has commenced the preliminary work of building its new shops at this place.

WHEELING, W. VA.—The Baltimore & Ohio has given a contract to Horr & Kinner, of Columbus, for the substructure for its new passenger station to be built at a total cost of $300,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—Announcement has been made that this company has definitely decided the proposed route of its trunk line from Galveston to the Pacific coast. The surveys which have been completed run from Weatherford, Tex. (which is already connected with Galveston), to Texico through a level country for a distance of 250 miles, and thence by the Belan cut-off now under construction and over the El Paso line to Silver City, where connection will be made with the Santa Fe, Prescott & Phœnix, now under construction in an easterly direction. The plan to build a line from the Pacos Valley lines to Rincon has been abandoned.

ATLANTIC COAST LINE.—Plans are being made to build a large freight yard 1½ miles long and 750 ft. wide at Waycross, Ga.

BERLIN, PRINCETON & WESTERN.—Surveys are being made for this proposed road from Berlin, Wis., south to Princeton, thence west to Necedah, a distance of 77 miles. Henry Behm, of Chicago, is the promoter. The Chicago & North-Western is said to be back of this project.

BONNERVILLE & SOUTHWESTERN.—This company has secured the necessary capital, completed surveys, and secured the right of way for its proposed road from Bonnerville, Ark., to Jelks, a distance of 65 miles. Contracts for building have been let to the Frisco Construction Co. (May 12, p. 158.)

CANADIAN VALLEY & WESTERN.—Bids for building a line from Chickasha, Ind. T., to Lehigh, it is said, will be let by this company about September 1.

CANEY, OKLAHOMA & TEXAS.—A contract has been given by this company to W. R. Stubbs for building its road from Caney, Kan., to Perry, a distance of 116 miles. The road, which is backed by Eastern Pittsburg bankers, it is said, will be operated by either the Missouri Pacific or the Atchison, Topeka & Santa Fe.

CHICAGO & EASTERN ILLINOIS.—This company, under the direction of General Manager H. I. Miller, has begun to make improvements, for which $1,500,000 was recently appropriated. Nearly all parts of the line from Chicago and Terre Haute will be laid with new and

heavier rails, new passing tracks and switches, and the installation of a new modern block system.

Chicago & North-Western.—According to reports, this company is planning to make improvements on its Galena division, to include the laying of four tracks for a distance of 30 miles as far as West Chicago. The tracks are being elevated between Ada street and Western avenue, and a new freight yard with a capacity of 5,000 acres is under construction between Melrose Park and Elmhurst. The new yard will contain more than 25 miles of side tracks.

Announcement has been made confirming the report that this company has bought the right of way of the Rapid City, Missouri River & St. Paul Railroad, which will give a connecting link for the Chicago & North-Western from Pierre, S. Dak., to the Rapid City line.

Chicago, Burlington & Quincy.—The improvements to be made by this company during the present year at an expenditure of about $350,000, it is said, will include a new track from Forest City, Mo., to Parkville; a cut-off from Beverly to Waldron, in Platt County, and taking out three curves between Waldron and Parkville; also a cut-off at Nodaway and Forest City. The most important work is the cut-off from Beverly to Waldron. Twelve miles of track will be laid and the distance between the two places will be shortened by about 1½ miles. The work also includes the building of a new bridge over Bush creek.

Chicago, Milwaukee & St. Paul.—Announcement has been made that this company is about to lay tracks on about 75 miles of road in South Dakota. The new extension, it is said, will run west from Lyman County, the proposed terminus of the extension now under construction.

Cleveland, Cincinnati, Chicago & St. Louis.—An officer writes in regard to the work being carried out by this company from Haughville, Ind., to Augusta, that this work is a relocation of five miles of the Chicago division. The present line is very crooked, following Crooked creek and the White river, and has six large bridges and a great deal of curvature. The line from Haughville to Augusta is intended to take the place of this crooked portion. The relocation is a tangent, and will reduce the line considerably. The work was decided upon when it became necessary to double track the existing line.

Columbus, Marion & Bucyrus (Electric).—An officer writes that contracts for building this proposed electric railroad from Marion, Ohio, to Bucyrus, a distance of 17 miles, will be let at once. The work does not include any steel bridges or tunnels. John G. Webb, of Springfield, Ohio, is President. (August 18, p. 54.)

Denver, Kansas City & Gulf.—Application, it is said, has been made by a company under this name for a charter in Kansas with a capital of $2,000,000 to build 300 miles of line, with branches, from a connection with the Burlington lines on the north either at Oronoque, in Norton County, Kan., or Republican Junction, in Harlem County, Neb., south to Hayes City, Kan., and then through Great Bend or Larned to Pratt, passing out of Kansas at Kiowa. At Cherokee, Okla. T., it will connect with the Denver, Enid & Gulf, running east from Oklahoma City to Texarkana, where it will connect with the Texas & Pacific. The headquarters of the company will be at Medicine Lodge, Kan. The incorporators include: Breckenridge Jones, of St. Louis; E. L. Peckham, of Blackwell, Okla. T.; J. J. Cunningham, of Enid, Okla. T.; C. J. Rhoads, of Medicine Lodge; W. C. Robinson, of Winfield, and others.

Edmonds & Eastern.—Rights of way have been secured by this company and contracts will shortly be let for building its proposed road for a distance of 36 miles. (June 27, p. 183.)

Gainesville Midland.—An officer writes in regard to the Gainesville & Athens Construction Co. that it was organized by the Gainesville Midland to build its extension from Jefferson, Ga., southwest to Athens, a distance of 18 miles.

Grand Trunk Pacific.—A company to be known as the National Construction Co., it is reported from Montreal, has been formed to build the Grand Trunk Pacific, and is asking bids for building 500 miles of the road west from Winnipeg and for the section between Port Arthur and the main line.

Houston, Beaumont & Red River.—A contract is said to be let by this company to P. R. Turney, of Houston, Tex., for building the first 40 miles of its proposed road from Houston, Tex., to Alexandria, La. (July 28, p. 31.)

Kentucky Roads.—J. T. and Floyd Day, who own large timber interests in Kentucky, will build a narrow-gage lumber road from Torrent, in Wolf County, to Campton, about 12 miles.

Lake Shore & Michigan Southern.—A contract has been given by this company to the Ferguson Contracting Co., of New York and Pittsburg, at about $2,000,000 for grading at various points about 34 miles of the Franklin & Clearfield branch, to be built from Franklin, Pa., to Brookfield, a total distance of about 60 miles. The work includes the piercing of a tunnel 950 ft. long, and the excavation of 3,500,000 cu. yds. of earth and for 100,000 cu. yds. of masonry. Other contracts reported let are: Crary Construction Co., of Binghamton, N. Y., two tunnels, one 3,000 ft. long and the other 1,000 ft., and the masonry work on a bridge over the Clarion river; to the Thomas McNally Co., of Pittsburg, for the masonry work of a bridge over the Alleghany river, and to the Miller Construction Co., of Lockhaven, Pa., for the grading and masonry work on about 20 miles of the line.

Lima Eastern.—A charter has been granted this company in Ohio, with a capital of $100,000, to build a railroad from Lima to Marion, which is to be operated by gasolene power. The incorporators include F. C. Oleson, C. H. Chappell and others.

Louisiana Midland.—This company has filed its charter in Louisiana with a capital of $10,000,000 and headquarters at Homer. The company proposes to buy or build a railroad from some point near Magnolia, Ark., running in a southerly direction through Columbia County, Ark., and through the counties of Claiburne, Bienville, Natchitoches, Rapides and Calcasieu Counties, La., to Crowley, in Arcadia County, La. The officers are: George Hunter, St. Louis, President; Hugh C. Brown, Ruston, La., Vice-President, and W. N. Crouch, St. Louis, Secretary.

Mexican Roads.—According to reports from Mexico, the Royal Trust Co., of Chicago, which is the bankers of the Swift Packing Co., will build a narrow-gage railroad from Toluca to Poente de Ixtle and from Toluca to Zecualpan. R. J. Kerr, representing the Royal Trust Co.; Telesforo Garcia, owner of a concession from the Mexican Government for a parallel line; G. H. T. Shaw; Joan Henkel, who owns a narrow-gage road between Toluca and Tenango and Toluca and San Juan de las Huertoa, about 32 miles long, and C. V. Tackaberri, of the Los Arcos Mining Co., are interested in the proposed line. Negotiations have been completed for the purchase of the Henkel Railroad. This will be the first link of the proposed line. It is proposed to issue $3,000,000 of gold bonds, which have been underwritten by the Royal Trust Co. at 90, and stock to the value of $20,000 per kilometer of the road's length will be issued. G. H. T. Shaw, Chief Engineer for the road, has commenced surveys.

Montana Roads.—Construction work, it is said, has been commenced on a railroad, in which Marcus L. Hewitt, of Basin, is interested. The proposed road will extend from Basin, Mont., to Kalispell, and will be 200 miles long, passing through a rich timber and agricultural section.

Montreal & Southwestern Counties.—This company has obtained the right of way over the Victoria bridge from the Grand Trunk, and will at once commence the construction of an electric road from Montreal to Longueuil via St. Lambert.

New Jersey Short Line (Electric).—A contract has been given for building this proposed electric road to Cole & Tomson. The proposed route is from Milltown, the present terminus of the Trenton & New Brunswick road, to Elizabeth, N. J., over which high-speed electric cars are to be operated, giving a through route in connection with the Trenton & New Brunswick from Trenton to Elizabeth.

New York City Subways.—The Board of Rapid Transit Commission has been notified by the Board of Estimate that that body has approved the maps and routes of the subways as laid down by the Rapid Transit Commission, to be built in the boroughs of Manhattan and Brooklyn. Plans for carrying out the work will be completed at once and contracts let.

New York, New Haven & Hartford.—At a recent meeting of the directors of this company it was voted to at once build an electric road from Thomaston to Waterville, for which surveys are being made.

Northern Pacific.—The certificates filed in the State of Washington by this company, providing for the building of a road in the Yakima Valley, is for the construction of the Sunnyside branch. This was the road which the farmers of that section, represented by Walter Granger, of Zillah, projected, but were unable to complete, and which the Northern Pacific will finish. The road will be about 20 miles long through a rich farming section from Toppenish to Mabton, Wash.

Oklahoma & Cherokee Central.—A contract has been let to Maney Bros., of Oklahoma City, for building the first 14 miles of this proposed road from Chelsea to the Verdegris River. The road will eventually be extended to Pryor Creek via Bartlesville, Ind. T., a distance of about 60 miles. (April 7, p. 110.)

Pennsylvania Lines West.—Announcement has been made that a contract has been let to William Bros. & Morse, of Cleveland, for the elevation of the Cleveland & Pittsburg tracks through Newburg, a suburban section of Cleveland, Ohio. The work includes the elevation or depression of tracks at five crossings, on which work is to be started at once. The contract calls for the excavation of 194,000 cu. yds. of dirt and the building of 10,000 cu. yds. of masonry and

extends over a distance of 7,000 ft. in Newburg. The entire improvements cover a distance of about seven miles.

Pittsburg & Butler Street Railroad.—A contract has been given by this company to the Ferguson Contracting Co., of Pittsburg and New York for the grading, masonry work and track laying on its proposed electric railroad from Etna, Pa., north to Butler, touching Mars and Velancia. Its length will be about 35 miles, which will be seven miles shorter than the Baltimore & Ohio between these points. At Etna, the line will connect with the Pittsburg Railways Co. The companies are planning to run cars through Pittsburg and Butler. The officers of the company are principally Pittsburg capitalists, several of whom are connected with the Pittsburg Trust Co.

Pittsburg & Cross Creek.—A charter has been granted this company in Pennsylvania, with a capital of $70,000, to build a railroad from Pryor station on the main line to the Wabash-Pittsburg Terminal in a northerly direction along the north branch of Cross creek to a connection with the Pittsburg, Cincinnati, Chicago & St. Louis Railroad at Burgettstown, Washington County, Pa., a distance of seven miles. The directors are: N. F. Sanford, Pittsburg, President; J. W. Boileau, B. U. Young, S. A. Wartman, W. Craig Lee, F. P. Patterson and J. R. D. Huston.

Pittsburg & Lake Erie.—Announcement has been made that this company has begun the construction of a third track from Shamokin to Aliquippa to increase its facilities for the rapid handling of freight.

Pittsburg Subways.—Application has been made by a syndicate headed by Murray M. Verner and Mayor William B. Hayes, for a charter to build a subway to cost $10,000,000, starting at Oliver avenue and Smithfield street, reaching the surface at Neville street, in Bellfield, where the line will become a surface line. A franchise for the line through the down town district has already been granted and construction work will be commenced soon.

Rio Grande Western.—A contract has been given by this company to the Utah Construction Co. for the extension of the Bingham branch from the mouth of Bingham Canyon to Pleasant Green and Blackrock, Utah, a distance of 17 miles. The work includes the excavation of about 234,000 cu. yds. at Pleasant Green and about 400,000 cu. yds. near Blackrock.

Seaboard Air Line.—Preliminary surveys have been made by this company for locating a new line from Elberton, on the present Portsmouth-Atlanta route eastward to Augusta.

Shelbyville & Ohio (Electric).—The promoters of this road are selling bonds to secure funds for the immediate building of the road. The proposed route is from Milton, Ky., opposite Madison, Ind., via Carrollton, Campbellsburg, New Castle and Eminence to Shelbyville, a distance of 50 miles. (June 2, p. 184.)

Southbound Railroad.—Surveys are being made by Captain A. H. P. Cornell for this company to build a railroad from Winston-Salem, N. C., south to Wadesboro via Arcadie, a distance of about 90 miles.

Southern Pacific.—An officer writes that plans are being made by this company to build a railroad from Drain, Ore., southwest to Marshfield, on Coos Bay, a distance of 50 miles, where connection will be made with the Coos Bay, Roseburg & Eastern, which runs from Marshfield via Coquilla to Mertle Point, 28 miles, with a branch to Beaver Hill. The proposed line, when completed, will open up a good agricultural country in the valley of the Umpqua river, and will reach extensive timber lands and coal mines in the Coos Bay district.

Syracuse Northern Traction.—This company has been incorporated in New York with a capital of $1,000,000 to build an electric railroad from Syracuse and North Bay, on Oneida Lake, and Brewerton, Onondaga County, and Bridgeport and Shakelton's Point, in Madison County. The directors include: William M. Brown, of Newcastle, Pa.; W. K. Niver, W. H. Plump and L. L. Waters, of Syracuse.

Tonopah Terminal.—This company has been incorporated in California to build a railroad from Liberty via Goldfish Junction and the north end of Lone Mountain to Silver Peak, a distance of 100 miles. Camp Bros., of Philadelphia, are said to be interested. W. C. Wynkoop is President, and S. H. Park, Secretary.

Vancouver, Victoria & Eastern.—A contract is said to have been given to P. Welch, of Spokane, Wash., for building 14 miles from Midway, B. C., west. The road will eventually be extended to Oroville, Wash.

Waccamaw Railroad.—A charter has been granted a company under this name in North Carolina, with a capital of $250,000, to build a railroad from a point on the Cape Fear river near Oldtown, in Brunswick County, west to Lake Waccamaw, thence to connect with the Atlantic Coast Line at Bolton, and with the Seaboard Air Line at Manlyville, a distance of 50 miles. The incorporators include: E. Nelson, of Detroit; E. S. Hartwell, Chicago; J. E. Clark C. E. Clark, E. H. Silliman and W. H. Chadbourn, of Wilmington, all of whom are connected with the Waccamaw Land & Lumber Co

Wallula Pacific.—A charter has been granted this company in the State of Washington to build a railroad from Wallula to Vancouver, Wash., a distance of 100 miles. The road, it is said, is intended to be an active competitor of the Oregon Railroad & Navigation Company's lines, and it is thought to be a Northern Pacific project. The incorporators are: L. Gerlinger, of Portland, and G. M. Lyons and Joseph Stapleton, of Vancouver.

Warren, Johnsville & Saline River.—A charter has been granted a company under this name in Arkansas with a capital of $50,000 to build a railroad from Warren, in Bradley County, Ark., southeast for a distance of 25 miles. S. H. Fullerton, of St. Louis, Mo., is President; C. L. Robinson, of St. Louis, Secretary, and J. F. Forsyth, of Warren, Ark., General Manager.

Western Maryland.—This company has begun its proposed work of double tracking its line from Baltimore to Emory Grove, for which bids have been in for some time. A contract has been given to Walter A. Thorne for widening the roadbed on the first section from Fulton station to Walbrook.

Zitacuaro-Xoconosco.—Announcement has been made by William McLachlin, Manager of this railroad, that it will soon be put in operation. The road, which is narrow gage, has been built for logging purposes, and runs from Zitacuaro, the terminus of the Michoacan & Pacific, to Xoconosco, in the State of Mexico, where the company's timber lands are located and where it is at present building a large lumber mill.

RAILROAD CORPORATION NEWS.

Canadian Pacific.—The report of this company for the year ended June 30, 1905, shows gross earnings of $50,480,882; working expenses, $35,006,794; net earnings, $15,475,088; their income from other sources was $1,584,663, making a total net revenue of $17,059,751, as against $15,904,373 for the previous year. The sum available for the payment of dividends after all fixed charges had been met was $8,875,685. After dividends had been declared of 2 per cent. on preference stock and 3 per cent. on common stock for the half-year ended June 30, a surplus for the year of $1,784,533 was carried forward.

This company, it is said, has bought control of the new Bellingham Bay & British Columbia Railroad, which runs through rich mineral and lumber sections of Western Washington, giving the Canadian Pacific a direct outlet to Puget Sound.

Central of Georgia.—The report of this company for the year ending June 30, 1905, shows a surplus of $106,665 for the year after paying $750,000, which was 5 per cent. on three classes of income bonds amounting to $15,000,000. The road carried 4,008,111 tons of freight, as against 3,928,373 the previous year, and received 1.144 cents per ton-mile, as compared with 1.113 cents the previous year.

Chateaugay & Lake Placid.—Announcement has been made that this company has been leased to the Delaware & Hudson Co. until 2403. The road, which runs from Plattsburg to Lake Placid and from Saranac Lake to Lake Placid, is 83 miles long, and has been operated by the D. & H. since January 1, 1903. The road has been changed from narrow to standard gage. The bonds are guaranteed by the D. & H., who will also pay 4 per cent. dividend upon $2,000,000 preferred stock of the leased line.

Consolidated Railway (N. Y., N. H. & H.).—The annual report of this company for the first year of its existence ending June 30, 1905, shows that the company controls 525 miles of electric railroad. The next earnings for the year over and above all charges were $426,000. The capital of the company is $10,000,000, all of which is owned by the New York, New Haven & Hartford, with the exception of 15 shares.

Gainesville & Gulf.—Announcement has been made that this road, which began construction in 1885, and was completed in 1900, running from Sampson City, Fla., to Fairfield, a distance of 48 miles and connecting with the Georgia Southern & Florida at Sampson City, has been sold to F. M. Simonton, of Tampa; A. P. Stuckey and B. W. Blunt, of Ocala, Fla. It is said that the Southern Railway is back of the purchase of this property, and will extend the road at once to Tampa, shortening the route to that place from the west by about 50 miles. The officers elected are: S. F. Parrott, of Macon, President; A. P. Stuckey, First Vice-President; B. W. Blunt, Second Vice-President; H. E. Taylor, Gainesville, Treasurer; L. E. Barker, Gainesville, Superintendent, and W. S. Banks, Gainesville, Auditor.

Galveston, Harrison & San Antonio.—This company, on August 8, 1905, under authority of an act of the Legislature of Texas, bought the New York, Texas & Mexican Railway, the Gulf,

Western Texas & Pacific and the San Antonio & Gulf, which will in future be operated as the Victorian division of this company. The company also bought, under authority of the same act, the Galveston, Houston & Northern, which has not yet been transferred.

Interborough Rapid Transit.—The quarterly report of this company ending June 30, 1905, gives gross earnings for the year of $16,837,367, an increase over the preceding year of $2,649,684, during which time only the Manhattan division was in operation. Operating expenses for the year were $7,397,384, an increase of $1,551,333, and net earnings were $9,439,983, a gain of $1,098,348. The surplus has been increased by $1,056,593.

Lehigh Valley.—This company has foreclosed the mortgage which it held against the Montrose Railway, and the property of the latter will be sold September 2. The road is 28 miles long, connecting Montrose, Pa., with Tunkhannock, the county seats of Susquehanna and Wyoming counties.

Lehigh Valley Transit.—Four electric roads in the neighborhood of Philadelphia, including the Lehigh Valley Traction, the Philadelphia & Lehigh Valley, the Allentown & Slatington and the Coplay, Egypt & Ironton companies, have been merged under the above name. The capital of the new corporation consists of $5,000,000 first mortgage bonds, $7,500,000 consolidated mortgage bonds, $5,000,000 preferred stock and $3,000,000 common stock, a total of $20,500,000. The new corporation owns a roadway 150 miles long with principal terminals at Chestnut Hill, on the outskirts of Philadelphia, and Slatington, in Lehigh County; also in Allentown. Colonel Harry C. Trexler, of Allentown, is President. The directors are: Arthur E. Newbold, Philadelphia; Tom L. Johnson, Cleveland, O.; Edward B. Smith, Harry C. Trexler, E. M. Young, David Young, Newark, N. J.; George O. Albright, Allentown; William F. Harrity and George H. Frazier, Philadelphia.

Mexican Central.—This company has decided to exercise its option to buy the stocks of the Mexican National Construction Co. on September 1. Over 90 per cent. of the stocks of the latter company have been deposited with the Commercial Trust Co., of Jersey City. By this purchase the Mexican Central will pay at the rate of $9.75 a share for the preferred stock, 50 cents for the common and 9¼ per cent. of its face value for the dividend scrip. The Mexican National Construction Co. has outstanding $700,000 of preferred stock, $100,000 of common stock and about $180,000 of dividend scrip. At the option price, the Mexican Central will pay about $700,000 for these stocks, for which it will get 59 miles of railroad running from Colima to Manzanillo and 30 miles from Zacatecas to Ojecaliente, a total of 89 miles. The 59 miles of road from Colima to Manzanillo will eventually give the Mexican Central's main line an outlet on the Pacific coast, the southern terminus of the Mexican Central at the present time being at Tuxpan, which is 40 miles northeast of Colima. The intervening 40 miles which must be built to connect with this purchase runs through a wild, rough country, and the work will require a great deal of tunneling and bridge work. It is the intention of the company to build this connecting link. It is understood that Ladenburg, Thalmann & Co. have formed a syndicate to buy $9,000,000 of an issue of $10,000,000 of 5 per cent. three-year notes to finance the purchase of the above railroad from the Mexican National Construction Co., and to pay for contemplated extensions towards the Pacific.

Minneapolis, St. Paul & Sault Ste. Marie.—At a meeting of the directors on August 22, which was a month ahead of the regular time, it was decided to declare the regular annual 4 per cent. dividend on the common stock payable October 15. The road has a surplus of $2,063,415, but the directors decided not to increase the dividend and to use part of the surplus for betterments.

The annual statement of this company, which is controlled by the Canadian Pacific through stock ownership, gives gross earnings of $8,716,621, an increase of $1,723,132, and net earnings of $4,214,014, an increase of $967,305. The surplus for the year was $2,063,415, an increase of $676,000.

New Jersey & Hudson River Railway & Ferry Company.—This company will redeem its first-mortgage 5 per cent. bonds on September 1, 1905, at 110. Announcement has been made by Millett, Roe & Hagen, of New York, that they will anticipate the redemption by cash or by exchange for the 4 per cent. bonds of the same company.

New York, Ontario & Western.—At the annual meeting of this company to be held September 27, the stockholders will be asked to confirm the lease made by this company with the Port Jervis, Monticello & Summitville, the Ellenville & Kingston and the Pecksport Connecting Railroads. These three small roads form a part of the system, all the capital stock being owned by the New York, Ontario & Western. The lease provides for the payment to them of an amount equal to the fixed charges. The directors have already passed upon the leases, which have been in force for some time, but will ask for the ratification from the stockholders.

North Pennsylvania (Philadelphia & Reading).—This subsidiary line of the Philadelphia & Reading has arranged to redeem its collateral trust 6s due September 1, aggregating $1,200,000. Funds available for the redemption have been made possible by the purchase of stock effected by the Reading Railway through the proceeds of the bonds. The North Pennsylvania owns the line between Philadelphia and Bethlehem, and a part of the New York division.

Nova Scotia Eastern.—This new company, incorporated to build 236 miles of railroad from the eastern coast of Nova Scotia to a connection with the Intercolonial and the Grand Trunk Pacific, proposes to issue in England $4,600,000 5 per cent. 50-year bonds at 92½. These bonds will be a first lien on the line and on a subsidy amounting to about $2,800,000. Interest during the construction will be paid for out of the subsidy. It is expected that the road will cost $23,000 a mile. A sinking fund is to be provided with the Norwich Union Life Assurance Society to meet the principal when due.

Oakland Traction.—A supplementary agreement has been filed by this company with the Union Trust Co., of San Francisco, the trustee under the $7,000,000 mortgage of January 2, 1905, maturing January 2, 1933, providing that by July 1, 1928, the sum of $6,000,000 in cash or its equivalent in bonds secured by said deed of trust shall be in the hands of the trustee for the redemption of the bond issue. The mortgage provides a sinking fund beginning in 1906 intended to retire $4,000,000 of the bonds by January 2, 1931.

St. Louis Southwestern.—The preliminary statement of this company for the year ending June 30, 1905, shows an increase of $1,210,000 in gross earnings and $797,775 in net earnings. The surplus over charges and payments of all kinds was $1,043,823, as compared with $538,409 in the previous year. The surplus is equal to 5.2 per cent. on the $20,000,000 preferred stock, and this stock is entitled to 5 per cent. non-cumulative dividends, but has not received any since the reorganization in 1890. The income account shows reductions made in expenses and maintenance of way amounting to about $90,000. The company has during the year funded its floating debt and car trust notes involving a considerable increase in fixed charges, but a decrease in interest payments and other charges.

Tractional Company.—Under this name a company is reported incorporated under the laws of New Jersey, with a capital of $100,000, $76,000 of which is to be issued immediately, to take over the entire stock of the International Traction Co., which has a capital of $15,000,000, and which owns the street railways of Buffalo, including the Buffalo Railway Co., the Buffalo, Tonawanda & Niagara Falls Electric, the Niagara Falls, Whirlpool & Northern Railway, and others, with a total length of about 375 miles. One share of the new company's stock is to be exchanged for each 100 shares of the International Traction Company's common stock. Henry J. Pierce, President of the International Traction Co., is also President of the new corporation, and Arthur Robinson is Secretary and Treasurer. The directors include: Thomas De Witt Cuyler, G. L. Boissevain, E. B. Schley, Nelson Robinson, and Henry J. Pierce.

Wheeling & Lake Erie.—William A. Read & Co. and Blair & Co., of New York, are placing an issue of $8,000,000 three-year 5 per cent. gold notes, which are guaranteed principal and interest by the indorsement of the Wabash Railroad. These notes mature August 1, 1908, and are subject to call at par on any interest date on thirty days' notice, and are secured under an agreement with the New York Trust Co., as trustee, by a deposit of $12,000,000 Wheeling & Lake Erie general mortgage 50-year 4 per cent. bonds dated August 1, 1955. The authorized issue of the general mortgage bonds is limited to $35,000,000, of which $5,000,000 is reserved to retire prior liens that are not yet matured. The proceeds of these notes will be used for double tracking and making other improvements and for new equipment. The Central Trust Co., of New York, is the trustee of the general mortgage.

York Street Railway.—After eight months' consideration, the Common Council of York refused permission to Philadelphia capitalists to build lines in that place and adopted an ordinance giving to the York Street Railway Co., and allied corporations, franchises to build electric lines and extensions. The ordinance provides that the York Street Railway Co. shall pay to the city 5 per cent. on gross receipts for the first five years, 6½ per cent. for the next five years and 8 per cent. thereafter, in addition to taxation fees on all its property.

GENERAL NEWS SECTION

NOTES.

During the month of July the westbound "Pennsylvania Special" 18-hour train between New York and Chicago arrived in Chicago on time every day; the eastbound arrived in Jersey City on time 23 days.

The Hon. H. R. Emmerson, Canadian Minister of Railways, says that the operating department of the Intercolonial is to be reorganized on the "divisional plan." The office of General Superintendent will be abolished and additional power given to the Division Superintendents.

It is announced by the Pennsylvania Railroad that it will no longer maintain a ticket agency with Thomas Cook & Son, New York City. Officers of the Pennsylvania believe that the only way to maintain rates is to sell tickets exclusively through the company's own offices.

It is announced that the New York Central will abolish the practice of lettering passenger cars with the names of the trains in which they are run, such as the Empire State Express and the Twentieth Century Limited, thus making all cars conveniently available for any train, so far as lettering is concerned.

A clerk, discharged last week from the general office of the Atchison, Topeka & Santa Fe at Chicago, is said to have secured and sold many thousands of dollars' worth of free transportation by the unauthorized use of blank passes on the Atchison and official requests, signed by President Ripley, for transportation on other roads.

The Railroad Commissioners of Texas, after a hearing, have decided that railroad companies are responsible for the icing in refrigerator cars; and also have ordered a reduction in icing charges to the basis of $40 a car for 400 miles and $20 for 100 miles, which is the minimum.

The Great Central (C. H. & D.-Pere Marquette) route opened a new city office in Toledo, Ohio, August 24, which was made the occasion of a reception from 7 to 9 o'clock in the evening. Engraved invitations for the event were sent out, and there were music and flowers. The new office is at 416 Madison street.

President Ripley, of the Atchison, Topeka & Santa Fe, replying to critics, says that his company has derived no benefit from the advent of the Standard Oil Company in the Kansas field. The changes in rates for carrying oil were not made for the benefit of the Standard Oil Company. The road has never had any oil traffic in Kansas of any consequence.

The Secretary of the Navy in asking for bids for the transportation of naval supplies across the continent, has given the Canadian Pacific a chance. The Great Northern complained at the abrogation of an order issued by former Secretary Morton to confine the business to lines within the United States, but Secretary Bonaparte holds that under the law he must send goods by the cheapest route, regardless of ownership.

On the Oregon Short Line an order has been issued forbidding conductors to entrust student brakemen with the responsibilities of a brakeman's work. New men must ride over the road as students until they have had sufficient training. Another order requires telegraph operators to deliver to trains three copies of each train order; the third copy to be given to the brakeman at the head of the train, and by him, after reading, to the rear brakeman.

The Interstate Commerce Commission, by Chairman Knapp, has rendered a decision in the case of the Globe-Wernicke Co. against the Baltimore & Ohio Southwestern and others, in which it is held that while there is much to support the view that sectional bookcases might properly be placed in the first class of the Official Classification, it does not appear that "1½ 1st" for all bookcases is an unlawful discrimination against the sectional variety, and the action of defendants in fixing the same classification and rates for sectional as for other bookcases does not exceed the limits of their discretion; nor is defendants' 1½ times first-class rate for the transportation of sectional and other bookcases shown to be unreasonable. The complaint was dismissed without prejudice to further investigation.

A report from Montreal says that President Shaughnessy, of the Canadian Pacific has protested to the Dominion Government against the location of the Grand Trunk Pacific along the line now contemplated, which he declares is nowhere more than 10 miles from the Canadian Pacific main line or some of its branches. He says that it should be laid 30 miles away. In reply, Vice-President Morse, of the Grand Trunk Pacific, has issued a statement in which he says that it is impossible to avoid locating the new line near the Canadian Pacific. He asserts that the Canadian Pacific is estopped from objecting to the nearness of the two roads in the western territory, by the fact that in the province of Ontario the Canadian Pacific and the Canadian Northern are both paralleling Grand Trunk lines so near as to be within sight of them.

After discussing the question for several years the Railroad Commission of Texas has at last unanimously agreed that under the Constitution of that State the Houston & Texas Central, and the other north and south roads controlled by the Southern Pacific, in that state, are unlawfully combined; and the Commission has notified the Attorney General to proceed against the H. & T. C., in the District Court at Austin, for forfeiture of its charter. The Commission made similar charges against the Texas & New Orleans and the Houston, East and West Texas roads some months ago, but final action was deferred pending the outcome of negotiations that were said to be going on for the sale of the Texas & New Orleans to a separate corporation. This sale was authorized by a special act of the last Legislature, but it has never been carried out.

Grain Rates.

The Trunk lines have announced increases in the rates on grain from Buffalo to New York, and other Atlantic ports, varying from one cent a bushel on rye to ¼ cent on oats. The new rates in cents per bushel are shown in the first column of the table below:

	New rate.	Old rate.
Wheat	4½ cts.	4½ cts.
Corn	3½ "	3 "
Oats	3¼ "	3 "
Rye	4½ "	3½ "
Barley	3½ "	3½ "

The Chicago eastbound lines have decided to make advances of 2 and 2½ cents per 100 lbs. on grain and grain products; effective September 1, except that on grain products for export the advance will not be made until September 20. The new domestic grain rates will be on a basis of 17½ cents per 100 lbs. from Chicago to New York, and on export shipments, 15 cents. The Eastern and Gulf lines have not yet come to an agreement. Following the severe reductions of last spring, there was an agreement on the following rates, which are now in force:

Omaha to Gulf ports	18.0
Kansas City to Gulf ports	17
Omaha and Kansas City to Baltimore	22.5
Omaha and Kansas City to New York	23.5

The Gulf lines hold out for a differential of 6 cents below the Eastern lines. The Western railroads, at a meeting at which all except the Missouri, Kansas & Texas and the Kansas City Southern were represented, have adopted a resolution to the effect that "1¼ cents per 100 lbs. be once allowed for unloading all grain originating at or west of the Missouri River, when the grain is unloaded at any point, and will be paid but once either by the direct lines or the connecting lines. . . ." It is said that this will be followed by the announcement of an agreement settling the differences between the Gulf lines and those to the East.

Another Verdict on the Mentor Wreck.

Coroner York, of Lake County, Ohio, has rendered his verdict on the derailment at Mentor, June 21, when 19 persons were killed. He says that the testimony is insufficient to hold anyone guilty of criminal negligence; but that it tends to show that the misplaced switch was opened by an employee of the railroad company.

Japanese Cars—A Correction.

In the article describing the covered goods wagons built by the Western Steel Car & Foundry Company for the Japanese Railways in our issue of August 18, an erroneous impression was conveyed by the statement that this was part of an order for 2,400 of these cars placed in this country, the remainder being built by other works. As a matter of fact, the Western Steel Car & Foundry Company prepared its own designs for the lot of cars which they built and which the article described, being entirely independent of any other company in the matter.

Union Pacific Gasolene Motor Cars.

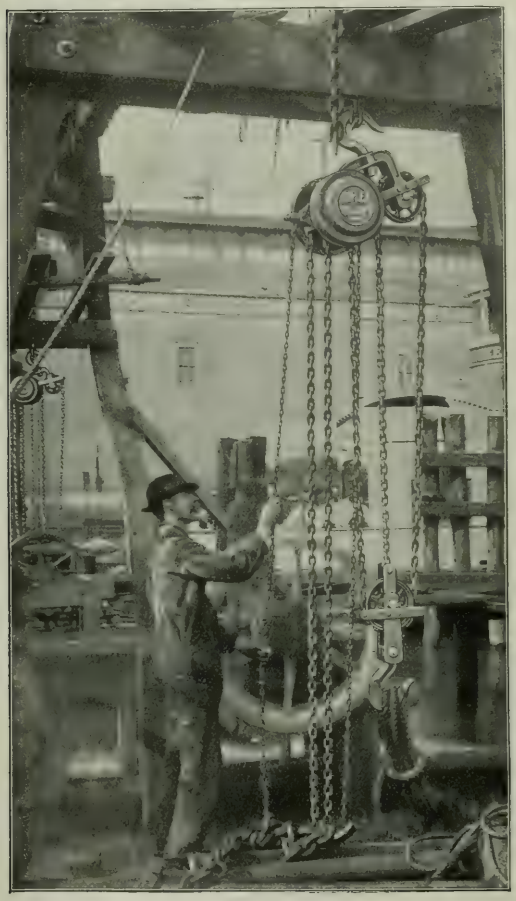
Union Pacific motor car No. 1, which for a time was in service out of Portland, Ore., is now running between Kearney and Callaway, Neb., 66 miles, at an average rate, including stops, of 20 m.p.h. There is one steam train and one motor car a day each way on this branch. Motor car No. 2 is about ready for the road at the Omaha shops. It is much larger than No. 1, being 55 ft. long, and has seating capacity for 56 persons. It has double trucks and is of steel construction practically throughout.

Disastrous Street Car Collision at Butte.

At Butte, Mont., on the night of August 20 an electric street car, returning from a summer resort, was struck by a freight train of the Butte, Anaconda & Pacific at a crossing; and nine passengers, seven of them girls, were killed. One other was fatally injured and 13 less seriously hurt. The freight train consisted of 14 cars and was being pushed eastward. The conductor was on top of the leading car with a lantern, and it is said he warned the motorman of the street car.

Triplex-Blocks as Emergency Hoists.

The accompanying illustration shows two five-ton Yale & Towne triplex chain blocks raising a bridge at the D., L. & W. ferry slips in Hoboken. Four of these blocks were secured promptly after the recent fire and were attached to supports and used for the purpose indicated. Chain blocks are sometimes used as permanent hoisting apparatus in ferry slips, but these blocks were used only as emergency hoists and were replaced as soon as permanent supports could be built and the regular hoisting apparatus installed. The principal features of these triplex blocks are the convenience with which they can be handled, their ease of operation and their high efficiency. The triplex block is probably the most convenient hoist for emergency work, in addition to its regular application to lifting jobs in shops, freight houses, roundhouses, and on docks.



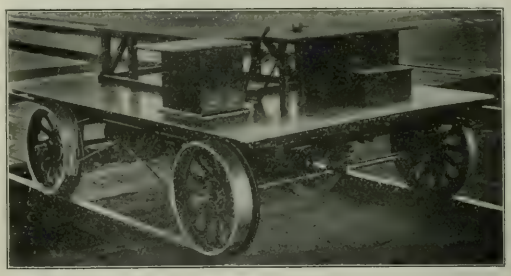
The Yale & Towne Triplex Block in Use as an Emergency Hoist.

Japan's Electric Tramways.

The first electric tramway built in Japan was the line, eight miles in length, which was opened in Kyoto in 1895. Since then, other cities of importance have built electric tramways, and there are now 17 companies with an aggregate capital of 36,000,000 yen ($18,000,000), whose lines already opened aggregate 120 miles, with 85 miles more building. Most of these companies have not yet a very profitable business; but that the profits will be large is indicated by the fact that the electric tramways of Tokio already pay annual dividends of not less than 10 per cent.

New Gasolene Motor Gang Car for Railroads.

A new type of Oldsmobile gasolene motor car for railroad use was exhibited in Chicago last week, and an illustration of it is shown herewith. It is intended for the transportation of section gangs, bridge gangs, yard switching crews, etc. It will carry a gang of ten men as well as tools and materials. The makers claim a number of features of novelty and special merit in the design. The car is propelled by a two-cylinder, 8-h.p. gasolene engine mounted on a rigid frame made of steel tubing to give maximum strength with minimum weight and durability. The transmission is arranged to give the same speed forward and backward, enabling the car to be run with equal facility in either direction without being turned. The engine is air-cooled—another new feature in this service.



Oldsmobile Gang Car.

The car is equipped with a double hub brake, enabling quick control and stopping of the car at all times. The engine and propelling machinery are so designed that they can be built for gages from 24 in. upward. The designers have endeavored to produce a car easily and simply handled so that an unskilled person can run it safely and successfully.

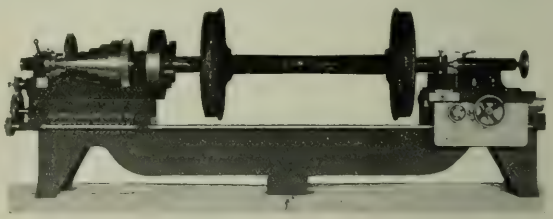
The Olds Motor Works, Detroit, Mich., are the builders and the Railway Appliances Co., Chicago, is the selling agent.

Progress at Panama.

Theodore P. Shonts, Chairman of the Isthmian Canal Commission, arrived in this country recently from Panama, and is quoted as follows on the situation: "I have laid off all steam shovels until the railroad tracks have been put into proper condition for their use. I found when I was on the Isthmus at least six steam shovels out of which the operators were not getting to exceed 25 per cent. of efficiency. That condition could not be allowed to go on, so we have ordered all steam shovel work discontinued for the present. We shall have no difficulty in getting all the labor we may want. The superintendent who has charge of that branch of the work has worked 75,000 men on a single contract, and he says he could get 100,000 blacks for work on the canal if so many were needed. The principal idea at present is to provide quarters for the employees, to establish good sanitary conditions and to arrange for the prompt payment of the men. Once these preliminaries are arranged we will begin to make the dirt fly."

A New Gap Lathe.

The accompanying illustration shows a 22-in. gap lathe made by the Draper Machine Tool Co., Worcester, Mass. It is especially adapted for steam and street railroads for truing car axles when the car wheels are in place, thus saving the time of forcing the wheels off, truing the axles and then forcing the wheels on again as is usually done when truing car axles. This tool swings 22 in. over the ways, and a standard car axle with wheels in place over the gap. It has a 13-ft. bed, which takes 7 ft. 8 in. between centers, and is furnished with a rod feed and plain block rest as shown. It can also be made with a block to fill the gap and can be fitted with a compound rest, lead screw and gears for screw-cutting, so that it can be used as a regular engine lathe when not being used for truing car axles.



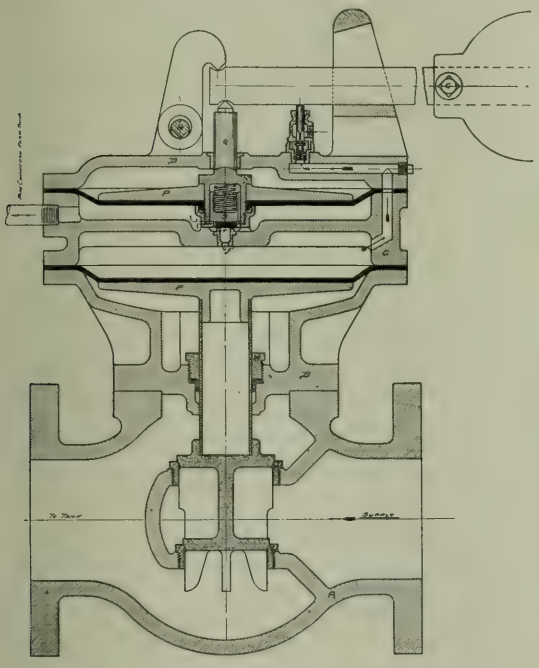
A New Gap-Lathe.

Ashtabula-Port Burwell Car Ferry.

J. W. Ellsworth & Co., coal dealers, have given a contract to the Great Lakes Engineering Works, of Detroit, Mich., for a twin-screw steel car ferry to operate between Ashtabula, Ohio, and Port Burwell, Ontario, in connection with the Pennsylvania Lines in Ohio and the Canadian Pacific in Ontario. The vessel will have four tracks, with a capacity for thirty fifty-ton cars, and will be equipped with engines capable of twelve miles an hour. It will be 350 feet over all, 56 feet beam and 20 feet deep from deck to keel, and will be of the enclosed type, with accommodations for passengers and crew on the upper deck. It will be equipped with triple-expansion engines and Scotch boilers.

The Anderson Altitude Valve.

Some difficulty has always been experienced by railroads with water-regulating valves failing to properly maintain a uniform stage of water in locomotive supply tanks. This is especially true in the northern states, where extreme cold weather forms ice in the tanks and interferes with the regularity of operation of the prevailing form of float valve inside of the tank. The float commonly used may be put out of service either through becoming water-logged and losing its buoyancy or through becoming lodged in or on ice formed on the surface of the water. If the float becomes water-logged the supply does not cut off and the tank overflows, while on the other hand if it lodges in the ice the supply is cut off and the tank is



Section Through Anderson Patent Altitude Valve.

soon emptied. In either case the tank is put out of commission until the water service repair men can be called to repair the valve. Another objection to this form of valve is the fact that the tank must be drained dry in order to make repairs on the float.

The Golden-Anderson Valve Specialty Company, Pittsburg, Pa., has recently brought out a novel valve known as the Anderson patent altitude valve which does away entirely with the use of a float and its attendant troubles. The valve is placed in the pit under the tank below the frost line, where it cannot become inoperative through freezing up and by placing a gate valve between the altitude valve and the tank, the tank can be kept full of water should it be necessary to make any repairs. The accompanying drawing shows a cross-section through the valve. Its operation is as follows: Normally the main valve in the bottom chamber is closed. When the pump is started the pressure forces this valve off of its seat—the valve being unbalanced—and water is allowed to pass through it to the tank. When the water in the tank reaches the required height it overflows through a small pipe leading down to the upper part of the valve. The pressure from this overflow raises the upper diaphragm and the auxiliary stem Q, which in turn raises the weighted lever off of the release valve in the top of the main valve cover. Continued upward movement of the top diaphragm raises the auxiliary valve leading to the lower diaphragm off of its seat and allows the tank pressure to act on the lower diaphragm. This is connected to the main valve and when the pressure comes on the diaphragm the main valve closes and cuts off the water supply. The small release valve in the top allows the pressure on the lower diaphragm to bleed off so long as the weighted lever is down and water is passing through the main valve. For gasolene engine pumping plants an auxiliary valve attachment is furnished for controlling the supply of gasolene to the engine so that the engine will run slow when the main valve is closed and no pumping is required. When the main valve opens, the supply of gasolene is automatically increased until the desired pumping speed is reached.

Drawbridge Disaster Near Norfolk.

On Thursday, August 17, an excursion train carrying 169 passengers, all negroes, ran into an open draw at the Elizabeth river, five miles from Norfolk, Va., on the Norfolk division of the Atlantic Coast Line, and the engine and first car fell into the stream. The car fell against the center pier and lodged with its body in a vertical position, so that most of the passengers in it were drowned, a few crawling out through a hole which was broken in the roof near the end which was uppermost. Thirteen passengers were killed and about 60 injured. The engineman was seriously injured. It appears that there is no derailing switch at the draw and that, according to rule, the train should have come to a full stop before crossing. This stop was not made. It is said that Engineman Reigs had never before run over this line. It is also said that at Bruce's station, a mile west of the drawbridge, he had received an all-clear block signal for the block section in which the drawbridge is situated. An officer of the road is reported as saying that this block signal had nothing to do with the drawbridge; in other words, that while it gives the right to the road throughout the block section, this right is subject to the liability of being stopped at the draw by a signal from the draw tender.

Concrete-Steel Ties in a Derailment.

H. E. Percival, inventor of the Percival concrete-steel tie, now being tried on the Galveston, Houston & Henderson, and illustrated in the *Railroad Gazette* July 28, writes that two or three cars were derailed on this experimental section of track recently, and that one truck ran over all 25 of the ties, but did not fracture or injure any of them in the least.

The First Trans-Atlantic Tow.

The steamship Captain E. L. Drake, with Standard Oil barge No. 95 in tow, arrived at Sabine, Texas, August 18, on her return trip from London. This is the first round-trip voyage of this character which has ever been made, although the Standard Oil steamer Atlas last year towed a barge from New York to San Francisco. The time required for the steamer and barge to make the run from London to Texas in ballast was 21½ days, and during the first two weeks strong winds and a rough sea were encountered.

The Missouri Maximum Freight Rate Bill.

Of all the measures passed by the last legislature the maximum freight rate bill was the most injudicious and discreditable. There was no call from business interests for such a bill. A single coal operator, who was almost constantly having suits with railroad companies, prepared this bill to create more trouble. It was placed in the hands of an able, experienced and excellent member of the house. He admitted that he did not know whether rates in the bill were right or wrong, yet he quietly but earnestly worked on the country membership and succeeded in passing the measure. The vast majority of the shippers of freight were perfectly satisfied with rates, and none came to the legislative committees to make complaint. Among the people of the state there was general satisfaction. But the enemy of railroads and railroad managers was constantly at the state capital. One of his statements was that the "railroad commissioners would see that the rates were fair." Again he assured the indifferent and uninterested members that "Governor Folk would veto the bill if he thought the bill was not good." The governor admitted that he knew nothing of railroad rates, and he only approved it because it was passed by a large majority in the House and Senate. He should have vetoed the bill, but as many officials do, he pandered to the anti-railroad men. The railroad commissioners seemed to be unusually eager to fix all maximum freight rates. They have been checked. By the ablest railroad experts and lawyers the law is considered unreasonable and unjust. It has been carried to the courts for decision.—*St. Joseph Gazette.*

Civilization as Affected by Railroads.

The war between the Pennsylvania and the Muncie & Portland Traction Company, which culminated last night in the fatal wounding of two men and the slight wounding of several others, continued to-day [Aug. 26], but the railroad company is holding the crossing, and so far has the advantage of the situation. Each of the rival companies has a large force of men on the ground, and the Sheriff of the county has sworn in 50 deputies in the hope of preserving the peace. The injunction got out by the railroad com-

pany is still in operation, but the citizens and the country people are in sympathy with the traction company and are anxious to make the crossing, regardless of the company's action. It is this threatening condition that causes the local officers to be constantly on the lookout for trouble.

After the shooting last night in which Detective Purdy and William McCarty were fatally wounded, there were many riots and much stonethrowing by citizens, and several of the railroad construction gang were struck and severely bruised. Two farmers who were watching the trouble but taking no part in it, were wounded. Sheriff Barr has made no arrests and says that it is impossible to learn who did the shooting, except in the case of the wounding of Detective Purdy. McCarty fired the shot that struck Purdy, but the Sheriff says it was justifiable, and he has not been arrested. —*Press despatch from Rock Key, Ind.*

The Up-Evening Courses in Railroad Education.

The University College of the University of Chicago has issued a special announcement concerning its evening courses in railroad education for the ensuing year. The establishment of these courses was given in outline thereof in the *Railroad Gazette* Nov. 18, 1904. The 1905-06 courses will begin October 3. An Advisory Board composed of leading railroad executive officers of Chicago and University officials has been organized. E. W. McKenna, Assistant to the President of the C., M. & St. P., is Chairman, and Daniel Willard, Second Vice-President of the Burlington, Vice-Chairman. It is the hope that ultimately there will be established a school of railroad education catering for every branch of service where special preparation is desirable. It is further hoped that in due time a large railroad museum, a complete railroad library and a well-equipped locomotive testing plant will form integral parts of this department of the University.

Canton-Hankow Concession.

At a meeting of the stockholders of the American-China Development Co., held in Jersey City on August 29, it was voted to sell to the Chinese Government the concession for a railroad from Canton north to Hankow, the Government paying the company $6,750,000. This concession was granted in 1898. Thirty miles of road have been laid and the whole line (800 miles) surveyed. According to the terms of the concession, the Chinese Government had the right to cancel the contract at the end of a period of 25 years; but since 1902, when the company began building, there has been a good deal of interference from the Government and the stockholders have evidently decided that the completion of the road will be impracticable. Mr. J. P. Morgan, whose banking firm held the controlling interest in the company, therefore decided to accept the offer of the Chinese Government to pay an indemnity and cancel the contract. Foreign interests in the Development Company, represented by the King of Belgium, have opposed this relinquishment, but unsuccessfully.

Ton-Mile Statistics in England.

At the meeting of the shareholders of the London & North-Western, August 18, the remarks of the Chairman, Lord Stalbridge, on the stormy subject of ton mileage returns were so moderate, as compared with his views expressed last year and on previous occasions, that the *Statist* (London) believes a change is slowly but surely working in this most conservative of English companies in favor of statistics according to the American method. Last week Sir Edward Grey, Chairman of the North-Eastern, the only road in Great Britain to adopt ton-mile statistics, said that about ton-mile statistics there was nothing of spiritualism or black magic, or anything uncanny of that kind, although the very mention of them seemed to excite hearty feelings and passion in the railroad world. He said that the figures were a simple, cheap and comprehensive method of telling the shareholders how much work the company had done. "You know, for instance, the weight of the stuff you have carried in the half-year. That does not tell you the amount of work you have done until you know how far you have carried that stuff. You want weight and distance combined to know the amount of work the railroad has done, and the ton-mile gives you that. It tells you the amount of work you have done, but standing by itself it does not tell you anything else. You want to go further—you want to know whether you have done that work well or ill, whether you have done it better or worse than you did it a year ago, and so you bring in train-mile statistics, and you compare the ton-miles and the train-miles, and that gives you some idea of whether you are doing your work better or worse than you did it a year ago. You want still further figures, into which I will not enter now, to complete your knowledge of whether you are doing your work well or ill. You want to know the time you have taken about it, and so forth. But my only object in introducing the subject of the ton-mile statistics is to explain that they are really a very simple question, and that the reason why we use ton-mile statistics is simply because we wish to know the amount of work we have done, not merely the weight of goods we have carried, but how far we have carried them, in order that we may then be able, by the use of the train-mile figures, to find out, not only the amount of work we are doing, but whether in each half-year we are doing that work better or worse than we did it the year before."

The *Statist* has from the first been an earnest advocate of ton-mile statistics, and is confident that they will come in time on the other British railroads as they have on the North-Eastern.

Westinghouse Train Tests at West Seneca, N. Y.

On August 23, the Westinghouse Air Brake Co. conducted at West Seneca, N. Y., on the tracks of the Lake Shore & Michigan Southern a series of tests with two trains of 50 cars each, equipped with Westinghouse friction draft gear, improved triple valves, automatic air couplers and automatic slack adjusters. The tests were similar to those made for the benefit of the visiting delegates to the International Railway Congress last May near Pittsburg. About 125 prominent railroad officers, representing nearly every important railroad east of the Mississippi river, were present, and witnessed the demonstration. The cars used were steel underframe gondolas 40 ft. long of 100,000 lbs. capacity, and the locomotives were of the Lake Shore heavy consolidation type. The stopping tests, with the improved triple valve, showed that it was possible to stop a train in 40 per cent. less distance than with the old type of triple valve. With the valve the brakes are released at the end of the train first instead of on the cars next to the engine. This will prevent break-in-twos to some extent. All of the tests were successful in showing the value of the devices with which the trains were equipped.

To Extend Foreign Trade.

The Department of Commerce and Labor is desirous of securing the co-operation of manufacturers and other persons interested in the efforts which are being made by the department, through the Bureau of Manufactures, to extend the foreign trade of the United States. In furtherance of this work it is proposed to establish a comprehensive card index, which will enable information to be furnished to manufacturers or intending purchasers. It is contemplated to extend the system to the principal United States consulates, if the necessary authority is granted by Congress. To enable the bureau to prepare such an index, blanks are being sent to manufacturing companies interested in export business asking certain statistical questions.

The Gordon Battery.

The Gordon Battery Company, 439 East 144th street, New York City, announces that henceforth the Gordon battery will have the copper element already packed in the perforated cylinder, so that there will be no trouble to fill the cylinder; and a new cylinder containing copper element is furnished with every recharge, so that no cleaning of cylinders or copper supporting frames is necessary. The necessity of handling any of the parts that are immersed in the solution is entirely obviated when renewing. It is only necessary to unscrew the brass connector on top, drop out and discard the old cylinder and zinc and empty out the old solution. New zincs and cylinder containing copper element are then affixed to the cover as in setting up new cells. The improved battery and recharge has been in experimental use during the past six months.

Manufacturing and Business.

Bids are wanted September 7 by George E. Best, Commissioner of Bridges of New York City, for furnishing and delivering track material for the Williamsburgh bridge over the East river.

Mr. James C. Hain, formerly Engineer of Masonry Construction of the Chicago, Milwaukee & St. Paul, is now in charge of masonry construction with J. G. White & Co., Engineers and Contractors, of New York.

The Allan F. McIntyre Co., Monadnock Block, Chicago, dealers in iron, steel, boilers, etc., has been appointed Chicago agent for the Falls Hollow Staybolt Co., makers of refined charcoal, bloom staybolts, both hollow and solid.

The Pressed Steel Car Company announce that Peter M. Kling, recently Superintendent of the John Stephenson Company, of Elizabeth, N. J., has been appointed Manager of its Passenger Car Department, with headquarters at McKees Rocks, Pa., effective September 1st.

The Lancaster Automatic Railway Crossing Co., of Petersburg, has been incorporated in Virginia with a capital of $100,000 to make railroad crossings and other safety appliances. The officers of the company are: G. W. Lancaster, President, and Morris A. Finn, Secretary and Treasurer, both of Petersburg.

According to a reported interview with an officer of the Baldwin Locomotive Works, this company expects this year to break its 1903 record, when it turned out 2,047 locomotives. During the first six months of the present year, 1,000 locomotives were built, and it is expected that the production for the entire year will be 2,100.

Frazier, Fox & Spencer, Consulting Engineers, Cleveland, Ohio, have opened offices in the Rockefeller Building. Messrs. Frazier and Fox have been connected with the designing and contracting department of the Brown Hoisting Machinery Co. for about six

years, and Mr. Spencer for several years was connected with the same department of the American Bridge Co.

Mr. Harry B. Jewkes announces that he has severed his connection with Hyde Bros. & Co., of Pittsburg, where he has had an interest and been Manager of the rail department for the past four years, and has organized the Iron City Steel Co., with offices in the Bessemer Building, Pittsburg. The new company will deal in new and relaying rails and other iron and steel products. Mr. Jewkes is President and Treasurer, and I. W. Jenks, Vice-President and Secretary.

The J. G. Brill Company, Philadelphia, has just received an order from the United Railroads of San Francisco for 200 of its patented No. 27-G-E-1 type of double-truck. This is a short-base double-truck having the Brill system of equalization which in this type consists of semi-elliptic equalizers which carry a truss form of bolster at either end suspended from the side frames by spring links at points some distance apart near the yokes. Each side frame is solid forged and the angle iron transoms are secured to the side frames with forged double and single-corner brackets. The brakes are usually inside hung.

The annual meeting of the stockholders of the National Battery Company, which now ranks second in this country in the electric storage battery business, was held August 4, at the general offices of the company in Buffalo. The old Board of Directors were continued unchanged, and the following officers of the company were elected: John R. H. Richmond, formerly Treasurer, was elected President; James Macnaughton, formerly Vice-President, was continued in the same office; Ralph Kimberly, formerly Secretary, was appointed to fill the offices of both Secretary and Treasurer, the latter office being the one formerly occupied by Mr. Richmond; R. L. Coleman, formerly President of the company, was elected Chairman of the Board of Directors, and James Macnaughton, under whose management the company has been brought to its present position of strength and activity, was reappointed General Manager.

Iron and Steel.

The Pennsylvania, it is reported, is in the market for 140,000 tons of structural steel and rails, and it is probable that the order will be increased to 200,000 tons. The rails will be used principally on the Lines West of Pittsburg.

Orders have been given by the Atchison, Topeka & Santa Fe for 1,000 tons of bridge material, and by the Missouri Pacific for 500 tons of fabricated steel to the American Bridge Co. Only small orders for rails have been placed lately, but negotiations are still pending for considerable quantities.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Academy of Ophthalmology and Otoloryngology.

At the meeting of this society, to be held at Lenox Hotel, Buffalo, September 15, there will be read a paper on "Advantages and Disadvantages of Glasses in Railway Service: With Appended Report of the Opinion of the Ophthalmologists throughout the United States as to the Safeness of an Employee Requiring Their Use." It is scheduled to be read Friday morning at 9.45. The Academy will be pleased to have railroad officers interested in this question attend the meeting and take part in the discussion of the paper. Inquiries should be addressed to Dr. Geo. A. Suker, Secretary, Columbus Memorial Building, Chicago, Ill.

Roadmasters' Association.

The Roadmasters' and Maintenance of Way Association will hold its twenty-third annual convention at Niagara Falls, N. Y., Sept. 12, 13 and 14. Rates have been made for delegates and others by both the International and Cataract Hotels, which are under the same management. C. E. Jones, Beardstown, Ill., is Secretary of the Association. Room for the exhibition of track material and devices in which roadmasters will be interested has been arranged for in the hotel and on the piazza and lawn at the rear of the hotel. Intending exhibitors to secure space should at once notify John N. Reynolds, Secretary and Treasurer of the Road and Track Supply Association, 1660 Monadnock Building, Chicago, Ill.

PERSONAL.

—Mr. James E. Price, General Superintendent of the Intercolonial Railway, died recently at his home in Moncton, N. B., at the age of 51.

—Mr. John B. Berry, Chief Engineer of the Union Pacific, has been appointed a member of the Board of Consulting Engineers of the Panama Canal. Mr. Berry fills the vacancy made by the resignation of Herman Schussler.

—Mr. C. G. Delo, Engineer of Maintenance of Way of the Chicago & Alton at Kansas City, began his railroad career with the Atchison, Topeka & Santa Fe in 1887, when the line from Chicago to Kansas City was being built, and he remained with that company about a year. In 1890, he was on the Burlington, Cedar Rapids & Northern, where he remained until 1902, during which time he was successively Assistant Engineer, Chief Draftsman and Division Engineer. When this road was absorbed by the Chicago, Rock Island & Pacific, Mr. Delo was made Principal Assistant Engineer of the Eastern district of that road. In March, 1904, he became Division Engineer of the Chicago Great Western, where he remained until he took his present position on the Alton.

ELECTIONS AND APPOINTMENTS.

Canada Atlantic.—See Morelia & Tacambaro.

Canadian Pacific.—C. W. Spencer, General Superintendent of Transportation of Eastern lines, has resigned, effective Aug. 31.

The office of Engineer of the Central division has been abolished and hereafter the work will be in charge of the Assistant Chief Engineer.

W. A. James has been appointed Engineer in charge of the grade revision and double tracking from Fort William to Winnipeg.

J. H. Eaton has been appointed Assistant Master Car Builder of western lines, with headquarters at Winnipeg.

Frank Lee, Assistant Engineer of the Western division, has been appointed Engineer of the Central division, with headquarters at Winnipeg, Man., succeeding J. E. Schwitzer, transferred.

Hugh Craig has been appointed General Car Inspector of the Western lines, with headquarters at Winnipeg, Man.

Chicago, Burlington & Quincy.—William Fitzgerald, Jr., General Agent at Hannibal, Mo., has been appointed Assistant General Freight Agent, with headquarters at St. Joseph, Mo., succeeding W. C. Maxwell, resigned.

Chicago, Rock Island & Pacific.—W. L. Hope, Division Engineer at Chicago, has been appointed Train Master of the Dakota division, with headquarters at Estherville, Iowa, succeeding A. B. Copley, promoted.

Chicago Southern.—See Southern Indiana.

Erie.—George H. Burgess, Assistant Engineer of the Northwest system of the Pennsylvania Lines West, has been appointed Assistant Engineer of the Erie. Mr. Burgess will have charge of the terminal improvements in Jersey City, N. J.

Green Bay, Oshkosh, Madison & Southeastern.—C. H. Hartley, Superintendent of the Ashland division of the Chicago & North-Western, has been appointed General Manager of this new road.

Lehigh Valley.—G. P. Troutman, Assistant Division Engineer, with office at Centralia, Pa., has resigned, effective September 15.

Missouri, Oklahoma & Gulf.—F. C. Faust, Chief Engineer, has resigned. H. S. Moore has been appointed Chief Engineer, with office at Muskogee, Ind. T., succeeding Mr. Faust.

Morelia & Tacambaro.—E. J. Chamberlin, hitherto General Manager of the Canada Atlantic, has been elected President of this Mexican road.

Oregon Railroad & Navigation.—See Southern Pacific.

Panama Canal.—W. C. Bierd, hitherto Superintendent of Terminals of the Chicago, Rock Island & Pacific in Chicago, has been appointed Assistant Construction Engineer of the Panama Canal.

Carl A. Strom, Mechanical Engineer of the Isthmian Canal Commission, has been appointed Superintendent of Motive Power and Machinery of the Panama Canal.

Pennsylvania Lines West.—George H. Burgess, Assistant Engineer of the Northwest system, with office at Pittsburg, has resigned. He is succeeded by D. Y. Swaty, hitherto Assistant Engineer on the Southwest system. Mr. Swaty is succeeded by C. E. Rowe; office at Pittsburg.

St. Louis & North Arkansas.—C. E. Overstreet has been appointed Purchasing Agent, succeeding F. H. Leslie, deceased, with office at Eureka Springs, Ark.

St. Louis, Watkins & Gulf.—H. B. Kane has been elected Vice-President and General Manager, and W. F. Lee, Assistant Secretary; both with office at Lake Charles, La. A. G. Cochran has been appointed General Solicitor, with office at St. Louis, Mo.

Seaboard Air Line.—Frank K. Huger, General Superintendent, has resigned. Charles H. Hix, Division Superintendent at Richmond, Va., succeeds Mr. Huger, with office at Portsmouth, Va.

Southern Indiana.—M. W. Wells has been appointed General Man-

ager of this company and of the Chicago Southern, with office at Chicago, succeeding J. W. Thompson.

The office of Superintendent being temporarily vacant, the duties of this office will be performed by the General Manager.

Southern Pacific.—The freight and passenger departments of the Oregon lines of the Southern Pacific, and the Oregon Railroad & Navigation Co. have been consolidated, effective September 1. R. B. Miller, General Freight Agent of the O., R. R. & N., with office at Portland, Ore., has been appointed General Freight Agent for both companies. W. E. Coman, who has been General Freight and Passenger Agent of the Southern Pacific, has been appointed First Assistant General Freight Agent for the two roads; Paul Shoup, heretofore District Freight Agent of the Southern Pacific at San Jose, Cal., and W. D. Skinner have been appointed Assistant General Freight Agents, and A. L. Craig has been appointed General Passenger Agent; all with headquarters at Portland.

Trans-Continental.—D. MacPherson, formerly Engineer of the Eastern division of the Canada Atlantic, has been appointed Assistant Chief Engineer of the Trans-Continental, which is being built by the Government from Moncton, N. B., to Winnipeg, Man., where it will connect with the Grand Trunk Pacific.

Wabash.—J. S. Goodrich, Superintendent of the St. Louis division, with headquarters at Moberly, Mo., having resigned, the jurisdiction of Richard Doyle, Superintendent of the Western division, will be extended over the St. Louis division.

W. S. Newhall, Chief Engineer, has resigned, effective September 1. A. O. Cunningham, Bridge Engineer, will succeed Mr. Newhall, with headquarters at St. Louis, Mo., and the position of Bridge Engineer will be abolished.

LOCOMOTIVE BUILDING.

The Iowa Central is reported as being in the market for locomotives.

The Minneapolis & St. Louis is reported as being in the market for 10 locomotives.

The Tennessee Central is reported to be in the market for 15 freight locomotives.

The Canadian Pacific, it is reported, will place an order for 10 locomotives at its Angus shops.

The Isthmian Canal Commission is reported as being in the market for additional locomotives.

The Toledo, St. Louis & Western has ordered 15 simple consolidation (2-8-0) locomotives from the American Locomotive Works. These engines will be built at the Dunkirk Works and are for December delivery. They will weigh 189,000 lbs., with 166,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 57 in.; wagon-top boiler, with a working steam pressure of 200 lbs. There will be 322 Detroit tubes, 14 ft. 6 in. long x 2 in. outside diameter; the firebox is of carbon steel, 109 in. x 63 in.; grate area, 47 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 15 tons. The special equipment includes: Midvale steel axles, Carey boiler lagging, Sterlingworth brake-beams, American Brake Shoe & Foundry Co.'s brake-shoes, Tower couplers, Dressel headlights, Simplex injectors, Ajax journal bearings, Jerome valve and piston rod packing, Consolidated safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashton steam gages, Midvale driving, truck and tender wheels, and cast-steel wheel-centers.

The Seaboard Air Line, as reported in our issue of June 9, has ordered 10 ten-wheel (4-6-0) freight locomotives from the Richmond Works of the American Locomotive Co. These locomotives will weigh (engine and tender) 265,050 lbs., with 125,300 lbs. on the drivers; cylinders, 19 in. x 28 in.; diameter of drivers, 60 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,644.94 sq. ft.; 328 steel tubes, 2 in. in diameter and 14 ft. 1⅞ in long; firebox, 9 ft. long and 3 ft. 5¼ in. wide; grate area, 31.50 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 11 to 12 tons. The special equipment includes: Westinghouse-American air-brakes, Seaboard Air Line bell ringers, couplers, headlights and springs, Monitor injectors, U. S. metallic piston rod packings, Garlock valve rod packings, Coale safety valves, Leach automatic sanding devices, Nathan triple sight-feed lubricators and Ashcroft or Star steam gages.

CAR BUILDING.

The Pullman Company has asked for prices on material for 2,000 cars.

The Chicago, Burlington & Quincy is in the market for five dining cars.

The Mexican International is reported as being in the market for 200 dump cars.

The Chicago, Peoria & St. Louis is reported to be in the market for 500 freight cars.

The Central Railroad of New Jersey is asking bids on 50 all-steel hopper ore cars.

The Havana Central (*Electric*) has ordered 30 cars from the Wason Manufacturing Co.

The Southern is reported as being in the market for 1,500 flat cars of 100,000 lbs. capacity.

The Central of Georgia has ordered 50 Hart convertible cars from the Rodger Ballast Car Co.

The Erie, it is rumored, is figuring on 2,000 steel underframe box cars and 1,000 steel flat cars.

The St. Louis Syrup & Preserving Company, Granite City, Ill., is in the market for 25 steel tank cars of 7,000 gallons capacity.

The Nashville, Chattanooga & St. Louis has just completed at its own shops 100 standard flat bottom coal cars of 80,000 lbs. capacity.

The Muncie & Portland Traction Co., of Portland, Ind., as reported in our issue of Aug. 28, has ordered 10 passenger cars from the Cincinnati Car Co.

The Seaboard Air Line has ordered 500 plain box cars and 500 ventilated box cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co. instead of from the American Car & Foundry Co., as reported in our issue of Aug. 25. These cars will weigh 38,600 lbs., and measure 36 ft. long, 8 ft. 6 in. wide, inside, and 7 ft. 6 in. high from floor to carlin. The special equipment for these cars was described in our issue of Aug. 25.

The Lake Shore & Michigan Southern, as reported in our issue of August 18, has ordered three combination coach and dining cars from Barney & Smith. These cars are for September delivery and the equipment includes: Commonwealth Steel Co.'s bolsters, Chicago Railway Equipment Co.'s brake-beams, American Brake Shoe & Foundry Co.'s brake-shoes, Westinghouse air-brakes, Magnus Metal Co.'s brasses, Tower couplers, Forsyth curtain fixtures, Barney & Smith's seats and trucks, Gould draft rigging, platforms and vestibules, Martin heating system, Pintsch light and Railway Steel Spring Co.'s springs and wheels.

BRIDGE BUILDING.

Aberdeen, Wash.—The City Council, at a recent meeting, decided to ask bids for building a steel bridge over the Wishka river at a cost of about $30,000, to replace the present wooden structure.

Albuquerque, N. Mex.—The Atchison, Topeka & Santa Fe, it is said, will spend about $300,000 for bridges and new track in New Mexico and Arizona.

Beaufort, N. C.—The War Department has approved the plans for building the bridge over the sound between this place and Morehead City; and work is to be commenced at once.

Bloomington, Ill.—A bridge 80 ft. long will be built over the Sangamon river at the intersection of Champaign, Ford and McLean counties. The cost, $20,000, is to be borne equally by the three counties.

Columbus, Ohio.—The Pennsylvania will put up a steel foot bridge over its tracks at North Twelfth street, to cost about $15,000.

East St. Louis, Ill.—The East St. Louis & Suburban Railway Co. will soon let a contract for two viaducts, one of which is to be built over the Louisville & Nashville tracks on North Seventh street at a cost of about $20,000, and the other at French Village over the Louisville & Nashville and the St. Louis & O'Fallon tracks. The latter is to be 1,000 ft. long, to cost about $35,000.

Florence, Colo.—The Denver & Rio Grande has decided to replace many of the wooden bridges over the line of its road between Salida and Pueblo with steel structures.

Ironton, Ohio.—A contract has been given by the Cincinnati, Hamilton & Dayton to Nave Bros. & Co., of Portsmouth, for building the piers for the bridge to be built over the Ohio river.

Jersey City, N. J.—The Pennsylvania, New Jersey & New York Railroad, which is the New Jersey corporation of the Pennsylvania Railroad for building the tunnel under the North and East rivers, has given contracts for the masonry for the bridges between Bergen Hills and East Newark. Drake & Stratton have the contract for the masonry for the drawbridge over the Hackensack river, and McMullen & McDermott, of New York, for the masonry of other bridges.

Norristown, Pa.—Montgomery and Chester County Commissioners have decided to jointly build a bridge over the Schuylkill river at Sanatoga. Plans are being made and bids will soon be asked.

Renfrew, Ont.—The County Council has decided to build a steel bridge over the Waba creek.

ST. JOSEPH, MO.—The Chicago Great Western, it is said, will spend about $75,000 in improvements between this place and Des Moines. A contract has been let to the Pettibone-Gentry Co., of Chicago, on which work is to be commenced shortly, to replace many wooden bridges with concrete structures.

ST. PAUL, MINN.—A combined highway and street railroad bridge is proposed to be built over the Mississippi river near Fort Snelling, at a cost of about $25,000.

SCRANTON, PA.—Plans are being made by the Lackawanna Bridge Co. to build a bridge over the Lackawanna river at this place.

SPRINGFIELD, ILL.—Bids are wanted September 4 at the office of the Park Board for building two reinforced concrete bridges in Washington Park. Arthur Hay, Secretary Engineer.

TAUNTON, MASS.—The special grade crossing commission appointed by the Mayor of Taunton, Mass., it is said, has agreed to the plans made by the New York, New Haven & Hartford for the elimination of grade crossings at that place.

TORONTO, ONT.—The Toronto & York Radial Railway Company will build a steel overhead bridge over the Etobicoke River, in Etobicoke township, on its line to Mimico.

WASHINGTON, D. C.—Bids are wanted at the office of the Engineering Commissioner September 16 for building a concrete bridge on the line of the Sixteenth street extension over Piney branch. D. C. Henry is Commissioner.

WISCASSET, ME.—At a recent meeting of the Selectmen of the towns of Damariscotta and Newcastle, it was decided to at once jointly build a steel or concrete bridge over the Damariscotta River between these two places at a cost of about $15,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA CENTRAL.—According to newspaper reports, this company has given a contract to P. Welch & Co., of Spokane, for building 30 miles of its proposed road along the north shore of the Turnagain Arm at about $1,200,000; also to Rich & Harris, of Prosser, Wash., for the construction of 2,500 ft. of tunnel at Placer River canyon, 50 miles from the Seward terminus of the road, at $300,000. With the completion of this grading contract, all the heavy work will be finished on the proposed line from the coast to the Tanana district. In addition to the work which the company has let to contractors, it will continue construction work with its own forces, between 600 and 800 men, during the winter.

ASHLAND, ODANAH & MARENGO.—Incorporation has been granted a company under this name in Wisconsin, with a capital of $100,000, to build a railroad from Odanah, in Ashland County, south to Sedgwick, a distance of about 15 miles, where connection will be made with the Duluth, South Shore & Atlantic. The incorporators include: J. S. Stearns, of Luddington; L. K. Baker, of Ashland, Wis.; John P. Gary, of Chicago; G. F. Merrill, of Ashland, and E. B. Hill and F. J. Darke, of Odanah.

BEAUMONT & GREAT NORTHERN.—Lamb & Hansen, of Trinity, Tex., who have the contract for grading the first 20 miles of this proposed road, which is to run from Trinity to Beaumont, Tex., are asking for sub-bids for this portion of the work.

BROXTON, HAZELHURST & SAVANNAH.—Application has been made in Georgia by a company of this name to build a railroad from Osierfield, Irwin County, on the Atlantic & Birmingham, east through Coffee, Appling, Tattnell, Liberty, Bryan and Chatham Counties to Savannah, a distance of about 130 miles. The incorporators include: J. A. J. Henderson, W. N. Smith, J. A. Pruitt, J. D. Paulk and others, of Ocilla.

CANADIAN PACIFIC.—A contract has been let by this company to Rogers & Quirk for building a line from the Highlands near Montreal, down the south side of the Lachine canal to Cote St. Paul, a distance of about seven miles.

CAROLINA NORTHERN.—This company, which operates a line from Lumberton, N. C., to Marion, S. C., a distance of 41 miles, is planning to extend the road north from Lumberton to Fayetteville, 30 miles; also to build an extension south from Marion.

CHERRYVALE, OKLAHOMA, GULF & TEXAS.—Work, it is said, is to be started September 15 by W. R. Stubbs, who has the contract to grade the first 16 miles of this road. The proposed route is from Caney, Kan., southwest through the Osage reservation via Pawhuska and Perry to Kingfisher, Okla. T., about 160 miles. Senator S. M. Porter, of Caney, is President.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—An officer writes that bids were asked by this company August 31 for masonry work and grade reductions on the St. Louis division between Coal Bluff and Indianapolis. The proposals were to be for any portion of not less than 10,000 cu. yds. or more than 65,000 cu. yds. of masonry reinforced with metal rods and beams. Bids were also wanted on the same date for grade reduction at Danville, Ind., on the St. Louis division, for the excavation of 500 cu. yds. and for 9,000 cu. yds. of reinforced masonry. W. M. Duane is Superintendent of Construction.

COLORADO, WYOMING & IDAHO.—This line, which was organized in Wyoming and Idaho to build from Denver, Colo., to Boise, Idaho, has given a contract to the Interstate Construction Co., organized in Idaho, for building the section of its road from Walcott, on the Union Pacific, south to Fort Collins, Colo., a distance of 252 miles. Active work is to begin at both ends of the line. (July 14, p. 15.)

DETROIT RIVER TUNNEL COMPANY.—This company, which was formed by the merging of the Michigan & Canada Bridge & Construction Co. and the Canada & Michigan Bridge & Tunnel Co., has commenced work on the railroad tunnel under the Detroit river between Windsor, Ont., and Detroit, Mich. The maps show that the approach on the Detroit side will start midway between Fifteenth and Sixteenth streets on the present line of the Michigan Central. The length of the underground portion of the tunnel will be 2.6 miles, and the distance from surface to surface about three miles. It will take between two and three years to complete the work. The officers of the company are: W. H. Newman, New York, President; H. B. Ledyard, Detroit, Vice-President; D. W. Pardee, Secretary, and Charles F. Cox, Treasurer, of New York.

GENESEE RIVER (ERIE).—This company, which was recently incorporated in New York with a capital of $350,000 by officers of the Erie Railroad, is planning to build a low-grade freight line from Portage, in Livingston County, N. Y., on the Buffalo division, south to Cuba, in Allegheny County, on the Allegheny division, a distance of about 30 miles.

GRAND TRUNK PACIFIC.—A contract for the complete construction of the roadbed of this road (other than steel bridges) ready for ties and rails, on the section from Portage la Prairie west to Touchwood Hills, N. W. T., 275 miles, has been let to the McDonald, MacMillan Company, of Westbourne, Man. There were a large number of bidders. Work will be started at once. The line west of Portage la Prairie does not pass through any towns of importance until it reaches Edmonton. It will run about ten miles north of Brandon, pass through the Touchwood Hills and cross the Prince Albert branch of the Canadian Pacific near Saskatoon. It is expected that the entire line from Winnipeg to Edmonton will be put under contract prior to March 1st next. H. A. Woods is Assistant Chief Engineer. Contracts for the remainder of the line to the Pacific Coast, also the branch lines from Fort William to Lake Superior Junction, are reported to have been let to the National Construction Company. This construction company was incorporated in November, 1904, by men connected with the Grand Trunk Railway, including Joseph Hobson, Robert S. Logan, Wenny Walker and others, the total capitalization of the company being nominally $250,000. Specifications for the first 100 miles of the Lake Superior branch show prospects of very heavy work. The estimates include 300,000 yards of solid rock and 250,000 of loose rock, and six million yards of earthwork.

HARTFORD & WORCESTER STREET.—Plans, it is said, for the construction of this road have been completed by the Shaw interests, of Boston, which control and operate the Boston & Worcester Street Railway. Construction work will be begun within one month. The original survey, which is 23 miles shorter than the steam road, will be followed for a distance of 60 miles. The line will run west from Worcester through Spencer to East Brimfield, where the Springfield branch joins the main line, being continued in an almost straight line to Hartford through Monson. The cost of the work will be about $3,000,000.

INDIANAPOLIS, LOGANSPORT & SOUTH BEND TRACTION.—The Common Council of Mishawaka, Ind., at a recent meeting granted a franchise to this company for 35 years, to become operative on the completion of its line from Logansport to the southern limits of Mishawaka.

INDIANA ROADS.—Three independent surveys have been made for building an electric railroad from Hartford City, Ind., southwest to Alexandria, a distance of 21 miles. The Indianapolis, Hartford City & Salina Traction Co., of which W. H. Maxwell is President, and in which C. G. Buell and Freeman Wilson, of Fairmont, are also interested, proposes to build a line between these points this fall. The Indianapolis, Hartford City & Western, which has been formed by former members of the first company, also proposes to build a line, as well as the Fort Wayne & Wabash Valley Traction Co., an opposition road to the Muncie, Hartford City & Fort Wayne, which road it proposes to parallel from Fort Wayne to Hartford City and then build to Alexandria.

KANSAS CITY, OLATHE, LAWRENCE & TOPEKA (ELECTRIC).—Wyandotte County Commissioners, at a recent meeting, granted a fran-

chise to this company to build a system of electric roads from Kansas City south to Olathe. The right of way has also been secured through Johnson County and construction is to be commenced within 30 days. The ultimate end of one branch of the line will be in Topeka. Another branch will probably be extended into Allen County, touching Iola, and thence run to Chanute. At the Kansas City end connection will be made with the Westport and Roanoke roads in Rosedale, the main line extending through Rosedale. The project is being financed by New York capitalists, who are represented by W. B. Strang, President and General Manager of the company, of Linwood Boulevard, Kansas City, Mo.

Kentucky Roads.—Construction work is to be commenced at once on a narrow-gage road to be built by John C. Day, of Breathitt County, from Natural Bridge, in Powell County, Ky., on the Lexington & Eastern, east to Campton, in Wolfe County, a distance of 11 miles through a rich coal and timber territory.

Lake Superior & Southeastern (Wisconsin Central).—This company, which has been pushing the construction work on its new road, will begin track laying shortly. The right of way extends from Superior southeast to Ladysmith, Wis., a distance of about 125 miles, through a rich agricultural territory. (June 30, p. 215.)

Pennsylvania.—Surveys have been completed by this company for extending its Turtle Creek branch, which runs from Stewart, Pa., on the Pittsburg division, northeast to Export, a distance of 10.4 miles, east to Blairsville, on the West Pennsylvania division, a distance of about 18 miles.

Plans are being made by this company to raise its tracks about 6 ft. and lower existing streets to eliminate grade crossings through Wilkinsburg, Pa., at a cost of about $250,000. The work will include the building of steel overhead bridges.

Philippine Railroads.—The Bureau of Insular Affairs of the War Department has been notified by Secretary Taft, now at Manila, that the date for opening bids for the concessions to be granted by the Philippine Government in aid of the construction of railroads in the Philippine Islands, has been postponed from November 1 to December 1. (June 16, p. 199.)

Plant City, Arcadia & Gulf.—An officer writes that this company, which now has 15 miles of road, is planning to extend its present road, which runs from Plant City, Fla., through Hopewell, Alifia, Keysville, Fort Grace, Castilia and Lilly, to Arcadia, 60 miles south of Plant City. No contracts will be let, as all the work is to be done by the company's forces. The route passes through a flat timber territory and there will be only light grades and curves. Construction work is to be commenced as soon as the rainy season is over. Frank A. Wheeler, of Plant City, Fla., is Chief Engineer.

Puyallup Railroad.—Incorporation has been granted a company under this name in Washington, with a capital of $250,000, to build a railroad from Puyallup west to Tacoma, a distance of about 15 miles. The incorporators include: F. J. Chamberlain, W. H. Elvins and W. D. Cotter. The offices of the company are in Puyallup.

St. Louis & Des Moines.—Articles of incorporation have been filed by this company in Iowa, with a capital stock of $100,000, to operate railroads in the State of Iowa and in other parts of the United States. The company intends to build a railroad from Des Moines to St. Louis. The officers of the company are: President, George J. Porter; Vice-President, Frank N. Morley; Secretary and Treasurer, Albert E. Little, all of Boston. It is understood that this is the proposed extension of the Minneapolis & St. Louis from Des Moines to St. Louis. The headquarters of the company will be in Des Moines.

Shawneetown & Western.—Incorporation has been granted a company in Illinois under this name, with a capital of $50,000 and office in Galconda, to build a railroad from Shawneetown, in Gallatin County, southwest through Hardin, Saline, Pope, Johnson and Massac Counties to the Ohio river, a distance of about 55 miles. The incorporators and first board of directors include: John Gilbert, H. B. Pierce, J. L. Murphy and W. H. Moore, all of Galconda, and Charles E. Turner, of New York City.

Southern Pacific.—An agreement, it is said, has been reached by this company and the Atchison, Topeka & Santa Fe, under which the California Northwestern, which is controlled by the former, will be extended north from Sherwood to Pepperwood, Humboldt County, Cal., six miles southeast of Scotia, a distance of about 40 miles, where connection will be made with the San Francisco & Northwestern, which is owned by the Santa Fe, furnishing a direct route from San Francisco to Eureka.

Tacoma Eastern.—A certificate, it is said, has been filed by this company, which operates 55 miles of road in Washington, seeking permission to build extensions in Pierce and Lewis Counties; one from Park Junction via Kapowsin, Eatonville and Elbe, a distance of seven miles; also one from a point beyond Park Junction to a point in section 12, township 14, range 4 east, a distance of three miles.

Valley Railway.—A company has been incorporated under this name in Wisconsin, with a capital of $25,000, to build a railroad from Green Bay southwest, passing through Depere, Kaukauna and Appleton to Menasha, a distance of about 35 miles. The incorporators include: T. W. Orbison, Ackworthy, E. O'Keefe, R. Ackworthy and O. C. Smith, all of Appleton.

Vandalia.—Plans have been submitted to the city authorities for elevating the tracks of this company and of the Indianapolis & Vincennes through the western part of Indianapolis. It is thought that an agreement will be reached and work commenced shortly. The Vandalia will pay about $400,000 as its share of the cost.

This company, it is said, is planning to build an extension of its line from Brazil, Ind., south to Saline City, and from that place southeast to Worthington, on the Indianapolis & Vincennes division, a distance of about 45 miles. The proposed new line will form a connecting link, touching important coal districts.

RAILROAD CORPORATION NEWS.

Atlantic Coast Line.—A quarterly dividend of 2½ per cent. has been declared on the $10,500,000 capital stock. The annual dividend since December, 1902, has been 8 per cent.

Carolina Northern.—This road will be sold under foreclosure on October 17, at Lumberton, N. C. It is 40 miles long and runs from Lumberton, N. C., to Marion, S. C. Capt. V. E. McBee is receiver.

Delaware & Hudson.—Authority has been granted to the Albany & Susquehanna by the New York State Railroad Commissioners to issue a new first mortgage for $10,000,000, in order to replace the $3,000,000 7 per cent. consolidated mortgage bonds and $7,000,000 6 per cent. consolidated mortgage bonds which mature in April, 1906. This road is operated by the Delaware & Hudson, under a 150-year lease.

Manistique, Marquette & Northern.—This road will be sold under foreclosure on September 21, the interest on its bonds having been in default since Nov. 1, 1903. The decree of foreclosure of June 27, 1905, was for $1,215,491.

Mahoning & Shenango Railway & Light Company.—Under this name, the Youngstown-Sharon Railway & Light Co. and the Pennsylvania & Mahoning Valley have been merged. The new company has a capital of $10,000,000, of which $4,000,000 is 5 per cent. cumulative preferred stock and $6,000,000 common stock. Ten million dollars 10-year 5 per cent. gold bonds will be issued. The Youngstown-Sharon owns and operates 40 miles of road in and about Sharon, Pa., and from Sharon and New Castle, Pa. to Youngstown, Ohio. The Pennsylvania & Mahoning Valley operates 85 miles of track connecting New Castle, Pa. with Youngstown and Leavittsburg, Ohio.

Massachusetts Electric Companies.—An issue of $3,500,000 4½ per cent. gold coupon notes of 1910 subject to call on any interest date at 102 has been authorized. Of this amount, $800,000 has already been issued and the remainder is reserved to retire existing coupon notes which mature Jan. 1, 1906. The collateral for this new issue consists of shares of the Old Colony Street Railway and the Boston & Northern Street Railway. The Old Colony Trust Co., of Boston, is trustee.

Pennsylvania & Mahoning Valley (Electric).—See Mahoning & Shenango Railway & Light Co. above.

Philadelphia & Western.—A mortgage for $15,000,000 has been filed with the Mississippi Valley Trust Co., of St. Louis, as trustee. This road is under construction from Philadelphia to Parkesburg, Pa., 45 miles.

Port Angeles Pacific.—The Knickerbocker Trust Co., of New York, has brought suit to foreclose the $2,000,000 mortgage of 1904 of this company. Interest on $100,000 bonds issued on five miles of road was defaulted last April. This road is 6½ miles long, leading out of Port Angeles, Wash., and had been in the hands of a receiver for some time previous to the making of the above mortgage.

Schuylkill River East Side.—The Philadelphia Stock Exchange has listed $5,000,000 first-mortgage 4 per cent. gold bonds of 1925. The principal and interest of these bonds are guaranteed by the Baltimore & Ohio. This road has 50 miles of track in and about Philadelphia.

Western Pacific.—At a meeting of the stockholders on August 24, it was decided to increase the capital stock from $50,000,000 to $75,000,000. This was done to provide for a possible contingency in case the cost of construction should be more than $50,000,000, for according to California law, bonds cannot be issued to an amount greater than the amount of capital stock. (July 7, p. 8.)

Youngstown-Sharon Railway & Light Company.—See Mahoning & Shenango Railway & Light Co. above.

GENERAL NEWS SECTION

NOTES.

The Long Island Railroad Company has bought 17 acres of land near Wading River, on the north side of the island, and intends to establish a model farm for the instruction of landowners in that vicinity.

The Ottawa (Ontario) Electric Street Railroad Company has just given out $1,000 in bonuses to its employees. To men who have received no demerit marks for a year a bonus of $10 is given and those who are charged with only five marks receive a bonus of $5. About 30 per cent. of the men received bonuses.

The Interstate Commerce Commission has rendered an opinion in the case of the Rock Hill Buggy Co., against the Southern and the Seaboard Air Line, holding defendants' rate of $1.30 per 100 lbs. on buggies, c.l., from Rock Hill, S. C., to Tallahassee, Fla., is not shown to be unreasonable; and under the construction placed on Section 4, by the Supreme Court, competition by the Atlantic Coast Line justifies defendants' lower rate of $1.10 for the longer distance to Quincy, Florida.

The Interstate Commerce Commission has rendered a decision on Rates on Corn and Corn Products from Missouri River points to points in Texas. Up to February 19, 1905, the rate on corn meal was 3 cents per 100 lbs. higher than the rate on corn. On that date, the differential against corn meal was advanced so that it varied from 7 to 9½ cents. On April 15, it was reduced to 5 cents. The differential for hominy, grits and bran remains at 3 cents. The Commission holds that the differential on corn meal should not be more than 3 cents above the rate on corn.

"The Oriental Limited" is to be the name of the best through train on the Great Northern Railway after the completion of about fifty new cars which are now being built and which will exemplify the top notch of elegance and convenience. Whether or not there are to be more trains than at present, or whether speed is to be increased, are points on which the advertising agent leaves the reader in a state of uncertainty. But about the oriental feature of the enterprise there is no mistake. The porters and waiters will be Japanese, instead of negroes, and in the dining cars a specialty will be made of Japanese cooking. This improvement is said to be the result of the "conversion" of President Hill from a former state of benighted indifference to the interests of the passenger department.

A Traveling Master Mechanic.

Mr. B. A. Worthington, First Vice-President of the Wheeling & Lake Erie, the Wabash Pittsburg Terminal and the West Side Belt, has issued a circular announcing the appointment of M. E. Wells as Traveling Master Mechanic of these roads. Mr. Wells' duties are defined as follows:

"For the present Mr. Wells will have general supervision of roundhouse service, the care of locomotive boilers on the road and at terminals, the character of the water supply, etc. He goes out not to find fault or criticise, but to assist all concerned in getting better results."

Signaling.

The block system is to be extended on the Erie & Ashtabula division of the Pennsylvania, requiring 20 new signal towers and 40 additional signalmen.

Interlocking signals are to be erected at the crossing of the Chicago, Indianapolis & Louisville; the Cleveland, Cincinnati, Chicago & St. Louis, and the Pennsylvania Lines in the southeastern part of Crawfordsville, Ind. The *Crawfordsville Journal* says that this improvement follows 15 years of discussion of the question.

Uses of the Printing Press.

There is one railroad manager in Indiana who believes in obedience to the law. It is William S. Fleming, receiver of the Cincinnati, Bluffton & Chicago, Smith Bracey's memorial railroad, which connects Portland with the other end of the universe, 29 miles away. When the State Railroad Commission demanded of Receiver Fleming that he submit a complete list of the passes issued by the road to various persons, Superintendent Curtis was promptly allowed two weeks off duty to prepare the list. . . . And it is not the receiver's fault that there are so many passes out. It seems that about the biggest job of printing the old Cincinnati, Bluffton & Chicago ever had was the printing of these passes. They came in good place many times when Smith Bracey's smile failed to hypnotize the landowner whose right of way was wanted, or when the anxious liveryman was hungry for the payment of a bill. It was all done in the days when the railroad was being built. As some will remember, the company was somewhat shy of ready cash and other means had to be resorted to at times in order to get the public to "ease up" on the officers and promoters of the road. The liveryman or the landlord hesitated to present a statement for thirty days after receiving one of these passes, and time was all that the Bracey crowd was asking. There was method in everything that was done, and there was nothing so cheap that yielded the same returns as passes.

In the list are attorneys, officers—county, state and township—and the consideration is set out whenever Superintendent Curtis was able to ascertain the excuse.—*Muncie Press.*

The "Bedbug" Special.

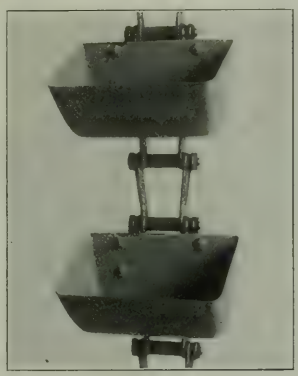
An extra train, called the "Bedbug Special," has just been sent out by the Union Pacific to exterminate bedbugs and other vermin in the section houses along the road. It is equipped with steam hose, poisons and disinfectants. Steam from the engine will be used.—*—Press despatch from Cheyenne.*

Wearing Glasses on Engines.

At the meeting of the American Academy of Ophthalmology and Otoloryngology to be held at Lenox Hotel, Buffalo, September 15, there will be read a paper on "Advantages and Disadvantages of Glasses in Railway Service." The Academy will be pleased to have railroad officers interested in this question attend the meeting and take part in the discussion of the paper. The Secretary is Dr. Geo. A. Suker, Columbus Memorial Building, Chicago.

Pressed Steel Elevator Buckets.

The Link-Belt Engineering Co., Philadelphia, is using pressed steel for its elevator buckets. The new buckets are made in one piece free from seams and rough surfaces, and are from 20 to 40 per cent. lighter than malleable iron buckets of corresponding sizes. The accompanying illustration shows the uniformity of gage and the symmetrical design. The advantages claimed for the new pressed steel buckets over cast buckets are compactness and lightness, they obviate the destructive wear on chain and sprocket wheels and prolong the life of the elevator. Where cement, sand, grain, coal, gravel and materials of a like nature are to be handled, the use of these buckets should prove materially advantageous. Users of japanned or galvanized buckets will recognize the superior qualities of pressed steel in the service demanded by the conditions that exact special surfaces in conveying buckets.



Pressed Steel Conveyor Buckets.

A Summer Story About a Summer-and-Winter Girl.

The speech of General Superintendent M. S. Connors, at the opening of the Railway Y. M. C. A. at Middleport, Ohio, on the Kanawha & Michigan, in which he advised the men in the service to get married and secure a home of their own, may result in at least two hearts being bound in happy wedlock. The speech was published in *The Dispatch* and was read by a young widow in the far-away west, who wrote to Mr. Connors asking that he recommend one of his men as a husband. Her communication was published and the other day inquiry was made by letter for the young widow's address. Mr. Connors wrote to the station agent at the town which was given as the home of the would-be suitor and the reply received was a great surprise for it plainly showed that the station agent himself was the one who had been mortally wounded by Cupid's dart. He had used an assumed name. It is said that correspondence between the agent and the widow, who admits that she is young and beautiful, will be commenced in the near future.—*Columbus Dispatch.*

Appreciation.

The St. Paul Jobbers' and Manufacturers' Association has resolved that—

"Whereas, one of the greatest steps forward has been made by the reduction of grain rates which will be of incalculable benefit to all classes and interests, and

"Whereas, though it is easy to realize the benefits now that the

thing is done, it is difficult to grasp the breadth of the mind that foresaw the wisdom of these reductions and was the one to inaugurate them. . . . its members acknowledge the high-minded policy and foresight of Mr. James J. Hill"—and so on.

Street Railways in Manila.

A long step forward in the Americanizing of the Filipino was celebrated recently at the official opening of the Manila Street Railway. The plant of the Manila Electric Railway & Light Co. not only serves the purpose of supplying adequate transportation and lighting service to Manila, but it justifies the belief of its promotors that it was possible to educate the Filipino so that he could undertake skilled work as well as that of an ordinary laborer. Many Filipinos are now employed in the capacity of carpenters and machinists, as well as conductors and motormen on the cars. During the last two and one-half years some 1,500 to 2,000 of the "little brown men" have been occupied in erecting the power house and car barns and installing a complete electric system. Their wages ranged from 50 to 70 cents per day, varying according to their occupation. The Filipinos were well satisfied with this small sum, because it was almost twice as much as they were accustomed to receive under Spanish rule. The main trouble was to keep them at work steadily. With their increased wages they felt that two or three days of consecutive labor was quite sufficient. By allowing them to observe innumerable feast-days, and letting them take

The Street Railway System of Manila.

a rest in the middle of the day when the heat was intense, the foreman found that they were more willing to work.

A hard problem was to find a wood for ties and poles, and also for the car bodies, which would withstand the assault of the white ant and be practically weatherproof. As an experiment, three kinds of wood were used for ties; the native wood called molave, California redwood, and an Australian wood. Further experimenting has been done by treating the ties with preservatives such as creosote, jodelite, solignum and carbolineum. The rails were painted with asphaltum, and in low lying ground were laid in concrete. The only wood which seemed to be ant-proof was teak, and the cars were built of this material, combined with steel of a heavy design which was carefully protected with rust-proof paint. Teak is a dense hard wood which needs no chemical treatment. It is difficult to work with tools and to steam bend, and has such a beautiful appearance that the cars were finished in the natural color wherever possible. The climate in Manila is intensely hot, and hurricanes are a common occurrence. The majority of the equipment consists of open cars, but several convertible and semi-convertible cars are being used for experimental purposes. Absolute simplicity was the keynote of the designs for the cars, so that there would be no difficulty in keeping the cars clean. The heavy driving storms occur so frequently that extra precautions were taken to secure the comfort of the passengers. All cars are vestibuled and equipped with curtains of Pantasote mounted on extra heavy slats which will resist the strongest wind. The gutters, water ducts, and cables for curtains are made of non-rusting metals, and the dash boards of extra heavy steel. There is a considerable overhang to the monitor roofs, and the ventilation is so arranged as to readily dispose of any water which may collect. The Manila Electric Railway repair shops are thoroughly equipped to design and build their own cars, and are conducting experiments with a view to using native woods. The present equipment consists of 95 passenger cars furnished with Westinghouse two-motor equipments throughout. On account of the lower price of teak wood in Europe most of the car bodies were purchased there, but the trucks were purchased in America. The power house contains four Westinghouse turbo generators which produce approximately 4,000 h.p. electricity for general power purposes, and lighting is furnished by the company as well as the power for the street railroad. The power house, car barns, and other buildings are built entirely of steel and concrete, all metal being painted to guard against deterioration. The plant, which was built and is being operated by the J. G. White & Co., New York, is fully up to the most advanced standard of American practice.

Advertisement of 18-Hour Train(?)

Members of the Indiana State Board of Tax Commissioners sat up in their chairs and gasped. Well they might do so, for their ears were hearing unstinted laudation for the Pennsylvania system from an officer of the New York Central system. This remarkable praise came at a hearing of the Tax Board in the matter of the proposed taxation of the two systems. The Pennsylvania's Western division of the Ft. Wayne route through Indiana last year was assessed $15,000 more a mile than the Lake Shore & Michigan Southern's line through that state. Attorney S. O. Pickens, of Indianapolis, solicitor for the Pennsylvania, had argued a couple of days before this hearing against this assessment being repeated this year. Mr. Pickens said that, inasmuch as both were first class roads and carry first class traffic, and as both run through the same territory, it was only fair that the assessment should be the same for both lines. This aroused the Lake Shore solicitor, Attorney E. T. Glennon, of Chicago, to the heat of the debate, and he went into the matter without gloves. The praise of the Ft. Wayne route was unstinted, Mr. Glennon claiming that the difference in the assessment was justified by the difference in the roads.

"This division of the Pennsylvania is better than our road," Mr. Glennon is quoted as saying, while speaking of the Ft. Wayne route. "We admit the superiority of the Pennsylvania roadbed and the general excellence of their rolling stock. Their roadbed is rock; ours is gravel, and if there was any law in Indiana for taking real estate out of the state, the passengers on our trains would certainly be liable, because of the dust they accumulate.

"If the Pennsylvania has as good a roadbed clear through from Chicago to New York as it has on this Ft. Wayne division, the special train between these two cities could make the trip in 13 or 14 hours. We were forced to the 18-hour schedule, reducing our time to that after the Pennsylvania had cut an hour from our former 19-hour schedule. The Pennsylvania carries 70 per cent. of the total east-bound traffic from Chicago and far more west-bound traffic than the Lake Shore."—*Pittsburg Gazette.*

The Passengers Enjoy It.

The rapidity with which the Lackawanna has recovered from the recent Hoboken fire is little short of a miracle; for 130,000 persons and 3,000 teams pass through the Hoboken terminal every day of the year. First Vice-President E. E. Loomis was on the scene an hour after the blaze was discovered and took charge of operations. To him belongs chief credit for the excellent state of order that has been established. At daybreak the morning after the fire 1,500 men were busy clearing away the débris. . . . The temporary terminal is to-day nearly complete. The buildings are large and commodious one-story wooden structures, built in rough bungalow style, painted white inside and green without. They are already well equipped, and a large restaurant will soon be ready. One hundred thousand dollars has been spent in these temporary arrangements. The new steel station will be completed in about 18 months. General Passenger Agent Lee says the fire has hastened the erection of the station a full year. Mr. Lee was asked how his patrons stood the inconvenience of the temporary arrangement.

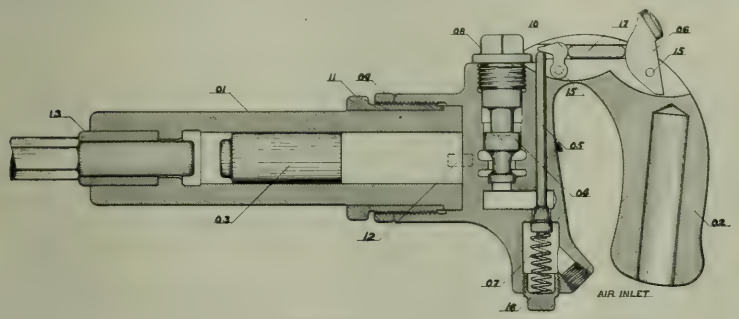
"Why," he replied, "the people seem to enjoy it. Every com-

muter comes through with a smile, for he sees something new every night." . . . Fires may come and sheds may go, but all trains run for Phœbe Snow.—*New York Globe.*

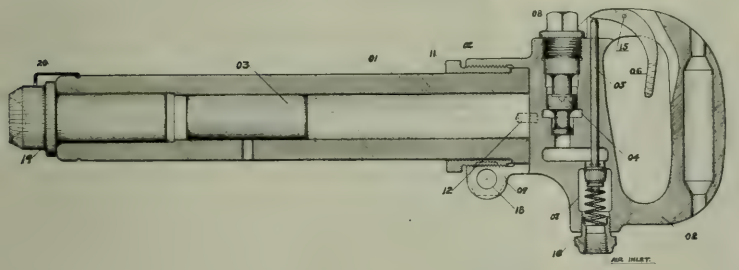
"Green" Pneumatic Hammers.

Sectional views of two classes of "Green" pneumatic hammers are shown in the accompanying engravings, one being the long-stroke riveting hammer, and the other a closed handle and pistol grip chipping and caulking hammer. Another class of the latter type, not shown, is similar in design to the long-stroke hammer. While a great many good points are claimed for these hammers, the first and most important relates to their simple construction, since they were designed with a view to minimizing the cost of maintenance and embodying such features of construction as will give them ample strength to withstand the severe service such tools must perform. The hammer consists of eight parts, namely, cylinder, handle, piston, main valve, valve plug, throttle valve, locking nut for coupling the cylinder and handle together, and trigger. Eight different size hammers are made which are all of the same general design, affording interchangeability of parts between the different size tools with the exception of the cylinders, which are of different lengths, and the handles, the latter being of a larger size on the long strokes than that used on the chipping and caulking hammers.

The valve mechanism, the life of a pneumatic hammer, is free from complication. The valve is a double piston, the simplest type obtainable. Live air is taken past its two ends and exhausted through the annular space between its two heads. It is perfectly balanced, is positive in action, and in addition to the laps provided, it is given a flat seat at each end of its stroke to eliminate leakage regardless of wear. A complicated valve lock is entirely



The Green Pistol Grip Chipping and Caulking Hammer.



The Green Long-Stroke Pneumatic Hammer.

dispensed with, the valve being placed vertically in the head block of the handle with the throttle valve directly behind it. This arrangement gives the most direct passage for air from hose to the hammer cylinder, and results in a higher cylinder pressure, producing a harder and quicker blow of the piston and also making it possible to operate the tool on an air pressure 25 to 50 per cent. lower than is customary in this practice. It is easily accessible and can be removed without disconnecting the handle from the cylinder. The best tool steel is used in its construction, which is hardened and ground to gage and is perfectly interchangeable.

The throttle valve is of the poppet type and is made of brass to prevent corroding and sticking. It is carefully balanced and graduated, giving thorough control of the hammer from the lightest to the heaviest blows. Only one longitudinal air port is used in the cylinders of the chipping hammers, and three in the cylinders of the long-stroke riveting hammers. It is stated that during a recent test with the 8-in. stroke hammer, ¾ in. structural rivets were driven in four and a quarter seconds. This is said to be the best time ever made on such work. The Dayton Pneumatic Tool Co., Dayton, Ohio, is the makér of these hammers.

The Manufacture of Claims.

Theodore Waters, in a lecture on "The Profession of Getting Hurt," before the Young Men's Club of the Church of the Archangel, tells about the fakirs who make a business of falling from street-cars and other public conveyances and gathering in money through lawsuits instituted against their owners. The lecturer produced a photograph of a prescription blank, such as are used in Bellevue Hospital, on which a physician had written the name of a lawyer on Broadway, with a view to having that lawyer handle the patient's case, which was one of accident. . . . It is a matter of fact that a runner for a lawyer is standing constantly in front of Gouverneur Hospital to pick off the accident cases that go to that institution. Some of the "ambulance chasers," on seeing a case on the way to a hospital, will fall in the street, "throw a fit," and be carried in the same ambulance to the hospital, there obtaining the other man's case for the "chaser's" lawyer. Mr. Waters said he spent several days in a hospital in Philadelphia, where he "fell" off a car to see how it worked. He was taken home, and was visited by innumerable lawyers, lawyers' clerks, cranks, agents, etc., and speedily recovered when the game "got warm." But, he said, it would have been easy to collect had he desired to do so.—*New York Tribune.*

Curtis Steam Turbines in Japan.

On July 29, 1904, the first shipment of steam turbines arrived in Japan via the steamship "Korea," from San Francisco. They were of 500 kw. capacity of the Curtis type, and were for operating the Shigai Railroad in Tokio. Four weeks after their arrival they were in full operation. As significant of the success of these first units, there have been ordered by the Japanese from the General Electric Company of New York, 37 Curtis steam turbines with electric generators with a total normal capacity of more than 35,000 h.p. Of these, 11 units are now installed and in satisfactory operation. Besides the adoption of electricity for tramway operation and for indoor and street lighting, Japan is following the best American practice in machine shops, which, as a rule, require electric motors mounted on each tool. The coal mines of Japan will also eventually be operated electrically. The Miike coal mines, on the Island of Kyushu, which are owned by Mitsui & Co., will use two 1,000 k.w. Curtis steam turbines.

The Osaka Electric Light Company, which furnishes electricity to the City of Osaka, which has a population of over 800,000, is equipped entirely with American electrical apparatus, including six steam turbines of the same make. The capital of this company is $1,200,000, and with its progressive methods it will soon rival some of the modern American illuminating companies. One of the largest electrical interests in Japan, which has ordered some of the machinery referred to above, is the Tokio Street Railway Company, which furnishes transportation facilities for the city of Tokio with its population of 1,440,000.

Although some English and German material is being used by this road, practically all of the electrical equipment is American made. This includes five 2,000 h.p. Curtis turbo-generator units with power house equipment and railway motors furnished by the General Electric Company; Wheeler condensers and Brill trucks. Besides a small amount of German and English machinery, such as boilers and trucks, there are a few small dynamos which were made in Japan.

Telephones on the Long Island Railroad.

The installation of a large number of telephones on the lines of the Long Island Railroad, in connection with the electrification of lines recently begun, has already been mentioned in the *Railroad Gazette.* The problems connected with electrification were quite intricate, and their solution demanded elaborate study. Each telephone affords direct communication with the Electrical Superintendent's office in Long Island City. Nearly 200 telephones are used, and they are scattered all along the line with not more than 2,000 ft. between them. One hundred of these telephones are placed in special boxes, similar to the boxes used by the Police and Fire Departments in New York and other cities. The employees of the repair and equipment departments are provided with keys, each one of which may be used for opening any or all of the boxes. There is a staff of electrical inspectors continually going over the line watching for possible trouble, and under the system adopted frequent reports to headquarters are made by these inspectors. To

facilitate prompt service in emergencies motor cars are provided for the quick transportation of emergency crews to the scene of any accident or reported trouble. Each of these gasolene motor cars, capable of making thirty miles an hour, and weighing but 750 lbs., is equipped with a portable telephone, provision being made for attaching them to telephone circuits at certain points. This system of inspection, supervision, motor-car emergency crews, and reporting by telephone, is undoubtedly as complete as any in the country. The telephone plant was supplied by the New York & New Jersey Telephone Co., and was put in under the supervision of Mr. L. S. Wells, the Electrical Superintendent of the railroad company.

Mail Discharging Device on the Rock Island.

The Chicago, Rock Island & Pacific has in use on one of its fast mail trains a device for discharging and receiving mail pouches that is said to be yielding most satisfactory results, performing satisfactorily at speeds from 15 to 70 m.p.h. According to information at hand, the device is entirely automatic and is operated by air from the brakes of the train. It consists of a platform arranged in the car door, on which the sacks of mail to be delivered are placed. Contact between the crane on the station platform and a trigger on the mail-catching arm on the car puts the mechanism in operation, which ejects the mail sacks into a receiving box placed at the side of the track, so constructed that the air is forced into either end by the momentum of the pouch and thus acts as a cushion, preventing damage to the pouch or its contents. The device combined with the standard crane, can be operated either to catch or deliver mail. Mail is being delivered daily from the Rock Island "Colorado Fast Mail" at a number of points in Iowa. The device is the invention of F. H. Burr, of Atlantic, Iowa, the patents being controlled by the Railway Mail Equipment Co., of that place.

London Tube Railways.

The chairman of the City & South London tube line stated on August 1st that the electric tramways of the London County Council had practically annihilated all its short distance traffic in South London. The hope of the company for the future lay in the direction of long distance fares and in that connection the extension of the tubes from Islington to Euston and St. Pancras will render great assistance. The extension is being proceeded with and the contract time expires in September, 1906. When completed the line will have connection with four steam railroads at that point; railroads whose suburban traffic is growing very fast. This traffic will be fed to the tube at Euston for conveyance to the city and South London districts. When the tube line has opened its various sections in the past it has tapped practically the full traffic at once, and there has been no continuous increase, because the districts affected have been already fully built upon and densely populated. By making connection with the Euston railroad systems, it is expected that this will be altered, as the new suburban traffic of the developing districts must continually be increasing. The City & South London early this year made considerable reductions in fares to see whether this would help the position, but it is reported that the result has been unsatisfactory.

The Baker Street and Waterloo tube system is nearing completion. The tunnels have been driven the whole way between Harewood avenue and Elephant and Castle, and between Harewood avenue and Westminster Bridge road and the depot. The permanent way will be completed early in September, the conductor rails in October, and the lift works by the end of November. The high tension cables are to be tested this month. The rolling stock has not been delivered yet, although it should have been in May. The motors, control equipments, etc., are all waiting. It was hoped that the line would be completed by the end of this year, but the large amount of detail work yet to be done renders this improbable. It is expected, however, that the full service of trains will be running between Westminster Bridge and Baker street early in 1906. The chairman of this company, Mr. T. J. Hare, at the half-yearly meeting on August 14 referred to the report of the Royal Commission on London Locomotion and said it seemed that it was most desirable to wait and see the full effect of the electrical working of the Metropolitan and District railways, and the several new tube lines now building and planned, and to observe the effect of the altered conditions brought about by motor traffic, before laying out capital upon unnecessary duplication of lines.

The Great Northern, Piccadilly & Brompton line, which is to be three-quarters of a mile long, double track, in separate tunnels, is being pushed forward by the contractors. All the tunnel work, with the exception of two small sections, has been driven and lined with cast-iron, between Holborn and Finsbury Park, and 97 per cent. of the concrete for the permanent way roadbed had been laid. For the Holborn-South Kensington section also the driving of the tunnels is almost completed. The progress of the Earls Court section is proceeding at about the same rate. It is expected that at the next half-yearly meeting the probable date of opening will be announced. The system is controlled by the Underground Electric Railways Co., of London, and electricity for operating the trains will be supplied from the big generating station at Lot's Road, Chelsea.

The other tube line now being built is the Charing Cross, Euston & Hampstead, some 8⅛ route miles long, between Charing Cross and Golder's Green and the Archway Tavern. This line also is to be under the control of the Underground Electric Railways Company of London.

The Great Northern & City during the first half of this year increased its earning per week from £1,404 to £1,778 (average), and its passengers carried from 201,062 to 445,830, exclusive of season tickets. In view of the unfortunate beginning which the line made, the improvement is regarded as very encouraging. The contractors (Messrs. Pearson), who still operate the line, receive 50 per cent. of the gross receipts. The ratio of working expenses to receipts has diminished each half year since the line was opened. A large amount of additional traffic could be handled without materially adding to the capital account. The passengers carried per car will have increased from 5.65 to 7.68. New rolling stock is on order to be ready to meet the heavy demands expected in the coming winter. The extension of the line from Moorgate street to Lothbury, in the heart of the city, will be undertaken as soon as the necessary capital can be raised.

The Waterloo & City Railway working expenses have been reduced from 47.55 per cent. in 1904 to 45.37 per cent. in 1905. It is still considered unprofitable to work the line on Sundays. The North East London Railway Bill, which has been occupying Parliamentary attention for some time, is still undergoing exhaustive examination. It is proposed to build an electric railway, partly in tube and partly in the open, from the city to Waltham Abbey. The estimated traffic from all sources has been put down at 44½ millions per annum, but this estimate was cut up by representatives of the Great Eastern and other railroad companies. Sir Douglas Fox, the engineer-in-chief for the line, estimated the cost of the undertaking at about £2,600,000. A decision of the committee will be given shortly.

Manufacturing and Business.

Mr. F. B. Archibald, formerly in the Railway department of Berry Bros., Detroit, is now sales representative of the National Lock Washer Co., of Newark, N. J.

Mr. W. R. Strickland, formerly in the office of the Engineer of Maintenance of Way of the New York Central, is now Assistant to the Secretary of J. G. White & Co., New York City.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, state that it has received orders for hollow staybolt iron bars from the Imperial Railway of North China and from a leading railroad of Japan.

Mr. R. W. Christian has, by contract with the Allis-Chalmers Company, given that company the exclusive right to his patents and also his services as engineer in designing and constructing gold dredges embodying his inventions.

The firm of J. G. White & Co. will be represented at the convention of the American Street Railway Association, to be held in Philadelphia, September 25-30, by Mr. W. E. Harrington, Mr. W. E. Goldsborough and Mr. William Petsell.

Mr. F. W. Williams, who recently resigned as Master Mechanic on the Delaware, Lackawanna & Western, is now Superintendent of the Leslie Co., of Lyndhurst, N. J., maker of the Leslie pressure regulator and other steam and hydraulic specialties

Mr. Geo. M. Basford, editor of the *American Engineer & Railroad Journal*, is to take charge of the newly established Department of Publicity of the American Locomotive Co. He will take his new position on October 1, with office at 111 Broadway, New York City.

At a meeting of the board of directors of the Locomotive Appliance Co., Chicago, on August 21, the following officers were elected: Ira C. Hubbell, President; Willis C. Squire, Clarence H. Howard and J. J. McCarthy, Vice-Presidents; J. H. Allfree, Consulting Engineer; E. B. Lathrop, Treasurer; W. H. England, Secretary; Executive Committee, Ira C. Hubbell, Willis C. Squire and E. B. Lathrop.

The co-partnership existing under the firm name of Bates & Neilson has been dissolved by limitation. Putnam A. Bates has succeeded to the business of the above firm, and, as before, will devote his time to giving special attention to the preparation of plans, specifications and supervision of electrical installations, special investigations and reports, and the application of electric power to machinery.

The Fort Pitt Spring & Manufacturing Co. of Pittsburg announces the election of William McBride as President, F. W. Wallace as General Manager and Treasurer, and George W. Cox as General Sales Agent. Mr. McBride has been for several years connected with the Sales Department of the Standard Underground Cable Co., of Pittsburg. Mr. Wallace has had considerable practical experience in the manufacture of springs and under his supervision the company's plant, which is located at McKees Rocks, Pa., has been completely modernized and equipped with up-to-date machinery for the manufacture of coil springs of all kinds. Later on

it is planned to make elliptical springs also. Mr. Cox was for eight years connected with the St. Charles and Madison plants of the American Car & Foundry Co., and for two years with the Pressed Steel Car Co., and has a wide acquaintance in the railroad world.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the business meeting of this Society, September 6, a paper by Edwin H. Warner, M. Am. Soc. C. E., on "The Hydraulic Plant of the Puget Sound Power Company," was presented. This paper was printed in the *Proceedings* for May, 1905.

Iron and Steel Institute.

At the meeting to be held in Sheffield September 26, 27, 28 and 29, there will be papers on "The Wear of Steel Rails on Bridges" and on "The Transformation of Nickel Steels." The other papers to be read were mentioned in the preliminary program of the meeting which was given in the *Railroad Gazette* of August 11.

PERSONAL.

—Mr. Charles H. Hix, who was recently appointed General Superintendent of the Seaboard Air Line, was born in Nelson County, Va., in 1862. He entered railroad service in 1880 as rodman in an engineering corps on construction work on the Norfolk & Western. In the winter of 1881 he was appointed receiving and delivery clerk at Saltville, and at the end of the year was made assistant agent and operator at that point, being appointed in 1884 agent at Buford, Va. In 1886 he was appointed relief agent, and in 1888 train despatcher at Roanoke. He held this position until Oct. 1, 1891, when he was appointed chief despatcher. He was appointed trainmaster of the Radford division in 1897. Owing to a change in administration, he was appointed chief despatcher again, remaining there until July 1, 1900, when he went to the Seaboard Air Line as trainmaster of the Second division. He was appointed trainmaster of the First division on June 1, 1901, and Superintendent of the First division in September of the same year. He has held this position until the first of the present month, when he was appointed General Superintendent.

Charles H. Hix.

—Mr. L. J. Ferritor, who was recently appointed Superintendent of the Middle division of the Wabash, was born in Athens, Ohio. He began railroad work at the age of 15 as telegraph operator on the St. Louis, Kansas City & Northern, having studied telegraphy while at school. Later he was made traveling agent and operator, and in 1880 was appointed train despatcher on the Omaha division. In 1885 he was appointed chief despatcher of that division, where he remained until 1896, when he went to the Grand Trunk as trainmaster at Stratford, Ont. Eighteen months later he was made Assistant Superintendent at London, Ont., and was later appointed joint Superintendent of the Wabash and the Grand Trunk at St. Thomas, Ont. In February, 1904, he was made Superintendent of the Eastern division of the Wabash, where he remained until appointed Superintendent of the Middle division.

L. J. Ferritor.

—Mr. M. J. Caples, who was recently appointed General Manager of the South & Western, entered railroad service in 1883 in the engineering department of the Boston & Lowell. He remained with that company until August, 1887, serving successively as rodman, transit man and division engineer on construction. From 1887 to November, 1889, he was in South America engaged in mining work and railroad surveys for the Republic of Columbia. At the end of that time, he was appointed Resident Engineer on construction of the Norfolk & Western, being later promoted to be Supervisor. In 1893, he was made Assistant Division Engineer, but in August, 1899, left railroad service to go into lumber manufacturing business in West Virginia. In August, 1901, he was appointed Engineer of Maintenance of Way and Trainmaster of the Columbus, Sandusky & Hocking. He returned to the Norfolk & Western in April, 1902, as Superintendent. Later he was made General Manager of the Pocahontas Coal & Coke Co., a subsidiary company of the railroad, and in January, 1904, Superintendent of the Pocahontas division, which position he has left to accept his present appointment.

ELECTIONS AND APPOINTMENTS.

Canadian Northern.—C. W. Spencer, until recently General Superintendent of Transportation on the eastern lines of the Canadian Pacific, has been appointed General Manager of the Canadian Northern lines east of Fort William.

Canadian Pacific.—W. R. Baker, Assistant to the Vice-President, has been appointed Assistant to the President.

See also Canadian Northern.

Cleveland, Cincinnati, Chicago & St. Louis.—S. D. McLeish has been appointed Assistant General Passenger Agent, with headquarters at Indianapolis, succeeding H. M. Bronson, who has been in the service over 50 years and who, at his own request, is to be transferred.

El Paso & Southwestern.—F. L. Hunter, Superintendent of the Western division, has been appointed General Purchasing Agent.

Grand Trunk Pacific.—Archibald Glassco has been appointed Bridge Engineer, with headquarters at Montreal.

Missouri Pacific.—A. R. Duncan has been appointed Car Accountant of this road and of the St. Louis, Iron Mountain & Southern.

C. O. Eames has been appointed Chief Special Agent, with headquarters at St. Louis. Heads of departments are to refer all matters relating to special service direct to him.

Northern Alabama.—See Southern.

Northern Pacific.—William Richards, Assistant Auditor of Freight Receipts, has been appointed Auditor of Freight Receipts, succeeding E. H. C. Taylor, deceased; and the office of Assistant Auditor of Freight Receipts has been abolished.

Seaboard Air Line.—W. R. Hudson, Superintendent of the Second division, has been appointed Superintendent of the First division, succeeding C. H. Hix, promoted. W. J. Jenks, Superintendent of the Fourth division, succeeds Mr. Hudson, with headquarters at Raleigh, N. C. Walter Hale, Superintendent of the Fifth division, succeeds Mr. Jenks, with headquarters at Jacksonville, Fla.

Southern.—George G. Thompson, Jr., Assistant General Freight Agent of this road and of the Northern Alabama, has been appointed Division Freight Agent, with office at Greensburg, N. C. E. H. Shaw succeeds Mr. Thompson, with headquarters at Birmingham, Ala.

Southern Indiana.—F. W. Ranno, Engineer of Way and Structures, has resigned. E. H. Pfafflin succeeds Mr. Ranno, with office at Chicago.

Western Pacific.—Thomas J. Wyche, Resident Engineer of the Union Pacific at Omaha, Neb., has been appointed Supervising Engineer in charge of the construction of the first 282 miles of the W. P. out of Salt Lake.

LOCOMOTIVE BUILDING.

The Midland Valley has ordered four locomotives from the Baldwin Locomotive Works.

The Western Maryland has ordered two locomotives from the Baldwin Locomotive Works.

The Hocking Valley has ordered nine locomotives from the American Locomotive Works.

The Illinois Northern has ordered two four-wheel saddle tank locomotives from the Baldwin Locomotive Works.

The New York, New Haven & Hartford denies having ordered 17 locomotives, as reported in our issue of August 25.

The Intercolonial has been authorized by the Dominion Government to purchase 40 locomotives from Canadian firms.

The Delaware, Lackawanna & Western has ordered five passenger locomotives from the American Locomotive Company.

The Cuba Company has ordered six 10-wheel locomotives from the American Locomotive Co. These are for freight and passenger service and are for this year's delivery.

The Lehigh Valley has ordered 10 simple (4-6-0) freight locomotives from the Schenectady Works of the American Locomotive Co. These locomotives will weigh 199,200 lbs., with 150,200 lbs. on drivers. Total weight of engine and tender, 351,100 lbs.; cylinders, 21 in. x 28 in.; diameter of truck wheels, 33 in.; straight boiler, with a working steam pressure of 205 lbs.; heating surface, 3,084.26 sq. ft.; firebox, 199.98 sq. ft.; total, 3,284.24 sq. ft.; 378 charcoal iron tubes 2 in. in diameter and 15 ft. 8 in. long; wide firebox, 120⅛ in. x 102 in.; grate area, 85.08 sq. ft.; tank capacity, 7,500 gallons; and coal capacity, 12 tons. The special equipment includes: Westinghouse air-brakes, Richardson's balanced valves and Paige engine, truck and tender wheels.

CAR BUILDING.

The Elgin & Belvedere Electric is in the market for eight cars.

The Boston & Maine has ordered seven passenger cars from the Laconia Car Co.

The Pennsylvania Lines have placed a large order for cars with the Pressed Steel Car Co.

The Chicago, St. Paul, Minneapolis & Omaha has ordered 500 cars from the Pullman Co.

The Nashville, Chattanooga & St. Louis, it is reported, will build 100 box cars at its own shops.

The Kansas City Southern has ordered 1,000 box cars from the American Car & Foundry Company.

The Merchants Despatch Transportation Co. will build 250 refrigerator cars at its Despatch shops.

The California & Northwestern has ordered 10 freight cars from the Russell Wheel & Foundry Company.

The New York, New Haven & Hartford, it is reported, has ordered 200 box cars from the Keith Manufacturing Co.

The Kansas City Southern is figuring on five chair, two combination passenger and mail, and one combination mail and express car.

The Southern has ordered 20 passenger cars from the American Car & Foundry Co., five from the Pullman Co. and four from the St. Louis Car Co.

The Charleston (S. C.) Mining & Manufacturing Company has ordered through The Cameron & Barkly Co., Charleston, S. C., 30 flat cars from the South Atlantic Car & Manufacturing Co.

The Wabash.—It has been persistently reported that this road will place a large order for freight equipment in the near future. An official of the road writes that it is not preparing specifications for freight equipment with a view of going into the market in the near future, and that it will probably be some months before the purchase of additional equipment is even considered.

The Green Bay Traction Company, of Green Bay, Wis., as reported in our issue of August 25, has ordered two interurban cars from the St. Louis Car Co. for September delivery. These cars have wood bodies and combination wood and steel underframes. The length inside will be 34 ft., and the over-all dimensions will be 48 ft. 2 in. long x 8 ft. 8 in. wide. The cars were ordered through the Knox Engineering Co., Managers and Purchasing Agents, Chicago.

The Kankakee Electric Railway Co., Kankakee, Ill., has ordered 32 single truck passenger cars from the St. Louis Car Co., for October delivery. These cars will weigh 15,000 lbs., and measure 21 ft. long, 8 ft. 2⅝ in. wide and 9 ft. 3 in. high, all inside measurements. The special equipment will include: St. Louis Car Co.'s axles, bolsters, brake-beams, brake-shoes, air-brakes, brasses, couplers, curtain fixtures, curtain material, door fastenings, doors, draft rigging and seats.

The Colorado & Southern, as reported in our issue of August 11, has ordered 200 Ingoldsby dump cars of 80,000 lbs. capacity from the Pullman Co., for December delivery. The special equipment will include: Block-Pollak Iron Co.'s axles, Commonwealth Steel Co.'s bolsters, Pullman brake-beams, brake-shoes and dust guards, Westinghouse air-brakes, Hewitt Manufacturing Co.'s brasses, R. E. Janney couplers, Miner draft rigging for 190 cars, and Commonwealth Steel Co.'s draft rigging for 10 cars, Symington steel journal boxes, Lowe Bros. paint, Railway Steel Spring Co.'s springs, Diamond frame arch-bar trucks and Griffin Wheel Co.'s wheels.

The Orange & Northwestern has ordered 50 standard logging cars, as reported in our issue of August 25, of 60,000 lbs. capacity from the Beaumont Iron Works, inc., of Beaumont, Tex., for Oct. 3, 1905, delivery. These cars are to weigh 19,000 lbs., and will measure 3 ft. high inside, and 34 ft. long, 9 ft. wide and 3 ft. 6 in. high over all, with wood and metal frames and underframes. The special equipment will include: Beaumont Iron Works' axles, bolsters, brake-beams, brake-shoes, brasses, draft rigging, journal boxes and trucks; Westinghouse brakes, Tower automatic couplers, Railway Steel Spring Co.'s springs, and American Car & Foundry Co.'s wheels.

The Mexican Central has ordered from the American Car & Foundry Co. 40 steel tank cars with wooden underframes for carrying fuel oil. These cars have a capacity of 9,800 gallons each and measure 36 ft. over end sills x 6 ft. 8 in. over side sills. The height from rail to top of man hole is 12 ft. 1¼ in. The smallest outside diameter of tank is 7 ft. 2⅛ in., and the length over ends is 33 ft. 2 in. The special equipment includes: Wrought iron axles and bolsters, National-Hollow brake-beams, Christie brake-shoes, Westinghouse air-brakes, Tower couplers, Westinghouse friction draft rigging, Soule dust guards, McCord journal boxes and Mexican Central 80,000 lbs. standard car trucks.

The Central of Georgia, as reported in our issue of September 1, has ordered 50 Hart convertible ballast cars of 80,000 lbs. capacity from the Rodger Ballast Car Co. for delivery within 30 or 40 days. These cars will weigh 35,600 lbs. and will be 32 ft. 2 in. long, 8 ft. 8 in. wide, and 3 ft. 4¼ in. high, inside measurements, and 34 ft. long and 9 ft. wide over sills; extreme width, 10 ft. 3 in., with wooden frames and underframes. The special equipment will include: M. C. B. steel axles, Common Sense bolsters, Sterlingworth brake-beams, M. C. B. brake-shoes with Christie heads, Westinghouse brakes, M. C. B. brasses, Tower couplers, Rodger Ballast Car Co.'s door fastenings, side and center drop doors, Miner tandem draft rigging, M. C. B. malleable journal boxes, Carbon black paint, Railway Steel Spring Co.'s springs, arch-bar trucks and American Car & Foundry Co.'s wheels.

The Mexican Central has ordered 20 passenger coaches from Barney & Smith. Five of these are first class, five second class and 10 are third class. The second and third class are identical in every respect except the height of the back of the seats. The first class coaches weigh 38,000 kgs. empty, and measure 59 ft. 1 in. over end sills x 9 ft. wide; height from top of sill to bottom plate, 6 ft. 8 in. Both bodies and underframes are of wood. The second and third class coaches weigh 31,800 kgs., and measure 60 ft. over end sills x 10 ft. over eaves. The underframes and sides are of wood. The special equipment for all includes: Wrought iron axles and bolsters, National-Hollow brake-beams, Christie brake-shoes, Westinghouse air-brakes and automatic slack adjusters, M. C. B. standard brasses, National Miller combination couplers, Forsyth curtain fixtures, Pantasote curtain material, Westinghouse friction draft rigging, Soule dust guards, Baker heating system, McCord journal boxes, Pintsch gas, Standard Steel Car Co.'s platforms, Pullman vestibules and Chicago Railway Equipment Co.'s automatic frictionless side-bearings. The first class coaches are mounted on Mexican Central standard six-wheel trucks, and the second and third class coaches are four-wheel trucks with journals 4¼ in. x 8 in.

BRIDGE BUILDING.

CHILLICOTHE, OHIO.—Bids are wanted September 11 by C. H. Pinto, County Auditor, for building the superstructures of two steel bridges.

INDIANAPOLIS, IND.—The County Commissioners' budget for 1906 submitted to the County Council, asks for an appropriation of $190,000 for a new White river bridge at Thirtieth street.

JEFFERSON CITY, MO.—Bids are wanted October 1 by James H. Jones, Russellville, Mo., for building a steel bridge over Coon creek, in Cole County. F. W. Roer is County Clerk.

MOSCOW, IDAHO.—Bids are wanted September 11 for building three bridges over Paradise creek.

PORT HURON, MICH.—The Common Council is arranging to at once build a new bridge over the Black river at Military street to cost about $65,000. W. W. Phillips is City Engineer.

PORT ORCHARD, WASH.—Bids are wanted October 2 by the County Commissioners for building a 480-ft. bridge with a lift draw. R. S. Haywood is County Auditor.

RIPON, CAL.—A contract has been given by the County Board of Supervisors to the Pacific Construction Co. for the substructure and superstructure of a concrete bridge to consist of two spans each 100 ft. long to be built over the Stanislaus river at a cost of $26,500.

SEGUIN, TEX.—Bonds amounting to $20,000 are to be issued to raise funds to build a bridge over the Guadalupe river near this place.

UTICA, N. Y.—According to press reports of Sept. 5, the recent heavy rainfall and high waters have carried away about 150 highway bridges in central New York. The loss is so extensive that state aid will probably be asked to replace the bridges lost. Some of these were large structures. The line of the Unadilla Valley Railroad from Bridgewater to New Berlin had very serious washouts.

WASHINGTON, D. C.—Bids are wanted September 25 by Lieut.-Col. R. L. Hoxie, U. S. Engineers, for building a concrete steel bridge over Washington channel in the approach to the highway bridge over the Potomac river.

Other Structures.

ASH PARK, WIS.—The Atchison, Topeka & Santa Fe will put up a new station here to cost about $75,000.

BURNSIDE, ILL.—The Illinois Central, according to reports from Chicago, is planning to make improvements at its shops by putting up a new brick boiler house 550 x 120 ft., a car shop 160 x 362 ft. and a 30-stall roundhouse, at a cost of $300,000.

DAYTON, OHIO.—The Cincinnati, Hamilton & Dayton will let a contract on September 21 for putting up a brick freight house three stories high, to cost about $150,000.

DENNISON, OHIO.—The Pennsylvania has bought 20 acres of ground as a site for new shops, a large roundhouse and a yard.

EL PASO, TEX.—The El Paso & Southwestern will put up a new roundhouse here, to cost about $30,000.

GUELPH, ONT.—The Guelph & Goderich has plans ready for putting up 12 stations along the line of its road at a total cost of $150,000.

HARRISBURG, PA.—The Central Pennsylvania Traction Co., which operates all the electric lines in Harrisburg, has authorized the construction of a new power plant to cost between $200,000 and $250,000.

LEE'S SUMMIT, MO.—The Missouri Pacific has plans ready for putting up a brick passenger station 24 ft. x 145 ft.

MALONE, N. Y.—Arrangements are being made by the New York Central to enlarge its car shops at this place at a cost of about $170,000.

MT. CARBON, PA.—Plans are being made by the Pennsylvania to build a new boiler house and power plant, to contain an electric lighting generator and an air compressor.

NIAGARA FALLS, N. Y.—The New York Central, it is said, has been granted a building permit to put up a new roundhouse here to cost $175,000.

PORTSMOUTH, VA.—The Seaboard Air Line will put up a boiler shop 60 x 280 ft.

SIOUX CITY, IOWA.—Negotiations are under way by the Great Northern to buy 82 acres of land as a site for new shops and a roundhouse, to cost about $250,000.

VALLEY JUNCTION, IOWA.—The Chicago, Rock Island & Pacific is putting up a new 50-stall roundhouse to cost about $90,000.

WASHINGTON, PA.—The Pennsylvania has plans ready for replacing the present passenger station with a brick structure.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

CAIRO & TENNESSEE.—This road, which was incorporated in Tennessee to build from Bristol, in that state, to a point in Whitley County, Ky., a distance of about 400 miles, proposes to begin grading within the next two months between Wyckliff and Bristol. The route will be from Wyckliff via Mayfield, Cadiz, Hopkinsville, Franklin, Thompkinsville and Pineknot to Jellico, Ky., cross the Louisville & Nashville at Franklin and the Cincinnati, New Orleans & Texas Pacific at or near Pineknot. The office of the company is at 111 Broadway, New York. Charles H. Delano is General Manager at Wyckliff, Ky.; B. A. Neale is Vice-President; H. C. Neale, Second Vice-President; E. S. Beaumont, Secretary, and R. E. Lochbridge, Treasurer. (July 28, p. 30.)

CENTRAL OF GEORGIA.—The Greenfield branch of this company, running from Columbus, Ga., northeast to Greenfield, 49.6 miles, which has at present a 3-ft. gage, is to be made standard gage, and on the completion of this work the road will be extended north to Newnan, a distance of 20 miles, where connection will be made with the Atlanta & West Point, giving a route from Columbus to Atlanta shorter than any other line.

CHICAGO & ALTON.—Announcement has been made that the Patton & Gibson Construction Co., of Pittsburg, has a contract at $750,000 for straightening, leveling and double tracking a portion of this road between Chicago and Kansas City, and between Bloomington, Ill., and St. Louis.

COLUMBUS & LAKE MICHIGAN.—This company, which operates a road from Defiance, Ohio, south to Lima, a distance of 42 miles, will build an extension from the latter place southeast to Columbus, about 80 miles, for which the right of way has been secured.

DENVER & RIO GRANDE.—Surveys are being made by this company to build a line from Fort Garland, Colo., through San Luis, Costillia and Rinconada, passing within eight miles of Tais, down Red river and Rio Grande canyons to Embudo, in Rio Arriba County, a distance of about 95 miles. This cut-off will greatly reduce the grades and it will have a large traffic in ore and agricultural products.

DES MOINES, IOWA FALLS & NORTHERN.—The location survey for the extension of this company's road from Iowa Falls to Mason City has been completed. The proposed line runs in a northerly direction from Iowa Falls to Hampton, the county seat of Franklin County, thence west a short distance to a section line and thence due north in a straight line for 28 miles to Mason City. Agents of the company are now in the field securing the right of way. Contracts for grading the extension will soon be let. (See Construction Record.)

EDMONDS & EASTERN.—An officer writes that this company will at once let contracts for building 36 miles of its proposed road. The work, which is not difficult, includes the building of one steel bridge. (August 25, p. 62.)

FLORIDA EAST COAST.—An officer writes that bids are to be opened September 9 by J. R. Parrott, Vice-President and General Manager, at St. Augustine, Fla., for concrete work on the proposed Key West extension of this road. (See Construction Record.)

GREAT NORTHERN.—Surveys are being made by this company for a line from near Devil's Lake, N. Dak., northward to Brandon, Man.

ILLINOIS CENTRAL.—Rights of way have already been obtained by this company through Winston and Marion Counties, Ala., and others are being secured in Walker County, for the proposed branch line from Jackson, Tenn., to Birmingham. Preliminary surveys were made some time ago and active work is to be begun during the present year. (April 28, p. 143.)

This company is building a branch line from Philipp City, in Tallahatchie County, Miss., on the Yazoo & Mississippi Valley, north following the Tallahatchie river to the Panola County line, thence east to the main line of the Illinois Central at or near Sardis, a distance of about 60 miles.

KANAWHA & WEST VIRGINIA.—Bids are wanted September 9 by N. C. Van Natta, Chief Engineer, Charleston, W. Va., for the grading, masonry, trestle work and track laying on the proposed extension of this road, which will be 13½ miles long.

MEXICO CITY ROADS.—A syndicate of American and Mexican capitalists, in which Col. Felix Diaz and S. S. Neff, formerly General Superintendent of the Street Railway System in Mexico City, are interested, has made application to the Federal Government for a concession to build a system of elevated and subway railroads in that city. The cost of the proposed work will be about $5,000,000.

MICHIGAN CENTRAL.—In order to have its tracks permanently settled by the time the tunnel under the river is completed, this company has notified the Common Council of Detroit, Mich., that it will separate all grade crossings between Livernois avenue and Fifteenth street in addition to its general agreement with that city to spend $200,000 a year for grade separation work. The total cost to the Michigan Central for the work will be about $1,200,000.

NASHVILLE INTERURBAN.—This company has recently secured the rights and franchises of the Nashville & Columbia Electric Railway and the Nashville & Gallatin, and will at once begin the construction of its line from Nashville south to Franklin, Tenn., a distance of 21 miles. C. S. Brown is Consulting Engineer.

OREGON EASTERN.—Incorporation has been granted a company under this name in Oregon with a capital of $1,000,000 to build a railroad from Natron, Ore., the present terminus of the Springfield branch of the Southern Pacific, east to Ontario, Ore., on the Oregon Short Line, a distance of about 320 miles. The incorporators are connected with the Harriman Lines.

PHILADELPHIA RAPID TRANSIT.—A contract has been given by this company to the E. E. Smith Contracting Co. to build the Market street subway around the City Hall from Fifteenth street eastward to Juniper street. The cost of the work will be about $3,000,000.

PINEVILLE & NORTHERN.—This company has been incorporated in Missouri with a capital of $50,000 to build a railroad from Pineville, in McDonald County, Mo., northeast about 40 miles to Monett, where connection will be made with the St. Louis & San Francisco. The stockholders include: John A. Sturges, Adair W. Noel, E. E. Coffee and others, of Pineville. The office of the company will be at Pineville.

ST. LOUIS, VANDALIA, TERRE HAUTE & EASTERN TRACTION.—Articles of incorporation have been filed in Illinois by a company under this name with a capital of $1,000,000, to build a railroad, with branches, from East St. Louis, Ill., northeast to Terre Haute, Ind., a distance of about 550 miles. The directors include: Peter Chase, Decatur, Ill.; Charles W. Mills, Chicago; Louis H. Bissell, Effingham, Ill.; H. J. Wanner and W. D. Baldwin, Chicago. The office of the company will be in East St. Louis.

San Pedro, Los Angeles & Salt Lake.—This company is planning to build a spur from a point on its road near Las Vegas, Nev., east to the Grand Canyon of the Colorado in Arizona, a distance of about 26 miles.

Southern.—Rights of way have been secured by this company for building a branch from French Lick Springs, in Orange County, Ind., on the Chicago, Indianapolis & Louisville, southwest to Jasper, in Dubois County, a distance of about 20 miles. The work includes the piercing of a tunnel 2,000 ft. long, for which a contract has been let to a contractor of Knoxville, Tenn. It is expected to have the line in operation by Oct. 1, 1906.

Springfield Southwestern (Missouri Pacific).—A contract has been given by this company to the Williard Construction Co., of Springfield, Mo., to grade 32 miles of its new road from Springfield, on the St. Louis, Iron Mountain & Southern, southwest to Crane. The contract calls for the completion of the work about April 1, 1906. (March 24, p. 90.)

Standard Coal & Railroad Company.—This company, which was recently formed with a capital of $2,000,000, is making surveys for building a line from Truro, N. S., west to Parrsboro, and thence north to Maccan, a total distance of about 80 miles.

Stillmore Air Line.—This company, which operates a road from Wadley, Ga., southwest to Collins, a distance of 54 miles, is planning to build an extension from its northern terminus via Warrenton to Comak, about 40 miles, where traffic arrangements are to be made with the Georgia road. It is intended to ultimately extend the road from Comac north to Elberon, a distance of 50 miles, where connection will be made with the Seaboard Air Line.

Texas Roads.—Rights of way have been secured by Orton G. Campbell, of Dallas, Tex., for building a railroad from Lometa, Texas, west to San Saba, a distance of 22 miles.

Trinity & Brazos Valley.—An officer writes that this road is to be extended south from Mexia to Houston, Tex., and from Dallas to a point near Mexia, a total distance of about 230 miles. A contract for the construction work has been let to P. M. Johnston & Co. and grading has already been begun at three or four places. The lines lie through a rolling prairie country. Maximum grade will be .5 per cent.; maximum curve will be 4 degrees. The work includes the building of three steel bridges of about 60 ft. each.

Union (Pittsburg).—Plans for building the Carnegie Steel Co.'s portion of the railroad to connect the Union Railroad with the West Side Belt (Wabash) have been completed and contracts will shortly be let. The work is to be finished within six months. According to an arrangement between the Carnegie company and the Wabash, each company will build a part of the connecting link. The proposed road extends from Longview, Pa., on the West Side Belt, to Duquesne, a distance of 10 miles, where connection will be made with the Union Railroad. The work will be rather expensive, as it is intended to build a first class railroad. The contract for the four miles to be built by the Wabash, beginning at Longview, has been let to the Moran-Phellen Construction Co., of Pittsburg. Grading has been started and it is expected that this portion of the work will be completed by January 1.

Virginia & Southwestern.—This company, it is said, is ready to begin the building of its proposed new line from Clinchport, Va., northeast to Tom's Creek, a distance of about 28 miles.

Washington, Baltimore & Annapolis (Electric).—This company, which has an ordinance pending before the Baltimore City Council for permission to operate its suburban cars in the city, has organized a subsidiary company to be known as the Baltimore Terminal Co. to build a terminal in Baltimore. President George T. Bishop, of Cleveland, is reported as saying that the new company has $5,000,000, which will be spent in making these improvements. The company expects to operate high-speed electric cars between Baltimore and Washington, 31 miles, with a branch of 14½ miles.

West Virginia Midland.—A charter has been granted a company under this name in West Virginia, with a capital of $500,000, to build a railroad from Sutton, on the Baltimore & Ohio, southeast via Webster Springs to Marlinton, a distance of about 50 miles. The incorporators include: Col. John T. McGraw, of Grafton; former Congressman C. P. Dorr and J. E. Woddell, of Webster Springs; G. A. Hechner, of Palmer, and C. D. Elliott, of Parkersburg.

RAILROAD CORPORATION NEWS.

Arkansas Southern.—See Chicago, Rock Island & Pacific below.

Buffalo, Hamburg & Aurora.—The receiver of this road is distributing $76,000 among the creditors of the line, making the final dividend. The road is now operated as the Buffalo Southern.

Chicago & Alton.—This company has absorbed the Quincy, Carrollton & St. Louis, which runs from Eldred, Ill., to Litchfield, 57 miles.

Chicago, Rock Island & Pacific.—At a meeting of the stockholders of the Arkansas Southern on August 25, negotiations were completed for the formal transfer of the road to the Chicago, Rock Island & Pacific. The Arkansas Southern runs from Eldorado, Ark., to Winnfield, La., 99 miles.

Consolidated Railway (N. Y., N. H. & H.).—This company has paid a dividend of 2 per cent. on its $10,000,000 capital. This is the first dividend declared by this company.

Hampshire & Worcester Street.—This electric road, which extends from West Brookfield, Mass., to Ware, will be sold on September 16 under an order of the court. The American Loan & Trust Co., of Boston, is trustee.

Indianapolis, Shelbyville & Southwestern Traction.—This company has filed a mortgage for $1,000,000 in Ripley County, Ind., on the roads now in operation between Indianapolis and Shelbyville, 26 miles; the franchise from Shelbyville to Greensburg, 20 miles; and the proposed extension from Greensburg to Batesville, 15 miles.

Kansas City, Mexico & Orient.—The International Construction Co., which is building the Mexican section of this road, is reported to have issued $500,000 of two-year notes bearing 6½ per cent. interest, secured by $1,000,000 of the bonds of the Kansas City, Mexico & Orient and also by the company's claim on the Mexican Government for subsidies amounting to $950,000, gold. The Union Construction Co., which is building the line from Fairview, Kan., to Sweetwater, Tex., has issued $275,000 two-year notes bearing 6½ per cent. interest secured by $550,000 4 per cent. first-mortgage bonds of the Kansas City, Mexico & Orient and by the assignment of subsidies due from counties in Kansas and Oklahoma.

Lehigh Valley.—The Common Pleas Court of Pennsylvania has decided that the 10 per cent. preferred stock of this company is cumulative and that therefore the company must pay back dividends from October, 1893. As dividends to the amount of 30 per cent. have already been paid to the stockholders, the amount due is now 70 per cent., or about $95,000. The claim of the holders was that when this preferred stock was issued it took the place of the 10 per cent. preferred stock of the Beaver Creek Railroad, the terms of which were that no dividend should be paid upon common stock until dividends had been paid on the preferred stock for each year. The case will be appealed. (July 22, 1904, p. 42.)

Mexican Central.—The Mexican National Construction Co., which was recently bought by this road, has declared a dividend of 4.9 per cent. on the preferred stock. The Mexican Central has decided to pay over the entire amount of the current assets of the construction company to the old stockholders, and therefore an addition to this dividend of 9.3 per cent. will be paid on the preferred stock, making the entire dividend $14.65 per share. (August 25, p. 64.)

Newburgh, Dutchess & Connecticut.—The lease of this road to the New York, New Haven & Hartford has been canceled by the Central New England Railroad Co., which has resumed the operation of the road; and also of its own line from the Poughkeepsie bridge to Campbell Hall, N. Y. (July 21, p. 24.)

New York Central & Hudson River.—It is reported that of $6,000,000 to be spent on the new 42d street terminal in New York, the New York Central will pay $3,000,000 and the Lake Shore & Michigan Southern and the New York, Chicago & St. Louis the remaining $3,000,000, being assisted, however, to a small extent, by the Western Transit Company, the New York Central's steamship line.

Quincy, Carrollton & St. Louis.—See Chicago & Alton above.

St. Louis Transit.—The Cella Commission Co., of St. Louis, is offering at 97½, and interest, $1,000,000 5 per cent. 20-year gold bonds of this company.

Southern Pacific.—At a meeting of the shareholders on August 29, it was voted to increase the capital stock to $160,000,000 and to issue a first refunding mortgage for $160,000,000. (July 14, p. 16.)

Stamford (Conn.) Railway (Electric).—A meeting of the shareholders has been called for September 12 to act upon a proposition to lease the road to the Consolidated Railway for a period of 999 years.

Virginia & Carolina Coast.—This railroad company, which has been formed by a syndicate headed by Rudolph Kleybolte & Co., of New York, to develop a large timber tract in the North Carolina pine belt, has purchased the Suffolk & Carolina at a price said to be $1,500,000. The Suffolk & Carolina runs from Suffolk, Va., to Edenton, N. C., and has 75 miles of track. It is reported that the Pamlico, Orient & Western, now under construction from Newbern, N. C., to Goose Creek, at the mouth of the Pamlico river, 37½ miles, has been also bought by the Virginia & Carolina Coast.

GENERAL NEWS SECTION

NOTES.

The Metropolitan District Railway (London) now has the whole of its services working electrically with the exception of the Inner Circle and the London and North-Western trains which have running rights over the lines of the Metropolitan. On August 27th, a new service of electric trains was begun from Wimbledon and Putney through London to Whitechapel.

The passenger department of the Southern Pacific is projecting a hunting and fishing trip to start from Houston, Tex., November 15, and last about 50 days. The trip will be made along the gulf coast from Houston to Aransas Pass, and good fishing and the hounding of bear and deer are expected. The price, $6 a day, includes board, lodging and the use of one horse and transportation beyond Bay City, Tex.

London Motor-Omnibuses.

Sir John Pound, Chairman of the London General Omnibus Company, expressed the opinion recently that the time was not yet at hand for motor-omnibuses to replace horse-omnibuses. His argument is that while a motor-omnibus service shows a good profit for the first few months or a year of its operation, maintenance charges increase rapidly after the expiration of that period, so that it is evident to him that the horse vehicle will remain the standard in omnibus companies for some time to come. The company, however, is introducing some motor-omnibuses into its service, and it is reported that a motor-omnibus service between London and Brighton will be started as an experiment.

Gasolene Motor Cars.

Of the gasolene motor trucks, designed at the Baldwin Locomotive Works and now in the experimental stage, Mr. John H. Converse says: "So far the work has progressed most satisfactorily. Its scope of usefulness will depend more or less upon the results we hope to attain. The truck will be so constructed that it can be placed under the ordinary passenger car and operated over the rails used by steam locomotives. The advantage of this is obvious. In the first place, the cost of equipping cars will be comparatively small. Consequently, railroads can provide for an extensive suburban service at small additional expense. On small roads, where a locomotive is now used to haul one or two coaches, the gasolene truck will be of sufficient power to handle that tonnage at far less cost."

Hall Electro-Gas Signals in England.

Reports come from the Northeastern Railway (England) that the installation of Hall automatic electro gas signals on the section from York northward is working admirably. This is the first experiment made in Great Britain with individual-power automatic block signals and the work was completed nearly a year ago.

Changes at Purdue.

Professor Goss has announced a number of appointments and resignations in the staff of the engineering department of Purdue University, Lafayette, Ind. Professor C. P. Matthews has been appointed Director of the Electrical Laboratory and in charge of the school of electrical engineering. W. O. Teague, B.S., heretofore with the Fore River Shipyard and the General Electric Company, has been appointed Assistant Professor of Experimental Engineering. Albert Smith, B.S., C.E., has been appointed Assistant Professor of Civil Engineering, and G. A. Young, B.S., M.E., Assistant Professor of Mechanical Engineering. Arthur B. Smith, B.S., has been appointed Instructor in Telephone Engineering. Nine other places have been filled by graduates of Purdue and other technical schools. Professor Goss also announces a number of resignations, including those of Professor W. E. Goldsborough, who is to become Assistant to the President of the J. G. White Company; Professor J. C. Kelsey, who takes a place with the Kellogg Switchboard & Supply Company, and Professors E. E. Reynolds and G. E. Waesche. Professor J. R. McColl has also resigned, to become Chief Engineer for the American Blower Company.

Curious Transportation in Africa.

A large shipment of Ruberoid Roofing some time ago went to Chinde, East Africa. It had been ordered in rolls two-thirds the usual size, in order to make them light enough in weight to accommodate the native carriers, who carry them into the interior of British East Africa. The outside label should be pasted on the end of the rolls, instead of at the center, as is usual. The reason given for this request is that the carriers always carry the roofing on their heads, and it was found they thought the label, which was stuck on the middle of the roll, was meant to show them where to put their heads. They therefore moulded a hollow in the roll, without damaging the roofing, so that it just fitted the shape of their heads, and so carried it very easily. The perspiration, however, completely destroyed the label and made it unreadable, so that when the roofing reached its destination they were unable to distinguish the different plys, etc.

Production of Pig Iron and Steel in 1903.

The Bulletin of the American Iron and Steel Association, in its usual table of statistics, gives the production of pig iron and steel in all countries for the year 1903 at 46,381,000 tons of pig and 35,883,000 tons of steel. English tons of 2,240 lbs. are used for the United States, Great Britain and her colonies, and for all other countries the metric tons of 2,204 lbs. The table shows:

Countries.	Pig iron — Years.	Production, tons.	Per-centage.	Steel — Years.	Production, tons.	Per-centage.
United States	1903	18,009,252	38.83	1903	14,534,978	40.51
Great Britain	1903	8,935,063	19.27	1903	5,134,101*	14.31
Germany & Luxem.	1903	10,085,634	21.75	1903	8,801,515	24.53
France	1903	2,840,517	6.13	1903	1,885,000	5.25
Belgium	1903	1,216,500	2.62	1903	969,230	2.70
Austria-Hungary.†	1903	1,428,158	3.08	1902	1,193,000§	3.32
Russia & Finland	1903	2,486,610	5.36	1903	2,410,938	6.72
Sweden	1903	506,825	1.09	1903	318,897	.89
Spain	1903	302,657	.65	1903	199,642	.56
Italy	1903	75,279‡	.16	1903	187,361	.52
Dom. of Canada	1903	265,418	.57	1903	181,514	.50
Other countries (*a*)	1903	229,087	.49	1903	66,824	.19
Total		46,381,000	100.00		35,883,000	100.00

*Does not include direct steel castings.
†Includes Bosnia and Herzegovina.
‡Not including blast furnace castings.
§Estimated. Official figures wanting.
(*a*) About.

The world's production of pig iron in 1880 was 17,950,000 tons; in 1890, 27,257,000 tons, and in 1900, 40,400,000 tons.

Oil Furnaces.*

Having built a great many oil furnaces on our system, and had much experience in their operation in our own shops and observed their working in other shops, I am convinced that oil furnaces must be built according to the class of work for which they are to be used. We have ten oil furnaces running in our shop at Houston, Tex. We are only about 17 miles from the Humble oil fields, and oil is very cheap while coal is expensive and we do all of our blacksmithing we possibly can in oil furnaces.

What I believe to be the most important point in building an oil furnace so that it will work properly is to have sufficient air or fan blast to cause the proper combustion in the furnace. In order to do this, you must have not less than eight ounces of fan blast, or from 60 lbs. to 75 lbs. of air pressure, to cut your oil or spray it properly into the furnace.

The construction of the burner also forms a very important item in the successful operation of an oil furnace. We have many kinds of burners in the different furnaces in our shops, such as steam, compressed air and fan blast burners. We use only air and fan blast in the blacksmith shop, as we believe them to be the best. I tried steam burners but they did not work well on account of the water connected with the steam, which prevents getting a good welding heat on the iron. We have one large scrap or axle furnace in which we heat 10-in. driving axles. It is operated with 10-ounce fan blast, three burners at one end, and stack at other end, and has two doors. The burners are made of 3-in. gas pipe with ⅜-in. oil pipe in center. In making pipe burners, you should have the oil pipe back of blast pipe and 1½ in. from the end of same, and protected by about 2 in. of extra fire brick inside the furnace. Without this arrangement you will experience great difficulty in keeping the oil pipe clear of the severe heat with which it comes in contact inside the furnace.

There should be a combustion chamber on every scrap furnace, or a firebox about 3 ft. wide with a bridge extending well over the burners, so that the oil will have no possible chance to come in contact with the piles of scrap or slabs in the furnace. If the oil does come in contact with the slabs, you will have black seams or streaks in the forging, and when it is planed or turned up, the forging will be condemned. This, of course, makes no difference in any but a welding furnace.

A bolt furnace should have a water front and a continuous stream of cold water running into the bottom of the water front, and the hot water running out through a waste pipe at the top. In this way the heat in front of the furnace will be diminished, which makes it much more comfortable to a man heating the iron. A bolt furnace should have two burners, one at each end, so that in case one burner gets out of working order, the other can be used.

*From a paper read by George Jordan, Foreman Blacksmith, T. & N. O. R. R., Houston, Texas, before the Cleveland meeting of the National Railroad Master Blacksmiths' Association, August, 1905.

In all cases you must use blast in both burners and oil in only one; otherwise the burner which is not working will be damaged or ruined by the excessive heat. We use from 40 to 50 gal. of fuel oil in 10 hours on one of these bolt furnaces.

A spring furnace should have a combustion chamber, or firebox, and a stack to carry off the gases arising from the oil, so the spring maker can stand close to the door at all times with comparative comfort, in order to gage the oil to keep the furnace at the same degree of heat and prevent overheating the steel. Our spring furnace has two burners at one end and stack at the other. It has firebrick floor and is large enough to heat the longest spring leaves.

The construction of a flue furnace differs materially from any other, on account of the short heat taken in welding the scarf end on the flue. A flue furnace should have a combustion chamber, and from it should lead a narrow passageway (say about 4 in. square) to where the flame comes in contact with the flue. After it passes the flue there should be a stack to draw off the blaze and prevent its coming out at the opening where the flue is heated to be welded. If you have no stack on the flue furnace, you will get too long a heat on the flue, and it will be almost impossible for the flue welder to stand by his machine, on account of the intense heat and the gases arising from the oil. With the old coke furnace, 200 flues was a good day's work, while with one of these oil furnaces 400 flues can be welded in 10 hours with ease.

In regard to the kind of furnace best adapted for a bulldozer for heating arch bars, and all other work that needs forming or bending, I would suggest that it be wide enough to accommodate the longest piece of iron to be bent. Also that it have one door opposite the one out of which you are working, so when you have a piece of iron of extraordinary length you can put it through the opposite door. It should have two burners at one end and a stack at the other, to draw off the surplus heat and gases, so that you can put your machine close to the furnace door and save the unnecessary expense of handling the material a distance. No combustion chamber or firebox is necessary with this furnace as no welding is done with it, and the burners can be run right into the furnace.

There is another kind of furnace that I wish to call your attention to, and that is a special furnace for use in straightening steel underframing for freight cars. When cars are wrecked, as you know, it does everything to them except tie them in a knot. In some cases they are about 40 ft. long and 20 in. wide, so I built a special furnace for them. This furnace is 9 ft. long, 30 in. wide, and has two air burners on one side and two doors, one at each end, so that we can run the sheets clear through and heat them at any place where they are bent. This is a very good furnace for this class of work, as you can erect them at any place needed, and with very little expense can run air into it, and set out a car of oil next to it. The oil cars are of sufficient height to run the oil into the burners by gravity. By this process you can take an 8-ft. heat on a sheet ½ in. thick in about five minutes.

In conclusion, I wish to say that I am a firm believer in oil furnaces, as the work that we turn out with them is double and even sometimes treble the work done with coal or coke. Even if oil were considerably higher and coal proportionately low, it would pay to use oil on account of the greater output of work.

Long Hours on Freight Trains.

On the 6th of December, 1904, President Roosevelt in his annual message to Congress demanded the passage of a law requiring the adoption of block signals, and a limit to the hours of labor for railroad employees in train service. An engineer in freight service is required to be on duty from 12 to 30 hours. Almost all freight schedules are 13, 14 and 18 hours, with eight and 10 hours rest at terminals. During the time he is on duty he is frequently wet and hungry. We all know the modern 150-ton battleship is not arranged for comfort. Under such circumstances would you call it human weakness and punish the employee should he overlook his orders, or for an instant drop asleep?

An employee is a human being and not a machine like the one under his guidance. A block signal system would be of small benefit if an overworked engineer should drop asleep and run by the board.

During the month of December, 1904, an engineer made 23 trips, 157 miles each way. He made two trips in 12 hours and 10 minutes, 10 trips in 13 hours and 30 minutes, four trips in 15 hours and 48 minutes, one trip in 16 hours, two trips in 18 hours and 30 minutes, one trip in 10 hours. He was on actual duty on his engine 321 hours and some minutes. He was called at least one hour before leaving time, and consumed one hour at terminals washing up, inspecting engine and making work report. In 23 trips this amounts to 46 hours, add this to 321 hours it would put him on duty 377 hours. Out of 552 hours he would get 175 hours rest. I ask you in the name of common humanity is it right?

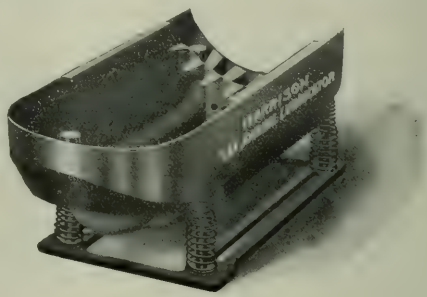
I believe in the efficacy of the block signal system, but it is without efficacy with an overworked crew on duty. Most wrecks are due to the human carelessness of one man, and that is the man at the top. Our present over-time system is a fraud and a delusion. Our schedules have been made so long that it is almost impossible to make over-time. An engineer is physically exhausted when he becomes eligible for overtime.

The long hour system in vogue on so many roads has become a curse, and is responsible for many serious disasters, and nothing will more surely or quickly undermine and destroy our health and happiness. The traveling public demand safer transportation, and when the hours are cut down they will get it. Not only the public has asked, but the President of this nation has urged and demanded it, and if our Congress is wise within its rights, it will make and enforce such a law.

The B. of L. E. should exhibit a determination to fight and fight hard this long hour curse. We would be better, healthier, and happier men for it. Under the present system we will deteriorate instead of progress, we will lose the nerve, stamina and backbone that an engineer should possess. Let us come together on this one vital question, and say to the railroad companies: We will give you an honest, sober day's work for your money, but we have decided to be men and not mere "dumb driven cattle." You must shorten your schedule and your hours, and we will repay you in safe and first class service.—*W. A. Kline, Columbus, Ga., in Locomotive Engineers' Journal.*

The Harrison Car Journal Lubricator.

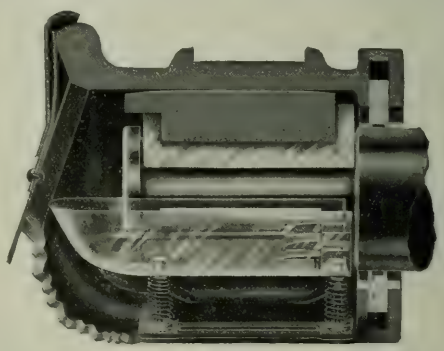
The accompanying illustrations show the Harrison car journal lubricator made by The Harrison-Williams Co., Toledo, Ohio. These lubricators are made to fit all sizes of M. C. B. standard journal boxes. It is claimed that less than 25 per cent. of the amount of oil and waste, used in packing the ordinary journal box, is required when the Harrison lubricator is used. It is stated that in a test recently made on the Lake Shore with this lubricator over



The Harrison Car Journal Lubricator.

8,000 miles were made with sealed boxes containing only 2½ pints of oil and eight ounces of waste, using less than one ounce of the lead lining of the brass. The claims, other than those of economy, for this lubricator are that it prevents the lubricant overflowing from the box after reaching the height of the dust guard chamber, and that it raises the oil clear to the journal.

Another feature that these lubricators possess is the oil chamber in the back. This gives the bearings just as perfect lubrication from the rear as from the front. As these lubricators hold all



The Harrison Lubricator in Position in the Journal Box.

the lubricant, and practically provide a double chamber in the back of the journal box, the packing is nearly all housed and what sand sifts into the box falls to the bottom and is kept out of the waste. These lubricators are pressed out of one sheet of steel and resiliently mounted on malleable bases, making them practically indestructible, and after once being placed in position in the journal box, they need not be removed for any cause, as the box can be

jacked up and the brass and wedge taken out by simply removing the waste from the lubricator, as from an ordinary oil box.

Iron Ore and Coal Production in 1903.

The Bulletin of the American Iron & Steel Association has published its usual statistics of the world's production of iron ore and coal for the year 1903, and the table is copied below. English tons of 2,240 lbs. are shown for the United States, Great Britain and her colonies, and Cuba, and metric tons of 2,204 lbs. for all other countries.

Countries.	Iron ore			Coal and lignite		
	Years.	Production, tons.	Per-centage.	Years.	Production, tons.	Per-centage.
United States	1903	35,019,308	34.95	1903	319,068,229	36.48
Great Britain	1903	13,713,645	13.69	1903	230,334,469	26.34
Germany & Luxem.	1903	21,230,650	21.19	1903	162,457,253	18.57
France	1903	6,219,541	6.21	1903	34,906,418	3.99
Belgium	1903	184,400	.18	1903	23,796,680*	2.72
Austria-Hungary.†	1903	3,269,175	3.26	1903	40,628,785	4.65
Russia & Finland.	1903	4,218,600	4.21	1903	17,818,000	2.04
Sweden	1903	3,677,841	3.67	1903	320,390	.04
Spain	1903	8,304,153	8.29	1903	2,800,843	.32
Italy	1903	374,790	.37	1903	346,887	.04
Dom. of Canada	1903	235,977	.24	1903	6,824,999	.78
Cuba	1903	624,858	.62	....	.....	...
Transvaal	.....	.....	...	1903	2,012,211	.23
Natal	.....	.....	...	1903	713,548	.08
India	1902	85,235	.09	1903	7,438,386	.85
Greece	1903	360,310	.36	1903	10,700	.00
New South Wales.	1903	22,120	.02	1903	6,354,846	.73
New Zealand	.....	.....	...	1903	1,420,193	.16
Other Australasia.	1903	52,707	.05	1903	760,158	.09
Japan	1901	70,172	.07	1903	10,088,845	1.15
Algeria	1903	588,893	.59	1903	140	.00
Other countries (a)	1903	1,943,625‡	1.94	1903	6,518,020	.74
Total	.....	100,198,000	100.00	....	874,620,000	100.00

*Lignite not included. †Includes Bosnia and Herzegovina.
‡Includes 588,795 gross tons mined by Newfoundland in 1903.
(a) About.

The Bulletin estimates the world's production of iron ore in 1880 at 43,359,000 tons; in 1890, at 57,474,000 tons, and in 1900, at 90,000,000 tons.

Proposed Light Railroads in Spain.

Consul-General Ridgely, of Barcelona, writes that the provincial council of Pamplona, in the Province of Navarra, northern Spain, will grant a considerable subvention to any Spanish or foreign company undertaking to construct light railroad lines in that Province. The area of the Province of Navarra is approximately 2,500,000 acres. The provincial council of Barcelona also desires to build light railroads. The proper form of address of the provincial councils is "Presidente de la Diputación Provincial de la Provincia de Barcelona" (or "Pamplona").

Manufacturing and Business.

Mr. W. S. Newhall, who recently resigned as Chief Engineer of the Wabash, is now with the McMyler Manufacturing Co., of Cleveland, Ohio.

The Buda Foundry & Manufacturing Company, of Chicago, have had such an increased business that it has been necessary to run overtime in order to fill their orders.

The Pennsylvania R. R. is installing gas producers for forge work in its Altoona shops. The contract for the producers, building and equipment was awarded to the Morgan Construction Co., 40 Exchange Place, New York.

The N. J. Holden Co., Ltd., has been incorporated in Montreal with a capital of $200,000 to make freight and passenger cars and to contract for the building of railroads. The incorporators are Lewis Johnson, William Palmer and P. A. Masse, of Montreal.

The Suderman-Dolson Company, of Houston, has been incorporated in Texas with a capital stock of $100,000, to construct roads and bridges, by Charles T. Suderman and Ben Dolson, Jr., of Galveston; Charles D. Allen, Joe E. Davis and Wilmer Waldo, of Houston.

Among the orders received last week by The Dayton Pneumatic Tool Co., Dayton, Ohio, was one from the American Car & Foundry Co., for 50 No. 88 (1⅛ x 8 in.) Green long stroke riveting hammers. It is understood that these tools are for use in the new steel underframe department of the latter company at their Madison, Ill., plant.

H. F. J. Porter, Consulting Engineer, has opened an office in the Metropolitan Building, New York, where he will devote his time to giving advice on general manufacturing and mechanical engineering questions tending towards industrial betterment and to install "welfare work" which is now recognized as an important adjunct to every enterprising manufacturing plant.

Halbert P. Gillette, formerly associate editor of *Engineering News*, and Geo. H. Gibson, formerly Manager of Publicity for the International Steam Pump Co., manager of the advertising department of the B. F. Sturtevant Co., and editor of the Westinghouse Companies' Publishing Department, have formed a partnership as "advertising engineers," under the name of the Geo. H. Gibson Co., with offices in the Park Row Building, New York City.

W. S. Doran, formerly associated with the British Westinghouse Electric & Manufacturing Company, Limited, has been appointed manager of the power department of the Allis-Chalmers Company, in which capacity he will have complete charge of the company's commercial affairs pertaining to reciprocating steam engines, steam and hydraulic turbines, condensers, gas engines, blowing engines for iron and steel blast furnace service, and rolling mill engines, with headquarters at the general offices of Allis-Chalmers Company, Milwaukee, Wis.

The Degnon Contracting Company, contractor for the two New York and Long Island Railroad tunnels, has just given to the Ingersoll-Sergeant Drill Co., of New York, one of the largest machinery orders of recent times. It includes 14 air compressors of two different types. Eight are of duplex compound Class "HC" pattern with steam cylinders 16 and 28 in. in diameter, air cylinders 25¼ and 16¼ in. in diameter, and a stroke of 16 in. Each unit has a free air capacity of 1,205 cu. ft. per minute. The other six are of straight line Class "A" type, with a 24-in. steam cylinder, 26¼-in. air cylinder, and a stroke of 30 in. The capacity of each is 1,444 cu. ft. per minute. The aggregate free air capacity of the 14 compressors is 18,304 cu. ft. per minute. The shield method will be used in driving these tunnels. The straight line compressors will furnish air to the headings for keeping out the water, and will also supply intake air to the other machines. The compound units, drawing their air at discharge pressure of the low pressure machines, will furnish air at high pressure to the rock drills and other machinery in the tunnel bores. As at present planned, the work of driving these tunnels contemplates three shafts. One will be at the Long Island terminus, and another at Forty-second street and the river front in New York. The third will be on Man-o-war's Reef in East river, where some interesting work is to be done in providing room for a power plant. It is expected that ultimately a large island will be made here with the rock removed from the tunnel. From this central shaft, the bores will be driven in both directions. The 14 compressors will be distributed among the three plants. This last order makes a total of 54 Ingersoll-Sergeant air compressors in use or contracted for on river tunnels entering New York City. The aggregate free air capacity of these machines is 138,426 cu. ft. per minute, and the pressures delivered range from 30 lbs. to 150 lbs.

Iron and Steel.

The orders given by the railroads for rails during the present year aggregate about 2,300,000 tons, including the 25,000 tons bought by the Pennsylvania for October and November delivery. This, in addition to the 500,000 tons carried over from last year, makes a total of 2,800,000 tons, and the probable output of the mills, by the end of the year, will be in the neighborhood of 3,000,000 tons. Negotiations are pending for 200,000 tons to be delivered next year. The plate mills, it is said, have secured orders from car shops which will keep them busy during the first half of next year. Moderate sized contracts for beams, angles and shapes are being made daily.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

New York Railroad Club.

The September meeting will be held on Friday evening, the 15th, at eight o'clock, the subject of the evening being a paper on the Quality and Utility of Hollow, Solid and Flexible Staybolts in Iron and Copper.

PERSONAL.

—Mr. Alexander Campbell, formerly and for many years Superintendent of the Chicago, Burlington & Quincy, at McCook, Neb., died in that town on August 28. Mr. Campbell was born in Scotland and entered railroad service in this country as a laborer on the Burlington in 1870. He later became foreman, and in 1872, assistant roadmaster. Then he was appointed roadmaster, and in 1880, Superintendent of the Western division, which position he has held ever since.

—Mr. W. J. Jenks, who was recently appointed Superintendent of the Second division of the Seaboard Air Line, began railroad service with the Raleigh & Augusta Air Line as a telegraph operator in 1885. He soon went to the Richmond & Danville and later to the Norfolk & Western as agent and operator. In January, 1889, he was made train despatcher on the Flat Top division of the latter road at Bluefield, W. Va. From that time he held positions as train despatcher, chief train despatcher and car distributor in the Pocahontas coal fields until September, 1901, when he went to the Seaboard Air Line as chief despatcher at Savannah, Ga. He was soon promoted to trainmaster at Americus, and then to the Fourth divi-

sion; and was appointed Superintendent of the Fourth division in 1904, where he has been until his recent appointment.

—Mr. George H. Burgess, who has been appointed Assistant Engineer of the Erie, in charge of terminal improvements at Jersey City, was born in 1874 in Oshkosh, Wis., and took a C. E. degree at the University of Wisconsin. After working as draftsman and estimator with the Edgemoor Bridge Works, of Wilmington, Del., he became rodman on the Northwest system of the Pennsylvania Lines West in 1896. From October, 1896, to February, 1898, he was assistant bridge inspector, from then until Jan. 1, 1901, bridge inspector, and from that time to Sept. 1, 1905, Assistant Engineer.

Marcus Talbot.

—Mr. Marcus Talbot, who has been elected Vice-President and General Manager of the Columbia River & Northern, began railroad service as a freight brakeman on the Grand Trunk in 1883. He remained there in various positions until 1886, when he went into the Freight Auditor's office of the Burlington at Omaha. From there he went to the Montana Union, remaining there until 1893 as clerk, cashier and agent. Next he went to the Butte, Anaconda & Pacific as agent, later becoming general agent at Butte and Anaconda, Mont. In June, 1900, he entered the service of the Pacific Coast Steamship Co., remaining there until his present appointment.

ELECTIONS AND APPOINTMENTS.

Ann Arbor.—G. Caspar Niles has been elected Treasurer of this company and of the Detroit, Toledo & Ironton, with office at New York, succeeding H. B. Henson.

Arkansas Southern.—Hugh C. Brown, Vice-President and General Manager, has resigned. A. E. Sweet has been appointed General Manager, succeeding Mr. Brown, and the office of Vice-President has been abolished.

Atchison, Topeka & Santa Fe.—The office of J. E. Hurley, President of the Southern Kansas of Texas and the Pecos Valley & Northeastern, has been removed from Amarillo, Tex., to Topeka, Kan.

Atlantic & Birmingham.—W. G. Raoul, President, has resigned. H. M. Atkinson has been elected President, succeeding Mr. Raoul.

Atlantic Coast Line.—J. C. Murchison, Superintendent of the South Rocky Mount district, has resigned. O. H. Page, Acting Superintendent of Transportation of the First Division, succeeds Mr. Murchison. W. H. Newell, District Superintendent at Charleston, S. C., has been appointed Superintendent of Transportation at Wilmington, N. C. G. D. Pugh, Superintendent of the Columbia district, succeeds Mr. Newell. C. L. Porter succeeds Mr. Pugh, with office at Florence, S. C.

Bessemer & Lake Erie.—William J. Post has been appointed Auditor, with office at Pittsburg, Pa., succeeding D. Hum, Jr.

Canadian Pacific.—J. W. Leonard, Manager of Construction, has been appointed General Superintendent of Transportation of the Eastern lines, succeeding C. W. Spencer, resigned.

Chicago & Eastern Illinois.—D. G. Reid has been elected Chairman of the board, and B. F. Yoakum, Chairman of the executive committee. T. D. Heed is Assistant Treasurer as well as Assistant Secretary.

Chicago Great Western.—Samuel C. Stickney, General Manager, has been also elected Second Vice-President. L. S. Cass, Assistant to the General Manager, has been elected Third Vice-President.

John C. Ilse, Commercial Agent at Chicago, has been appointed Assistant General Freight Agent, with office at Chicago, succeeding C. O. Johnson, resigned.

Chicago, Rock Island & Pacific.—The offices of Division Engineers of the Choctaw district have been abolished. H. G. Clark, Division Engineer of the Kansas division, has been appointed Engineer of the Choctaw district, with office at Little Rock, Ark. A. S. Zinn, Principal Assistant Engineer, with office at Oklahoma City, and J. C. Breedlove, Engineer of the Oklahoma division, have resigned.

Colorado & Southern.—J. Munday, Superintendent of Telegraph, has been also appointed Superintendent of Car Service, succeeding J. D. Welsh, promoted.

Denver & Rio Grande.—W. M. Edgar has been appointed Assistant Superintendent of the Second division, with office at Salida, Colo.

Denver, Enid & Gulf.—W. E. McEldowney, Master Mechanic at Enid, Okla. T., has resigned. C. J. Bushmeyer has been appointed Acting Master Mechanic, succeeding Mr. McEldowney.

Detroit, Toledo & Ironton.—See Ann Arbor above.

Gainesville & Gulf.—S. F. Parrott has been elected President; A. P. Stuckey, First Vice-President; B. W. Blount, Second Vice-President; F. M. Simonton, Secretary and H. E. Taylor, Treasurer.

Grand Rapids & Indiana.—C. L. Barnaby, Assistant Engineer of Maintenance of the Chicago Terminal division of the Pennsylvania Lines West, has been appointed Engineer of Maintenance of the Southern division of the Grand Rapids & Indiana, succeeding B. H. Hudson, promoted.

Illinois Southern.—F. S. Lewis, Superintendent, has resigned. J. C. Collins, Roadmaster on the Southern Indiana, succeeds Mr. Lewis.

Indiana Harbor.—Charles F. Cox has been elected Treasurer and F. Middlebrook has been appointed Assistant Treasurer, both with office at New York. The title of Byron Layton has been changed from Road Supervisor to Engineer of Maintenance of Way.

Manistique, Marquette & Northern.—S. T. Crapo has been elected President and General Manager, with office at Detroit, Mich. R. R. Metheany is Vice-President and J. B. Howard is Secretary and Treasurer, both with offices at Grand Rapids, Mich.

Metropolitan West Side Elevated (Chicago).—H. M. Brinckerhoff, having resigned, the position of General Manager has been abolished. W. S. Menden has been appointed General Superintendent.

Minneapolis, St. Paul & Sault Ste. Marie.—E. J. Coyle has been appointed Assistant General Passenger Agent, with office at Vancouver, B. C.

Mobile, Jackson & Kansas City.—George J. Kobush has been elected Vice-President, succeeding Alexander McDonald.

Monongahela.—John Ermire, Superintendent, has resigned. G. B. Obey, hitherto Superintendent of the Monongahela & Youghiogheny divisions of the Pittsburg & Lake Erie, succeeds Mr. Ermire.

National of Mexico.—John H. Guess has been appointed Purchasing and Fuel Agent, with office in the City of Mexico, succeeding William Burckel, resigned on account of ill health. E. E. Bashford is appointed Assistant Purchasing Agent, with office in New York, succeeding Mr. Guess, effective September 20.

New Orleans Terminal.—R. J. Palle has been appointed Assistant Treasurer, with office at New Orleans, La., succeeding G. McD. Nathan. R. B. Fowler has been appointed Superintendent, with office at New Orleans, succeeding C. W. Towsley.

New York Central & Hudson River.—R. E. Dougherty has been appointed Resident Engineer in charge of construction in the Exterior Zone, south of Poughkeepsie on the main line, Newburgh on the West Shore, Putnam Junction on the Harlem, and including the Putnam division and its branches.

Oregon Railroad & Navigation.—M. J. Buckley has been appointed General Superintendent, with office at Portland, Ore.

See also Southern Pacific, below.

Pennsylvania.—C. H. Niemeyer, Supervisor at Pitcairn, Pa., has been appointed Assistant Engineer at Sunbury, Pa., succeeding A. R. Fillebrown, deceased.

Pennsylvania Lines West.—Guy Scott, Division Engineer of the Cleveland & Pittsburg division of the Northwest system, has been appointed Assistant Engineer of Maintenance of the Chicago Terminal division, succeeding C. L. Barnaby. E. A. McCrea, Assistant Engineer of the Richmond division of the Southwest system, succeeds Mr. Scott. W. A. Hawley, assistant on the engineer corps of the Eastern division, Northwest system, succeeds Mr. McCrea. See Grand Rapids & Indiana, above.

Pere Marquette.—H. H. Hale has been appointed Assistant Master Mechanic of the Grand Rapids district, with headquarters at Grand Rapids, Mich.

Pittsburg & Lake Erie.—G. B. Obey, Superintendent of the Monongahela & Youghiogheny divisions, having been transferred to the Monongahela Railroad, the jurisdiction of J. W. Riley, Superintendent, has been extended over the Monongahela and Youghiogheny divisions. See Monongahela, above.

St. Louis, Rocky Mountain & Pacific.—E. J. Dedman, Purchasing

Agent of the El Paso-Northeastern, has been appointed Superintendent of Construction on this road.

Southern Indiana.—F. S. Lewis, Superintendent of the Illinois Southern, has been appointed Superintendent of the Southern Indiana, with office at Terre Haute, Ind. See Illinois Southern, above.

F. W. Van Etten has been appointed Superintendent of Telegraph, with office at Chicago.

Southern Pacific.—William McMurray has been appointed Assistant General Passenger Agent of the Oregon Lines of this road and of the Oregon Railroad & Navigation Co., with office at Portland, Ore.

Tidewater.—R. H. Williams, Jr., has been appointed General Freight and Passenger Agent, with headquarters at Richmond, Va.

Vandalia.—W. L. Elkin, assistant on the engineering corps of the Pittsburg division, Southwest system, of the Pennsylvania Lines West, has been appointed Assistant Engineer of the Michigan division of the Vandalia.

LOCOMOTIVE BUILDING.

The Canadian Northern, it is reported, will shortly order a number of locomotives.

The Missouri & Louisiana has purchased two small 20-ton locomotives from A. C. Torbert Co., for use in construction train work on their logging roads in Louisiana.

The Western Maryland denies having ordered two locomotives from the Baldwin Locomotive Works, as reported in our issue of Sept. 8, other than the 18 simple consolidation (2-8-0), five simple 10-wheel (4-6-0), and three six-wheel switching (0-6-0) locomotives, which were for fall delivery and reported in our issue of May 5, last.

The Nashville, Chattanooga & St. Louis has ordered three balanced compound 10-wheel (4-6-0) passenger locomotives from the Baldwin Locomotive Co. These locomotives will weigh 170,000 lbs., with 125,000 lbs. on the drivers; cylinders, 16 in. and 17 in. x 26 in.; diameter of drivers, 66 in.; extended wagon top boiler with a working steam pressure of 210 lbs., and a heating surface of 2,855 sq. ft. There will be 268 charcoal iron tubes 17 ft. long and 2¼ in. in diameter; the firebox is of steel, 120 in. x 41⅞ in.; grate area, 34 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 10 tons. The special equipment includes: Westinghouse air-brakes, Golmar bell ringers, Magnesia sectional boiler lagging, National Hollow brake-beams, Tower and Leeds reversible couplers, National Electric headlights, Simplex injectors, United States Metallic piston and valve rod packings, Coale muffled safety valves, Leach sanding devices, Nathan sight feed lubricators, Pittsburg springs, Crosby steam gages, Latrobe driving and tender wheel tires, and Standard truck wheel tires.

CAR BUILDING.

The Southern Pacific has ordered 15 passenger cars from the Pullman Co.

The Erie has ordered 3,500 steel underframe box cars of 80,000 lbs. capacity.

The Nashville, Chattanooga & St. Louis is asking bids on material for additional cars.

The Duluth, South Shore & Atlantic has ordered 200 box cars from the American Car Co.

The Bangor & Aroostook has ordered three box cars from the American Car & Foundry Co.

The Baltimore & Ohio, it is reported, is in the market for a large number of passenger cars.

The Darien & Western has ordered twenty 30-ton flat cars from the American Car & Foundry Co.

The South Side Elevated (Chicago) has ordered 30 car bodies from the American Car & Foundry Co.

The Johnston Automatic Refrigerator Company, Chicago, it is reported, will shortly close contracts for 250 refrigerator cars.

The Michigan Iron Co., Detroit, Mich., has purchased five flat cars from F. M. Hicks & Co., for use on their logging railroad.

The Canadian Pacific will build 139 passenger cars of various kinds; also five fruit express cars and 36 cabooses at its own shops.

The Florida East Coast, as reported in our issue of August 25, has ordered ten coaches, six baggage and express and two sleeping cars from the Pullman Co.

The Erie, as reported in our issue of August 25, is reported to have ordered 500 box cars from Barney & Smith, and 1,500 box cars from the Standard Steel Car Co.

The Merchants Despatch Transportation Co., as reported in our issue of September 8, is building at its Despatch shops 250 36-ft. refrigerator cars of 60,000 lbs. capacity.

The Georgia, Florida & Alabama has ordered one first class coach, one second class coach and one combination mail, baggage and express car from the American Car & Foundry Co.

The Central of Georgia, as reported in our issues of August 18 and 25, has ordered 500 gondola cars from the Pressed Steel Car Co., 400 flat cars from the Pullman Co., and 450 box cars from the South Atlantic Car & Manufacturing Co.

The Archer-Daniels Linseed Co., Minneapolis, Minn., has ordered two non-underframe steel tank cars of 80,000 lbs. capacity (10,000 gallons) from the Bettendorf Axle Co., for Oct. 15 delivery. These cars will weigh 36,000 lbs., and measure 26 ft. long and 13 ft. 10 in. high, over all. The special equipment will include: Bettendorf bolsters and trucks, Walsh brake-shoes, Westinghouse air brakes, Tower couplers, Miner draft rigging, Harrison dust guards, Camel journal boxes and Griffin wheels.

The Boston & Maine has ordered 500 box cars of 60,000 lbs. capacity from the Merchants Despatch Transportation Co., for Oct. 15, 1905, delivery; and 500 box cars of 60,000 lbs. capacity from the Laconia Car Co., for Feb. 1, 1906, delivery. All cars will weigh 32,000 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment will include: Simplex brake-beams, Westinghouse air-brakes, Gould couplers, Miner tandem draft rigging, Murphy roofs and Laconia Car Co.'s wheels.

BRIDGE BUILDING.

BELLEVILLE, ONT.—Bids are being received by Wm. R. Aylsworth, County Clerk, for building a steel bridge, 69 ft. long and 16 ft. wide near Gullett's mill in Rawdon.

BINGHAM, ME.—Contracts have been given to the American Bridge Co. at $21,800 for the superstructure, and to Fred Thornton, of Lewiston, for the substructure of a bridge to consist of two spans, the spans to be 330 ft. and 177 ft. long respectively. Other bids for the superstructure were: Eastern Bridge & Structural Co., New Haven, Conn., $24,500, and Boston Bridge Works, Boston, $20,400.

CHARLEROI, PA.—The Mercantile Bridge Co., of this place, will soon ask bids for building its proposed bridge from North Charleroi to Monessen over the Monongahela river. The plans call for the building of four stone piers and for a bridge 36 ft. wide, to carry two tracks. It is to be a combined street railroad and highway bridge.

CHICAGO, ILL.—Engineer C. D. Hill has completed plans for the proposed bridge to complete the connection between the north and south side boulevard systems. The plans call for a bascule structure 220 ft. from shore to shore, with a driveway 77 ft. wide and sidewalks of 16 ft. each.

CINCINNATI, OHIO.—Bids are wanted September 20 by W. M. Duane, Superintendent of Construction of the Cleveland, Cincinnati, Chicago & St. Louis, for the masonry work on three double-track bridges each to consist of five piers and two abutments, to be built over the Maimi river on the Cincinnati division of the road. The work calls for the construction of 12,000 cu. yds. of masonry reinforced with rods.

CLEVELAND, OHIO.—The steel viaduct, for which plans have been made by the Cleveland Short Line, to be built over the Cuyahoga river, Ohio canal and B. & O. tracks, from Newburg Heights village to Brooklyn Heights, will be about half a mile long and 165 ft. high. It will have masonry piers with steel towers and a steel superstructure. The estimated cost of the work is $1,000,000.

DONORA, PA.—At a joint meeting of the commissioners of Westmoreland and Washington counties it was decided to build a bridge over the Monongahela, which has been under consideration for a long time, at a cost of $150,000. The new bridge, including the approaches, will be 1,700 ft. long.

EAST ST. LOUIS, ILL.—The East St. Louis & Suburban Railroad Co. has given a contract for the substructure of a bridge to be built over the railroad tracks to The Foundation Co., and for the superstructure to the Wisconsin Bridge Co. The bridge will be about 800 ft. long and will cost $30,000.

INDIANAPOLIS, IND.—The appropriation of $18,000 for building a bridge over Eagle creek at Morris street was so low that builders refused to bid on the work. It has been decided to ask the county to increase the appropriation for this work.

LETHBRIDGE, N. W. T.—The Canadian Pacific has decided to build a bridge over the river at this place to be 900 ft. long and 350 ft. above the water line.

MEMPHIS, TENN.—The Illinois Central has plans ready for build-

ing a viaduct over its tracks at McLemore avenue at a cost of about $60,000.

Milwaukee, Wis.—A resolution has been passed in the County Council to submit to the voters an ordinance providing for the issuance of $200,000 of bonds for building a new bridge on East Water street.

Newcastle, Ind.—Henry County will spend about $15,000 during the present year for bridges.

Newcastle, Me.—A contract has been let for building a steel bridge 165 ft. long over the Damariscotta river between this place and Damariscotta. H. V. B. Nash is a Selectman.

New York, N. Y.—The New York, Westchester & Boston has completed plans for bridges to be built in the Bronx over White Plains road, Allerton avenue, Wilson avenue, Saw Mill lane, Wickham avenue and 222d street. Plans are also being made for a number of other bridges over street crossings. William A. Pratt is Chief Engineer.

Peterboro, Ont.—E. M. Elliott, County Clerk, will shortly ask for bids for the steel superstructure of a bridge to be built over the Indian river between Otonobee and Doupo townships.

Springfield, Ill.—The Chicago & Alton is making plans to build a new steel bridge over the Sangamon river to replace the present structure. Work is to be commenced at once. A bridge is also to be built on the Peoria branch over the Mackinaw river.

Toledo, Ohio.—City Engineer Consaul has filed a partial report estimating the cost of a Y bridge at Cherry street at $30,000. A straight bridge 82 ft. wide with a draw will cost $525,000, and the removal of the present old Cherry street bridge to Ash and Consaul streets will cost an additional $200,000. The consent of the War Department will have to be obtained as to the form of bridge to be constructed.

Other Structures.

Baltimore, Md.—Announcement has been made that the Baltimore & Ohio will build a grain drier near its elevators at Locust Point as soon as the plans are completed, at a cost of between $30,000 and $40,000.

Birmingham, Ala.—At a recent meeting of the Birmingham Terminal Co., plans for the new union passenger station were adopted. The new station will cost $1,000,000, and is to be completed by Jan. 1, 1907.

Fairbury, Neb.—The Chicago, Rock Island & Pacific has given contracts to O. G. Collier, Henry Stuteross and R. W. McHale for building its new roundhouse, turntable and cinder pits at this place to cost $30,000.

Fargo, N. Dak.—The Great Northern, it is said, will build a new station at this place to cost $50,000.

Knoxville, Tenn.—The Southern is planning to enlarge its passenger station.

Omaha, Neb.—Announcement has been made by the Union Pacific that work will be commenced at once on large new locomotive shops at Omaha, for which plans have been approved. The cost of the shops will be about $350,000.

Suspension Bridge, N. Y.—The New York Central & Hudson River is building a new 27-stall engine house.

Versailles, Ky.—The Southern is planning to replace the passenger station recently destroyed by fire at this place with two buildings, one for freight and the other for passengers, at a cost of about $30,000.

Walkerville, Ont.—The Grand Trunk has bought a large plot of ground here as a site for a passenger station and freight house.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Roads.—Surveys are being made by Col. Montgomery, a Civil Engineer, of Birmingham, for a railroad from Jacksonville, Ala., north to Anniston, a distance of 12 miles. The Seaboard Air Line is said to be back of this project.

Alleghany & Western.—Surveys have been completed by this company for a line from a point on Gauley river near Belva, W. Va., up the valley of the Meadow river through Nicholas and Fayette Counties into Greenbrier County, thence down Muddy creek valley to its mouth near Alderson, up the north bank of Greenbrier river to a point above Fort Spring, where it crosses the river and the Chesapeake & Ohio tracks; thence through Monroe County via Gap Mills and via Sweet Springs through Peter's Mountain by a tunnel into Potts creek valley, in Alleghany County, Pa. The project is backed by Charleston capitalists. William A. McCorkle, of Charleston, is President, and C. P. Peyton is Chief Engineer. The Kanawha & West Virginia, under construction from Charleston to Belva, 44 miles, and which is projected to run from the latter place to the Meadow river, 100 miles, it is said, will be a branch of this road.

Atchison, Topeka & Santa Fe.—Construction work, it is said, has been begun by this company on its branch from Glen Flora, Texas, south to El Campo, a distance of 12 miles.

Atlantic & Birmingham.—This company has given a contract to John Kries & Co., of Knoxville, Tenn., for the concrete work on its road between Montezuma and the Chattahoochee river.

Atlantic & North Carolina.—This company, which operates 95 miles of road in North Carolina, it is said, will extend its line from Beaufort, N. C., southeast to Cape Lookout, a distance of about 15 miles.

Atlantic Coast Line.—A contract is reported let by this company to Phillips & Allport, of Richmond, Va., to build new freight yards at South Rocky Mount, N. C., to contain 20 parallel tracks with a capacity of 3,000 cars. The work includes the laying of 32 miles of track.

Baltimore & Ohio.—An officer gives the following statement of improvement recently decided on: Increased facilities at Philadelphia at a cost of $650,000. Reconstructing the old main line and changing grade between Hollowfield and Davis City, $630,000. Second tracks to be built between Gaithersburg and Germantown, and between Barnesville and Dickerson, on the Metropolitan branch, at a cost of $450,000; extensions of third or passing tracks from Great Cacapon to Orleans road and from Hansrote to Baird, on the Cumberland division at a cost of $260,000; relocation of the line and the building of an entirely new one between Fairmont and Rivesville, and building a new bridge over the Monongahela river at a cost of $350,000; other improvements on the Connellsville division to cost $70,000 and improvements at Pittsburg and on the Pittsburg division to cost about $600,000. West of Pittsburg, $1,750,000 will be spent in fitting the Newcastle division to handle heavy business. Instead of double tracking the old line between Lodi and Sullivan, a new low-grade line is to be built between these points and a second track built from the latter place to Nova. When completed, these improvements will give a continuous double track between Pittsburg and Hamler, on the Chicago division. On the Cleveland division, extensive improvements will be made on the old Pittsburg & Western at a cost of $340,000, and an additional $150,000 will be spent for a new engine house, increased power plant and car repair yard at Lorain, and $180,000 will be spent for the new bridge at the mouth of the Cuyahoga river at Cleveland. The present bridge, which is not wide enough to accommodate the traffic will be replaced with a bascule bridge. This bridge will give 210 ft. clearance between fenders, complying with the United States navigation regulation.

Canadian Pacific.—J. D. McArthur, of Winnipeg, has been given a contract by this company to build 100 miles of the Wetaskiwin branch.

J. D. McArthur has received the contract for building 100 miles of track east and west of Saskatoon, N. W. T.

Canyon City, Plainview & Southeastern.—Preliminary surveys have been made and rights of way secured by this company as far as Lubbock on its proposed railroad to be built from Canyon City, Randolph County, Texas, south to Plainview, a distance of six miles. The road will eventually be extended south through Lubbock, Gail, Big Springs, Garden City, Sherwood, Eldorado, Sonora, Rocksprings and Brackettsville to Eagle Pass, an additional 400 miles. C. L. Tallmadge, of Chicago; D. C. Benton, of Nashville, Tenn., and E. C. Gordon, of Decatur, Ala., are interested. The company has an office in Chicago and also in Nashville, Tenn.

Chicago & North-Western.—Surveys are being made by this company for its proposed cut-off to reduce the heavy grades both east and west of Dixon, Ill. Two routes are under consideration; one from Nachusa to Dixon, and from the latter point to Nelson. If this is found impracticable, a cut-off passing south of Dixon will be built from Nachusa and Nelson.

Chicago, Milwaukee & St. Paul.—Surveys are being made by this company for a line from Albert Lea, Minn., to Mankato. The proposed route follows the Southern Minnesota division as far west as Armstrong, a distance of about six miles, thence northwest through Freeborn, Waseca and Blue Earth Counties to Mankato, a distance of about 50 miles.

Cincinnati, Hamilton & Dayton.—President Zimmerman is quoted as saying this company will build a line from Ashland, Ky., into Pike, Knott and Letcher Counties, Kentucky, for a distance of 125 miles to develop 350,000 acres of coal lands lately purchased; that the scheme has been nnanced and the construction will cost about $3,750,000. The line will cross the Ohio river at Ashland by means of the bridge which is being built by the Ashland & Ironton Bridge Co. It is the intention of the company to finally secure a through route to Charleston, S. C., by building further south and

connecting with existing roads. About 200 miles of new line will have to be built to complete the route.

DENVER, NORTHWESTERN & PACIFIC.—In the United States Circuit Court at Denver, Colo., Judge Moses Hallet has denied the application of the United States Government for an injunction to restrain this company from building a railroad through the Gore Canyon. The Government had proposed to build a reservoir in the canyon for the storage of water to be used for irrigation.

ELMIRA, CORNING & WAVERLY (ELECTRIC).—Articles of incorporation have been filed in New York by this company with a capital of $2,500,000, and with headquarters at Elmira, to build an electric road 37 miles long. The directors include: Senator William J. Tully, of Corning; G. T. Rogers, of Binghamton; A. N. Broadhead and A. C. Wade, of Jamestown; J. A. Powers and J. H. Caldwell, of Troy.

ERIE.—This company, it is said, has recently completed preparations for building a third cut-off to reduce the grades on its road. The new cut-off is to be a single-track line paralleling the main line from Lakewood, N. Y., at the south end of Chautauqua Lake southwest to Watts Flats, a distance of 15 miles. From that point to Columbus, Pa., 10 miles, a double-track line will be built to replace the existing main line, reducing 35-ft. grades to a ruling grade of 10 ft. per mile. This improvement will cost about $1,000,000.

FOURCHE RIVER VALLEY & INDIAN TERRITORY.—This company, which operates a line from Esau, Ark., nine miles southeast, is planning to build an extension to Perry County line south of Jennings Falls, a distance of about 35 miles. It has not been decided whether the company will do the work with its own forces or give the work out on contract. (April 7, p. 110.)

GREAT NORTHERN.—On the Minot division of this road, the Thorne line has been opened from York, N. Dak., west to Thorne, a distance of 34 miles, and on the same division the Maxbass line has been opened from Towner, N. Dak., west to Maxbass, a distance of 45 miles.

ILLINOIS CENTRAL.—A contract has been let by this company to W. J. Hutton, of Memphis, and to Lorimer & Gallagher, of Chicago, to build its proposed belt line from Woodstock to the Nonconnah yards in the southern part of Memphis, Tenn.

KANSAS CITY, MEXICO & ORIENT.—This company has extended the main line of its road from Fairview, Okla. T., west to Canton, a distance of 18 miles, and has also extended the Chihuahua division in Mexico from Las Trancas east to San Sostenes, a distance of 36 miles.

MEXICAN ROADS.—A narrow-gage railroad is to be built from La Dicha, State of Guerrero, to Acapulco, a distance of 40 miles, by the La Dicha Mining Company. George Mitchell, of New York, is president of the company.

A concession has been granted to J. A. Naugle, by the Mexican Government, for the construction of a railroad from Guaymas to Guadalajara or some other point on the Mexican Central Railroad. Under the terms of the concession the road must be completed within seven years, and a portion must be ready for delivery at the end of two years. A subsidy of $12,500 per kilometer has also been granted by the government. J. A. Naugle, of Guaymas, the assistant general manager of the Sonora Railroad, which is a branch of the Southern Pacific, can give information.

MICHIGAN ROADS.—A syndicate, in which Senator Burrows, of Michigan; S. J. Dunkley and O. W. Norton, of Chicago, are interested, is planning to build a railroad from South Haven, Mich., east via Fruitland, Bangor, Lake Cora, Pawpaw, Lawton and Kalamazoo to Detroit, about 180 miles. It is said that the syndicate has bought the line between Lawton and Kalamazoo from the Michigan Central, and that the entire road will be completed by July, 1906.

MISSOURI PACIFIC.—According to reports, this company is planning to build a double-track line through a portion of St. Louis County to avoid the heavy grades on its main line. Final surveys have been made and the company is now securing the right of way. The proposed line will leave the present tracks at Sutton, Mo., west of Maplewood, and run to a point west of Creve Coeur Lake, where it will again touch the present line. The maximum grade is to be .3 per cent.

MISSOURI ROADS.—Surveys are about to be made by Charles A. Gallagher, of Kansas City, for a railroad from a point south of Sedalia, Mo., north via Marshall and Miami, to Saline County, and on toward Iowa, a distance of about 68 miles. Such a line would require a bridge over the Missouri river at Miami.

NEW ORLEANS GREAT NORTHERN.—McKinney & Oliver, who have the contract to build this road in Louisiana and Southern Mississippi, will sublet eight miles of earthwork at Florenville, La.

NEW YORK, AUBURN & LANSING.—This company, which is building a road from Auburn, N. Y., south to Genoa, is securing rights of way from the latter place south for an extension to Ithaca, a distance of 18 miles additional. The work includes the building of a large overhead bridge at Auburn.

NEW YORK SUBWAYS.—Announcement has been made by President Orr, of the Rapid Transit Commission, that bids for the construction of additional subways in Manhattan will be asked for in January next. Bids will be opened September 20 for making borings, and when the results of these borings are known, definite action will be taken towards asking bids for the construction. Nineteen rapid transit routes, most of them subways, including three tunnels under the East river, have been laid out by the Rapid Transit Commission and approved by the Board of Estimate, but it does not yet appear which ones are to be first built. On most of the routes the commission has been unable to get the consent of the majority of the property owners, and application will probably be made to the court for authority to go ahead with the work.

NORTHERN MAINE SEAPORT.—The proposed road of this company will require a large number of bridges, viaducts and culverts. The proposed route is 60 miles long, from South Lagrange south to Stockton Springs. There will be 18 steel bridges, varying in length from 65 ft. to 400 ft. There are innumerable brooks and marshes to be crossed, and a considerable number of overhead crossings. (July 28, p. 31.)

NORWAY & WESTERN.—A charter has been granted in Maine to a company under this name with a capital of $150,000 to build a railroad from Norway, Me., to East Stoneham, and also from Norway to South Waterford, a distance of 21 miles. The directors include: J. Bartlett, of Stoneham; L. S. Burnham, of Albany; W. G. Rand, of Boston; F. H. Noyes, of Norway, and W. H. Kilgore, of North Waterford.

OREGON SHORT LINE.—Construction work is being pushed by this company on its Malad Valley branch out of Garland, Utah, north a distance of 32 miles. It has been officially announced that trains will be running to Malad City, Idaho, on September 15.

PAN-AMERICAN.—D. P. Doak, president of this company, says that track-laying on the second division of this road is progressing at the rate of one kilometer per day. The first division of the road, which runs from San Geronimo, State of Chiapas, to the town of Jalisco, a distance of about 200 kilometers, is in regular operation. Steel bridges are to be put in on the first division to replace the temporary wooden structures.

PELHAM, BAINBRIDGE & GULF.—A charter has been granted to this company with a capital of $100,000 in Georgia to build a railroad from Pelham, Ga., on the Atlantic Coast Line, southwest via Bainbridge to Fairchilds, on the Chattahoochee river, a distance of about 52 miles. It is the intention to eventually extend the road to a point on the Gulf coast. The incorporators include: J. W. Everett and J. L. Hand, of Pelham, and others.

PENNSYLVANIA ROADS.—Engineers have completed surveys for a line to be built from Pittsburg east to the Atlantic seaboard through central Pennsylvania counties, and it is said that rights of way are now being bought on the proposed line between Freeport, Leechburg and Pittsburg. The final survey leaves Alleghany by way of Millvale, Sharpsburg and Etna, paralleling the old Pittsburg & Western, across the county to a point on the river near White Rock, thence following the Alleghany to the mouth of the Kiskiminetas and thence down that stream to a point near Leechburg, thence towards Southbend and Shelocta, whence it follows the line surveyed about two years ago to Indiana; thence to Two Lick creek, following that stream through Pine Flats to Summit, and thence to Cherrytree and east along the west branch of the Susquehanna, through Clearfield, Center, Union and Snyder Counties. We are unable to obtain definite information as to who is behind this project, but one of the reports state that the Wabash and the Buffalo, Rochester & Pittsburg are working jointly in the matter.

PHILADELPHIA & SCHUYLKILL VALLEY.—A charter has been granted in Pennsylvania to this company, with a capital of $150,000, to build a 15-mile line from Mill Road and Keystone Avenue, Upper Darby Turnpike, Delaware County, to the northeast corner of Fifth and DeKalb Streets, Bridgeport, Montgomery County. The directors are: Loren N. Downs, Bryn Mawr, President; W. Robinson Molinaird, W. Evans Smith, George A. Chrisman, Ernest S. Chrisman, William Darling and William H. Ford, of Philadelphia.

PHILIPPINE RAILROADS.—Announcement has been made at the Bureau of Insular Affairs, Washington, D. C., that the date sent from Manila for receiving bids for Philippine railroads, which was given as December 1, was incorrect, and that bids will now be received until December 15.

PORTLAND & RUMFORD FALLS.—This company, it is said, is planning to extend its line from Oquissoc, Me., north to Megantic, where connection will be made with the Canadian Pacific. Rights of way have been secured from the Maine lake region to the Canadian border, where 100,000 acres of land have been bought. Three different routes are under consideration, all of which permit of easy construction. The country is level and very heavily wooded.

Salt Lake & Ogden (Electric).—This Utah company has filed an amendment to its charter increasing its capital stock from $800,000 to $1,500,000, for the purpose of extending its line from Lagoon north to Ogden, about 40 miles, and making other improvements. President Simon Bamberger is quoted as saying that the road will probably be opened to Layton within the next 30 days. It is expected to have the road in operation to Ogden by May, 1906.

Shreveport Northeastern.—Under this name a company has been granted a charter in Louisiana, with a capital of $2,000,000 to build a railroad from Shreveport, La., northeast through Caddo, Bossier, Webster, Claiborne and Union Parishes, in Louisiana, and through the State of Arkansas to Memphis, Tenn., a distance of about 275 miles. A. K. Clingman, of Shreveport, and T. E. Schumpert, J. V. Ardis, of Caddo Parish; A. McCrainie and A. T. Nelson, of Claiborne Parish, and others are interested. (See Shreveport, Eldorado & Memphis, July 28, p. 32.)

Southern Pacific.—According to reports, President Harriman has directed the engineering department to make a survey for piercing a tunnel through the Siskiyou mountains, in northern California, which tunnel it is proposed to have ready for operation within three years. When completed, the tunnel will greatly reduce the grade and shorten the distance by seven to ten miles between Sacramento and Portland. It is proposed to run through the tunnel by electric power.

This company, it is said, has given a contract to W. O. Robertson, of San Antonio, for building its proposed extension from Stockdale, Tex., east to Cuero, a distance of 47 miles.

Southern Traction.—Plans have been completed and contracts will be let next month for building a system of connecting lines 18 miles long for this company in Pennsylvania. The proposed road will connect Altoona, Hollidaysburg, Roaring Spring and Bedford on the south and Johnstown, Ebensburg and Gallitzin on the north and west. The cost of the work will be about $450,000. F. T. Patterson, of Pittsburg, is President, and F. J. Thompson, Secretary and Treasurer. The power house, car barns and general operating offices of the company will be at Duncansville, Pa.

Syracuse, Lake Shore & Northern (Electric).—This company has been incorporated in New York, with a capital of $2,250,000, to build a street railroad from Syracuse to Baldwinsville, a distance of 15 miles. The company is also to take over the Syracuse, Lakeside & Baldwinsville road, which was recently bought by the Beebe interests for $530,000. The road will be improved and probably soon extended north to Fulton and possibly to Oswego. The Beebe interests also control the Rochester, Syracuse & Eastern and the Auburn & Syracuse. The directors of the new company are: H. S. Holden, C. M. Warner, A. K. Hiscock, C. D. Beebe, W. Nottingham, W. A. Holden; W. K. Pierce and others, of Syracuse, and C. B. Benson, of Minetto, N. Y.

Texas Roads.—Final surveys will be begun in a few days and contracts for construction will soon be let for building 80 miles of railroad from Abilene, Tex., north to Munday, in Knox County. Major J. D. Beardsley, of Gibsland, La., has made a contract with the towns of Abilene, Anson, Stamford, Haskell and Munday whereby the road will receive a bonus of $123,000, also the necessary right of way and ground for stations.

Tulsa, Turnersville & Texas.—A charter has been granted this company in Oklahoma Territory with a capital of $3,500,000 to build a railroad from the northeastern corner of Indian Territory southwest to Shawnee, Okla. T., passing through the Cherokee and Creek nations and Pottawattomie County, a distance of 150 miles. The incorporators are: F. Turner, V. N. Sayre and W. S. Harsh, of Muskogee; Joseph M. Neil and W. N. Spurlock, of Guthrie.

Union & Glenn Springs.—This company, operating three miles of railroad in Union County, South Carolina, has extended its road from Union east to Pride, a distance of 16 miles.

Vandalia.—An officer writes in reference to the proposed extension from Saline City southwest to Worthington, Ind., that a survey has been made from Saline City to a point on the company's Green County coal branch near Dugger, Ind., but that the construction work has been indefinitely postponed. (Sept. 1, p. 72.)

Vinita & Western.—The general contract has been given by this company to the Osage Construction Co., of Vinita, Ind. T., for building its proposed line from that place northwest to a terminus probably at Coffeyville, about 50 miles. Winter & Walt, of Joplin, Mo., have the contract for the first 10 miles of grading and contracts for the remaining 40 miles will be sublet shortly. (July 7, p. 8.)

Virginia Light & Power Company.—A charter has been granted a company in Virginia under this name with a capital of $25,000 to build a railroad from Richmond, Va., north about 18 miles, to Ashland, and eventually farther north. A line from Richmond to Ashland would parallel the Richmond, Fredericksburg & Potomac. The incorporators include: H. W. Anderson, President; T. S. Wheelwright, Vice-President, and G. B. Williams, Secretary and Treasurer, of Richmond.

Virginia Ore & Lumber Company.—This company, whose head office is at Roanoke, Va., has given a contract to the Vaughan Construction Co., of that place, for building 12 miles of road from Town Creek, on the Winston-Salem division of the Norfolk & Western, in Henry County, Va., west to Stuart's Knob, in Patrick County, Va. F. A. Hill and H. D. Lafferty are interested.

RAILROAD CORPORATION NEWS.

Boston & Maine.—It is reported that this company will issue $10,000,000 4 per cent. 20-year refunding bonds. At a recent meeting of the board of directors, a new issue of 53,319 shares of common stock was recommended, the proceeds of the sale of which are to be used for improvements.

Chicago & North-Western.—The Wyoming Central, a proposed road subsidiary to this company, has recently filed amended articles of incorporation increasing its capital stock from $7,500,000 to $13,500,000. The road is to run from Casper, Wyo., to Lander, 123 miles, and it is reported that the increase in capital is to provide for a contemplated extension from Lander to Salt Lake City or Ogden, Utah.

Chicago Great Western.—The stockholders have authorized an increase in the issue of preferred stock from $10,000,000 to $24,000,000 to pay for the Mason City & Fort Dodge Railroad, recently bought. (August 18, p. 56.)

Great Northern.—This company has notified the trustees of the stock of the Union Terminal Railway Co., of Sioux City, Iowa, that it will exercise its option to buy the entire capital stock of that company. It is reported that the purchase price will be $1,225,000, payment to be made by October 1, 1906.

Maine Central (Boston & Maine).—The annual report for the year ended June 30 will show results as follows: Gross earnings from operation, $7,251,536; operating expenses (67.244 per cent. of gross earnings), including $191,764 for new equipment received and in process of construction, $4,876,202; net earnings, $2,375,334; net income, $2,110,066. The total fixed charges were $1,438,136, leaving a balance of net income over fixed charges of $671,930, and a balance available for dividends after sinking fund payments of $527,236. Dividends amounting to 7 per cent., or $348,366, were declared during the year, leaving a surplus for the year to be transferred to the contingent fund of $178,871. Total passenger earnings were $2,809,854, an increase of $81,388 over the preceding year. Total freight earnings were $4,289,365, an increase of $244,271. The increase in gross income for the year was $344,647. One of the principal charges against income was an appropriation of $300,000 for new passenger station and terminals at Bangor.

New Orleans Great Northern.—This company, whose road will run from Slidell, La., to Monticello, Miss., 100 miles, has filed a mortgage on its entire road, including branches, extensions and terminal properties now owned or hereafter acquired, equipment and franchises, with the Knickerbocker Trust Co., of New York, trustee, to secure $10,000,000 first-mortgage 5 per cent. gold bonds of 1955. Of these bonds, $5,000,000 were sold to a syndicate headed by Fisk & Robinson, New York, some time ago. (April 7, p. 112.)

Northern Maine Seaport.—The Bangor & Aroostook has guaranteed the $5,000,000 5 per cent. bonds of the Northern Maine Seaport, which proposes to build a road from Lagrange, Me., to Stockton, 65 miles, giving the Bangor & Aroostook a port on the Maine coast which will be open all the year round.

Southern Pacific.—The Southern Pacific of California, the Southern Pacific of Arizona and the Southern Pacific of New Mexico have been formally merged. The recent issue of $320,000,000 of securities was made partly for the purpose of buying up the outstanding securities of the three old companies, the outstanding stock of which amounted to $128,307,960, and the outstanding bonds to $70,000,000. (July 14, p. 16.)

Toledo & Western (Electric).—This company has filed a mortgage to secure $2,500,000 25-year 5 per cent. bonds of 1930.

West Jersey & Seashore.—This company has declared a semi-annual dividend of 3 per cent. The dividends since 1896 have been at the rate of 5 per cent. annually.

Wisconsin & Michigan.—Of the five-year 4 per cent. gold bonds of 1955 secured by a recent general mortgage to the Equitable Trust Co., New York, trustee, $2,500,000 is issuable for equipment, $1,800,000 for betterments and $1,200,000 to retire the $951,000 5 per cent. bonds issued in 1895. (August 11, p. 45.)

Wyoming Central.—See Chicago & North-Western above.

GENERAL NEWS SECTION

NOTES.

The Baltimore & Ohio announces that henceforth baggage insurance tickets will be sold by the agents and baggagemen of that company at its principal offices. The insurance covers losses of all kinds from the time the baggage leaves its home.

The Canadian Railway Commission, acting on the protest of the Canadian Pacific in the matter of the location of the proposed Grand Trunk Pacific route too near the C. P. west of Portage la Prairie, has held that the matter is not within its jurisdiction, since the route had been approved by the Minister of Railways.

The State of Indiana now prescribes by law the rates which railroads may charge for excess baggage; and for distances where the passenger fare is less than $1.34 these rates are much lower than those now charged by railroads. It is said that the Wabash has issued a new tariff conforming to the law but that no other road has yet taken action.

Rumors of the retirement of Mr. Cassatt from the presidency of the Pennsylvania are not uncommon and are now again revived. It is said that he will present his resignation at the next annual meeting in accordance with the Pennsylvania rule that all employees shall be retired at the age of 70; but this rumor is unconvincing, since Mr. Cassatt was born in 1839 and will celebrate his sixty-sixth birthday on the eighth of next December.

Counterfeit pay checks of the Baltimore & Ohio have recently been discovered at Washington, Ind., and at Cincinnati, amounting to $2,433. An officer of the road says that there is no reason to believe that anyone connected with the company had anything to do with the forgeries. The work appears to have been done by skilful and experienced counterfeiters.

The Grand Trunk Railway of Canada, in furtherance of its plans for getting the most possible benefit out of its apprenticeship system, has offered to apprentices and other employees under 21 years of ago two free scholarships in the School of Applied Science of McGill University. The scholarships are to be granted on the basis of competitive examinations.

Mr. E. P. Bacon, of Milwaukee, has issued a call for a convention to be held at the Auditorium Hotel, Chicago, Oct. 26, to impress upon Congress the extent and persistence of the demand for legislation empowering the Interstate Commerce Commission to make rates; to issue orders prescribing rates which shall go into effect promptly and remain in effect until changed by Congress.

A press dispatch from Lincoln says that the Governor of Nebraska and two other prominent state officers have, in consequence of the action of the Republican State Convention, in adopting an anti-pass plank, returned to the railroads the annual passes which they have held. Other state officers are expected to follow this example, but the Secretary of State declares that the passes which he has he will keep.

At the timber-treating works of the Gulf, Colorado & Santa Fe, at Somerville, Tex., the quantity of creosote used now is about 40,000 gallons a month, and it is said that this plant uses a third of all the creosote used in the United States. The tannin and zinc treatment is no longer used at Somerville. A tank steamer arrived at Galveston September 3 with 2,200,000 gallons of creosote, of which about one-third was for the Somerville plant.

At the Union station in Atlanta, Ga., recently Mr. Etheridge, a lawyer, had to buy a ticket, for which he paid 18 cents, in order to get admission to the train platform to bid good-bye to a friend who was going away. After the train had gone he applied for the redemption of his ticket, but was refused because the ticket had been punched by the gateman. He sued the road and got a verdict for his 18 cents, there being a clause printed on the ticket making it redeemable if not used; but it is said that the case will be appealed.

According to the *Telegraph Age* the experiments made with wireless telegraphy on the Chicago & Alton have developed some interesting facts. It appears that as the trains approached the Mississippi river the increase in the strength of signals became very marked, but when the train entered the truss of the Merchants' Bridge it was found that they died away almost entirely, apparently in consequence of the screening action of the truss. The signals were also stronger when the train was running at right angles to the transmission station. That the radiations followed the course of the river rather than overland was clearly evident. Chicago papers say that the experiments have finally been given up—which spoils several hundred "news" items, published all over the country, to the effect that the officers of the road expected to use the wireless telegraph as preventive of collisions.

The latest "city" to put forth its iron hand in restriction of the speed of railroad trains is Rush Hill, Mo., which is said to be inhabited by 250 men, women and children; and the people are so determined in their purpose to protect their lives and liberties that the railroad company involved, the Chicago & Alton, has applied for an injunction to restrain the officers of the city from arresting the company's train men. It appears that, by an ordinance recently passed, the rate of speed for all trains is limited to eight miles an hour; but the train men did not comply with it, and they were arrested and fined. A limit was also placed on the time that a locomotive or a hand car might remain on the tracks within the city limits. The railroad company, in applying for the injunction, avers that its tracks are in the southern part of the city, and that the occupants of only one house are required to cross the tracks to get into the business center of the town; and that therefore to cause any detrimental obstruction of the streets is impossible.

The roads from New York and those from New Orleans have once more reached an agreement to end the sugar and coffee rate wars, and new tariffs are announced to go into effect on Oct. 7, —provided somebody does not back out. The basis agreed upon for sugar is as follows:

To Missouri River points, from New Orleans, 34 cents.
To Missouri River points, from New York (all rail), 45 cents.
To Missouri River points, from N. Y. (lake and rail), 42 cents.
From New Orleans to St. Paul, 30 cents.
From New York to St. Paul (all rail), 33 cents.
From New York to St. Paul (lake and rail), 30 cents.
The usual differentials will be allowed on Phila. shipments.

The rates agreed upon for coffee are:

From New Orleans to Missouri River, 35 cents.
From New York to Missouri River (all rail), 43 cents.
From New York to Missouri River (lake and rail), 38 cents.
From New York to St. Paul (all rail), 40 cents.
From New Orleans to St. Paul (open navigation), 35 cents.
From New Orleans to St. Paul (closed navigation), 40 cents.

A Dried-Up Pool.

A pool of the Kansas City roads, which has been in existence for several months, was suddenly abandoned last week at the first intimation that the millers might cause trouble by bringing the matter to the attention of the Interstate Commerce Commission as a violation of the Elkins law and the Sherman anti-trust act. The fact became known yesterday when it was announced that G. A. Kimball had closed his Kansas City office and resumed his work with the Western Trunk Line Association. Kimball was known as joint contracting agent of all lines entering Kansas City which handled foreign shipments of grain. As a matter of fact, he had the routing of all the flour shipped out of Kansas City, seeing that each road secured its proportion, and it was only last month that the railroads gave him authority over grain shipments. The joint agency was established on account of the rate wars that have been disturbing the grain business. The Alton and the Milwaukee & St. Paul were not in the pool.—*Exchange.*

The Central Mileage Ticket.

All the prominent Michigan railroads except the Grand Trunk have been admitted to membership in the mileage bureau of the Central Passenger Association, and on Oct. 1 will begin using the Central Association's interchangeable mileage book. The companies are the Ann Arbor, the Michigan Central, the Pere Marquette, the Grand Rapids & Indiana, and the Detroit & Mackinac; also the Detroit & Cleveland Navigation Company, and the Detroit & Buffalo Steamboat Company. The interchangeable mileage books will then be good over 30 transportation lines, with an aggregate of over 28,000 miles. If the Grand Trunk joins, it will be good over nearly 30,000, including every railroad from Chicago and St. Louis to Buffalo and Pittsburg, and will be the only form of mileage ticket in that territory.

Since the bureau was organized eight years ago over $54,000,000 worth of mileage books have been sold, each book selling for $30 and a rebate of $10 being paid to the purchaser after he has traveled 1,000 miles. The average trip is about 40 miles and the longest possible trip 523 miles, from Chicago to Buffalo. A remarkable record made by the bureau is that since Sept. 1, 1897, it has disbursed in rebates of $10 each amounting to over $18,000,000, without the loss of a dollar. Checks for the rebates have been sent to every part of the United States and Canada, and Mexico.

Storage Battery Locomotive for a London Underground Railway.

The accompanying illustration shows one of two storage battery locomotives built by Hurst, Nelson & Co., Ltd., of Motherwell, near Glasgow, for the Great Northern, Piccadilly & Brompton Railway; one of the Yerkes underground electric railways now in course of construction in London. The main floor of the locomotive is of steel girders and plates, and upon this is built up a casing as shown. The length of the locomotive, over buffers, is 50 ft. 6 in., and its width is 8 ft. A driver's cab is provided at each end, and these are each fitted with a British Thomson-Houston master controller, and one of the cabs is also provided with accommodations for the electrical and brake apparatus. There are no collector shoes, the power being obtained from the battery; the main battery compartment contains about 36 tons of accumulators. The equipment consists of 80 cells, each cell having 21 plates. The normal discharge current is 179 amperes with a maximum emergency load of 800 amperes. The locomotives weigh about 64 tons each, and the free running speed, when hauling a train-load of 60 tons, varies between 7 and 9½ m.p.h. The batteries are capable of storing sufficient energy to operate for a whole day without recharging.

Storage Battery Locomotive for a London Underground Railway.

These locomotives were primarily designed for the purpose of hauling cars used in the conveyance of excavated material, and also for material required in the construction of the tunnels of the Great Northern, Piccadilly & Brompton "tube" line. They are equipped with automatic couplers and Westinghouse air-brakes and hand brakes.

Inclusive Fares.

One feature of British railroad practice this year has been the introduction of excursions at special inclusive fares which include meals on the train as well as transportation. The Great Central recently issued special return tickets from London to Doncaster, 180 miles (for the races) at inclusive prices, including lunch, tea and dinner at 33s. 6d. first class and 18s. 6d. third class.

New Equipment for the "Overland Limited."

New equipment is being delivered by the Pullman Company to the Chicago & North-Western for the "Overland Limited," the fast three-day train from Chicago to the Pacific Coast. The sleeping cars are of the latest design, and maximum size, and are electric-lighted. There are ten sections, a drawing room and two private compartments in each of the cars intended for the Chicago-San Francisco run. Similar sleepers having 12 sections, one drawing room and one compartment, will run to Portland. These sleeping cars, together with dining cars and composite buffet-smoking, library and observation cars, constitute the equipment of the train. The "Overland Limited" now connects by the San Pedro, Los Angeles & Salt Lake with a new short line to Los Angeles.

Proposed Railroad in Brazil.

It is reported that, under the auspices of the directors of the North German Lloyd and Hamburg South American Line, a company with a capital of 23,000,000 marks, backed by some prominent German banks, had been formed in Hamburg for the purpose of constructing a railroad from Blumenau to Hammonia (a distance of 75 kilometers), in which the German colonies are situated. From Hammonia the projected line will go directly north to Rio Negro, on the frontier of the State of Parana, traversing the large territories acquired by a German land association called Hansa, to connect with the Parana railway, and also a line that is projected from the State of Rio Grande do Sul. Another branch is to extend from Hammonia to Coritibanos, about 200 kilometers, which later on is intended to be connected with a post on the frontier of the State of Rio Grande do Sul.

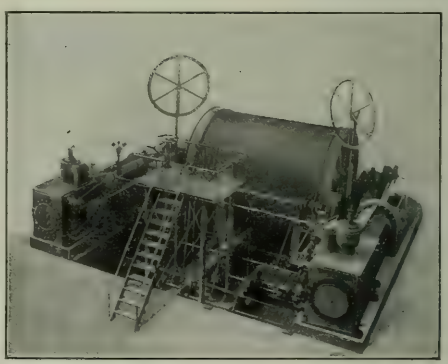
The Witham Accident.

The derailment of an express train at Witham, on the Great Eastern of England Sept. 1, killing 10 persons and injuring 45, is still classed as unexplained. Witham is 39 miles from London. Between the platforms at the London end of the station, the locomotive and the first three coaches broke away from the remainder of the train; and the third coach from the engine turned over across the up line and caught fire, being eventually completely destroyed. The locomotive proceeded some distance alone along the down line, and the train was badly scattered. A porter in the station was killed. The four last coaches suffered but little damage, and the locomotive did not leave the rails at all.

The theory of a broken axle, at first advanced, has been found untenable, as a thorough examination of the wheels and trucks proved all the axles to be sound. Both at the approach to the station, and in the station itself the line is straight, and no flaw in the permanent way, or obstacle on the track has been discovered. There are no facing points, but there is a crossing with four frogs. Lieut.-Col. von Donop has been appointed by the Board of Trade to conduct the official inquiry.

A Large Hoisting Engine for the Centennial Copper Company.

A hoisting engine of very heavy design is being installed by the Centennial Copper Co., Calumet, Mich. It is of the direct acting type and consists of two 36-in. x 60-in. simple, reversible Corliss engines of the heavy duty type, connected to a straight-faced drum, 15 ft. in diameter by 15 ft. winding face. The drum is grooved for 1⅜ in. wire rope and is keyed direct to the engine shaft. The plant is designed to hoist from a vertical depth of 5,000 ft. at a rate of 4,000 ft. a minute, with a boiler pressure of 150 lbs. The reversible engine is of novel design, and may be worked by either steam or air. The brake mechanism is arranged for steam, hand or gravity operation, with independent control in each case. The main throttles are on the cylinders, moved by hand from the engineer's platform, which is elevated to a point higher than the drum. The dial indicators are provided with fast and slow moving pointers. A sensitive and powerful automatic stop and throttle-closing device is another important feature, diminishing the danger of over-winding with the high speed used. This plant is complete in detail, being equipped with the most improved auxiliaries. It was built by the Sullivan Machinery Co., Chicago.



A Large Hoisting Engine for the Centennial Copper Company.

Officers Elected by the Road and Track Supply Association.

At a business meeting of the Road and Track Supply Association, held at Niagara Falls, September 14, the following officers were elected for the ensuing year: President, W. E. Clark (Continuous Rail Joint Co.); Vice-President, John McKinnion (Kalamazoo Railway Supply Co.); Secretary and Treasurer, John M. Reynolds (*Railway Age*); members of Executive Committee, Joseph H. Martin (Hussey-Binns Shovel Co.), William Goldie (William Goldie, Jr., Co.), W. F. Schleiter (Dilworth, Porter & Co.), C. W. Reinoehl (Pennsylvania Steel Co.), F. A. Poor (Weber Railway Joint Mfg. Co.), and George Stanton (Cleveland Frog & Crossing Co.).

Floods in Kansas and Missouri.

Despatches from Kansas City, Sept. 18, report floods in the Kaw and other rivers. The Missouri Pacific has lost two bridges near Syracuse, Mo. The Missouri, Kansas & Texas steel bridge, 150 ft. long, near Otterville, Mo., has been carried away, also the Missouri Pacific's 180-ft. bridge over the Lamine river at Otterville. Despatches from Jefferson City report the Missouri Pacific as completely tied up in that region by slides and washouts. Near Ironton, Mo., a passenger train of the Iron Mountain road was wrecked at a washout and three persons were killed.

Powerful Testing Machine at University of Illinois.

The laboratory of applied mechanics of the University of Illinois at Urbana has been installing some new apparatus, among which is a powerful machine for testing the strength of materials. It has a capacity of 600,000 lbs., and is probably the largest machine of this kind possessed by any educational institution. This department of the university does testing for several railroads and for other corporations.

The New President of the Allis-Chalmers Co.

Mr. Walter H. Whiteside, elected President of the Allis-Chalmers Company, does not mean a change in the policy of the company, for Mr. Whiteside has been, during the absence in Europe since April last of his predecessor in office, in full charge of operation. Mr. Whiteside has been with the Allis-Chalmers interests since July, 1904, when he was appointed General Manager of Sales. The company had just taken over The Bullock Electric Company, and Mr. Whiteside had not merely to become familiar with all the intricacies of the company's exceedingly varied products, but the new interests and the old had to be consolidated. The increase in the volume of the company's business and the re-opening of the old South Foundry at Milwaukee testify to his success. Mr. Whiteside is a member of the American Institute of Electrical Engineers and of the Engineers' and other clubs.

Walter H. Whiteside.

Manufacturing and Business.

J. B. Cowen has been appointed sales manager of The General Storage Battery Co., New York.

The Sanborn Company, 1030 Old Colony Building, Chicago, is a new company formed to deal in steam and electric railroad supplies.

Eugene Holcomb has recently been appointed as manager of the Foreign Department of the Allis-Chalmers Company, with headquarters at the general offices, Milwaukee, Wis.

In commemoration of its 50th anniversary, the Crane Company, Chicago, is distributing a memento in the form of an elephant, 50,000 of which are being made by the company.

J. G. White & Co., New York, have secured the services of J. F. Witmer, of Buffalo. Mr. Witmer will take charge of all work in connection with hydraulic engineering matters in foreign fields.

Distinguished recognition has been conferred upon Waddell & Hedrick, Consulting Engineers, Kansas City, Mo., by the Government of the Province of British Columbia for the satisfactory construction and completion of the new Fraser river bridge at New Westminster.

The Pittsburg Steamship Company has ordered from the American Shipbuilding Company, South Chicago, two lake vessels which will have the following dimensions each: Length over all, 600 ft.; keel, 583 ft.; beam, 58 ft.; depth, 32 ft. On a draft of 20 ft. they will carry about 12,000 tons. They will cost $450,000 each, and be delivered next spring.

The Detroit Lubricator Co. and the Detroit Seamless Steel Tubes Co., gave for the Traveling Engineers' Association, which met in Detroit last week, a boat ride from Detroit to the St. Clair Flats with supper on board, returning in the evening. There were about 250 guests.

Archer C. Stites, for many years Western Representative of the Phoenix Bridge Company, Philadelphia, died at Monteagle, Tenn., on August 27th. Mr. Stites was a graduate of Rensselaer Polytechnic Institute of the class of 1887, and was a member of the American Society of Civil Engineers.

The Westinghouse Brake Co., Limited, has secured the exclusive rights, under the Morse Chain patents, to manufacture and sell the Morse Rocker joint silent high-speed chains in Great Britain and on the continent of Europe, and has just completed a new building at York Road for the manufacture of these chains.

The St. Louis Expanded Metal Fireproofing Co., St. Louis, Mo., has issued a notice to the trade warning against the use of certain bars which are infringements of its corrugated bar patents. These patents cover all bars that can be rolled, having ribs or depressions, the sides of which make an angle with a plane at right angles to the axis of the bar less than the angle of friction between the concrete and the metal. The shape of the bar, whether circular, elliptical, square or flat, is immaterial.

The Calumet Supply Co., 411 Dearborn street, Chicago, is a newly incorporated concern which will handle packings, small tools and other railroad and mill supplies. It will also do a general power plant and factory equipment business. Exclusive selling agencies in that market for several makers of steam pumps, feedwater heaters, lubricator pumps and engine room specialties have been secured. J. S. Ward is President and General Manager, and Frank M. Gilmore, Vice-President and Treasurer. Both have been identified with the machinery and supply trade for the past 15 years.

The Sullivan Machinery Company, Chicago, has added two branch offices, one at Knoxville, Tenn., and one at Joplin, Mo. The Knoxville office, in the Houston Building, is in charge of E. L. Thomas, for several years connected with the New York branch. Rock drills, stone channelers and quarrying machinery are carried in stock. S. A. Allison, who has been the representative at Joplin for the past two years, becomes district manager at that point. A stock of Sullivan compressors, rock drills and duplicate parts and supplies is carried at the warehouse at Joplin. The new office is in the Keystone Hotel block, corner of Fourth street and Virginia avenue.

During the past week the control and management of the National Car Wheel Company passed into the hands of James D. Rhodes, of Pittsburg, Pa., and William F. Bonnell, of Cleveland. This company owns and operates four plants, one at Pittsburg, one at Cleveland, one at Sayre, Pa., and one at Rochester, N. Y. Its product is cast iron chilled car wheels, steel tired wheels, grey iron castings and aluminum and brass castings. The works have an annual capacity of 300,000 wheels, and the officers are as follows: James D. Rhodes, President; C. A. Otis, Jr. and William F. Bonnell, Vice-Presidents; George P. Rhodes, Treasurer, and C. A. Maher, Secretary. The Directors are James D. Rhodes, of Pittsburg; George P. Rhodes, of Pittsburg; C. V. Slocum, of Pittsburg; J. C. Holt, Grand Rapids, Mich.; C. A. Otis, Jr., of Cleveland; C. A. Maher, Cleveland; William F. Bonnell, Cleveland; W. T. Goodnow, of Sayre, Pa., and C. T. Chapin, of Rochester, N. Y. C. T. Chapin, the former President of the National Car Wheel Company, remains with the company in a special capacity, with headquarters at Rochester, N. Y.

J. W. Duntley, President of the Chicago Pneumatic Tool Co., recently returned from Europe, bringing news that the Fraserburgh and Berlin factories of the company had been started up and that manufacturing arrangements had been perfected in Russia. All factories are now running with sufficient business to keep them occupied for several months, and the outlook generally is satisfactory. The foreign business promises during the next few years to rival the American business. Recent foreign orders are for several hundred Air-Cooled Duntley electric drills. Among the domestic orders for compressors and tools received recently are the following: Compressor and complete equipment of pneumatic tools for the Western Steel Car & Foundry Company, Hegewisch, Ill.; three compressors each with 750 cu. ft. capacity for the Baltimore & Ohio R. R.; one 2,000-ft. compressor for the Buffalo plant of the American Shipbuilding Co.; one 1,000-ft. compressor for the Huntington shops of the Chesapeake & Ohio R. R.; one 1,200-ft. compressor for the Norfolk & Western R. R.; one 1,225-ft. compressor for the Otis Steel Co., Cleveland, Ohio; one 165-ft. and two 425-ft. compressors for Bartlett & Hayward, Baltimore, Md. A total of 157 Franklin compressors have been sold during the past 90 days, and it appears that the pneumatic tool business promises well for the balance of the year.

Iron and Steel.

The United States Steel Corporation is at present running nearly all of its mills and is planning to have its idle mills go into operation early next month.

Billets and bars are so scarce in the Pittsburg district that independent mills have asked prices from Welsh and German mills on billets and bars to keep the sheet and tin plate mills busy. Recent orders given for rails within four weeks have amounted to 831,000 tons. Only a small percentage of this amount is for 1905 delivery. The New York Central is said to be in the market for 150,000 tons. Orders given were: Pennsylvania, 179,450 tons, divided as follows: United States Steel Corporation, 90,750; Cambria Steel Co., 37,350 tons; Maryland Steel Co., 37,350; Republic Iron & Steel Co., 6,000 tons, and Lackawanna Steel Co., 8,000 tons. Other orders were: Harriman Lines, 107,000; Chicago & North-Western, 70,000 tons; Chicago, Milwaukee & St. Paul, 55,000 tons; Burlington, Atchison and Missouri Pacific, 50,000 tons each; Reading and Atlantic Coast Lines, 15,000 tons each, and other small orders for an additional 30,000 tons. The aggregate is greatly in excess of that of any corresponding period in the past.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

International Railway General Foremen's Association.

This is a new association which was formed in St. Louis the first week in September. It was founded for the mutual education of railroad mechanical foremen, with the object of bettering railroad mechanical service. It is patterned on the lines of the Master Mechanics' Association. Those eligible for membership are superintendents of shops, general foremen, roundhouse foremen, machine shop foremen, and division foremen and their assistants. No member is barred from his privileges as such when promotion or other change comes to him. The association starts out with 230 charter members, of which 222 are active, seven associate and one honorary. The officers are: President, W. H. Graves (C. & A.); First Vice-President, C. A. Swan, Jr. (C. & A.); Second Vice-President E. F. Fay (U. P.); Third Vice-President, L. R. Laizure (Erie); Fourth Vice-President, W. E. Farrell (Big Four); Secretary-Treasurer, E. C. Cook (*Railway Journal*, St. Louis); Chairman Executive Committee, F. W. Rhuark (Frisco). The next annual meeting will be held in St. Louis beginning May 8, 1906, and continuing until all business is transacted.

Railway Signal Association.

The annual meeting of the Railway Signal Association will be held at Niagara Falls, N. Y., October, 10, 11 and 12; headquarters at the International Hotel. There will be three sessions on the 10th, two on the 11th and one on the 12th. A room will be assigned for the display of exhibits, and it can be occupied by any member from 10 a.m. the 10th to 6 p.m. the 12th. At this meeting the Secretary will show samples of designs for a permanent members' badge. The following preliminary list of topics has been issued:

1. The word "Function." This does not appear to be satisfactory, and it is proposed to make an effort to substitute the word "Unit" for "Function."

2. "What is the best method for adjustment of cost of maintenance, operation and inspection of joint interlocking plants?".

3. Committee No. 2, Circuits for manual block signal systems; report and recommendations.

4. Committee No. 5, Organization of Signal Department; an exhaustive report with recommendations.

5. Report of Committee No. 6, "Cost."

6. Committee No. 8, "Standard Specifications." The committee submits a substitute for table "R" as printed in the 1904 Proceedings. Beginning with paragraph 60 the specifications will be considered for final adoption.

7. Committee No. 12, Signal lamps. This committee makes an exhaustive study of the long-time and one-day burners, and their relative visibility. A number of field tests under varied weather conditions are recorded and recommendations are offered.

8. Committee No. 13, Rubber covered insulated wire; preliminary report and recommendations.

9. Dr. Charles H. Williams, of Boston, will present a paper, "Observation on Signal Lenses."

10. Dr. Wm. Churchill, of Corning, N. Y., paper, "The Roundel Problem."

11. Mr. E. L. Adams (L. S. & M. S.) a paper on "The use of storage batteries for all-electric and other signal devices."

12. Dr. N. M. Black, of Milwaukee, Wis., presents his "Second report of comparative tests of roundels from an Ophthalmologist's standpoint."

13. Mr. J. A. Peabody (C. & N.-W.) a paper on "Cost of stopping trains compared with the cost of maintenance, operation and inspection of interlocking plants."

PERSONAL.

—Mr. J. E. Duval has resigned as Accident Inspector of the Dominion Railway Commission of Canada. He has been appointed manager of the recently organized Montreal Car Service Bureau.

—Mr. S. D. McLeish, who was recently appointed Assistant General Passenger Agent of the Cleveland, Cincinnati, Chicago & St. Louis, was born at Evansville, Ind., in 1864. He began his railroad work in 1882 in the Claim department of the Evansville & Terre Haute. He became General Passenger Agent of that road in 1889, and from there he went to the Peoria, Decatur & Evansville.

—Mr. D. Y. Swaty, who has been appointed Assistant Chief Engineer of Maintenance of Way of the Northwest system of the Pennsylvania Lines West, is a graduate of the University of Wisconsin. He began railroad work in August, 1899, as bridge inspector. Later he was draftsman and instrument man in the office of the Chief Engineer of the Pennsylvania Lines West. On January 1, 1903, he was appointed Assistant Chief Engineer of Maintenance of Way on the Southwest system, and on the first of the present month was transferred to his present position on the Northwest system.

—Mr. D. MacPherson, who has been appointed Assistant Chief Engineer to the Commissioners of the (Canadian) Transcontinental Railway, was born at Bath, Ont., in 1858. He graduated from the Royal Military College at Kingston, Ont., in 1880, beginning railroad service, in the same year, as rodman on the Canada Central. From this time to August, 1882, he went through the various grades in a field engineering corps up to engineer in charge of a section of final location and construction. On the latter date, he was appointed Assistant Engineer of the Eastern division, and four years later Division Engineer of Maintenance of Way, which position he held until his present appointment.

—Mr. Frank Lee, who has been appointed Engineer of the Central division of the Canadian Pacific, is a graduate of the Sheffield Scientific School of Yale University in the class of 1894. He entered railroad service that year as rodman and draftsman on the Trinidad Government Railways. From May, 1896, to September, 1901, he was in the Engineering department of the Chicago & North-Western. He was then appointed Assistant Signal Engineer, and in November, 1902, Signal Engineer of the Canadian Pacific. In January, 1904, he was made Assistant Engineer of the Western division, and, in August of the same year, Assistant Engineer of the Western lines, remaining in that office until appointed to his present position.

—Mr. W. P. Appleyard, Superintendent of Equipment of the Pullman Co., was killed in Chicago on the evening of September 19 by an incoming train at the Sixty-third street station of the Illinois Central. Mr. Appleyard was 49 years old and was one of the best known car builders in the country. He has taken a prominent part in the Master Car Builders' Association, being President for 1904-1905, and has served on many important committees. He was a valued member of the committee which supervised the 1903 edition of the Car Builders' Dictionary. He was educated at Notre Dame University at South Bend, Ind., studying engineering and architecture. Two years after graduating, he went into business with his father, who was a contractor and who built the State House at Lansing, Mich. He then followed his profession as an engineer and architect until 1888, when he went to the Pullman Co. as Mechanical Inspector and later as Superintendent of Repairs. He remained with the Pullman Co. until 1893, when he went to the New Haven road. Here he was put in charge of the car shops at Boston with the title of General Foreman of the Car department of the Old Colony system. In 1895 he was promoted to the superintendency of the Car department of the whole road and held that position, with the title of Master Car Builder, until February 1, 1904, when he returned to the Pullman Co., being put in charge of maintenance of equipment at the Pullman, Denver, St. Louis, Wilmington and Buffalo shops, his headquarters being in the Chicago office.

ELECTIONS AND APPOINTMENTS.

Arkansas Western.—W. Coughlin has been appointed General Manager; E. E. Smythe, General Freight Agent, and S. G. Warner, General Passenger Agent of this new road.

Atchison, Topeka & Santa Fe.—James Kurn, trainmaster at Pueblo, Colo., has been appointed Division Superintendent with headquarters at Wellington, Kan., succeeding L. U. Morris, resigned.

Atlanta & West Point.—W. E. Knox, hitherto General Agent of the Alabama Mineral division at Anniston, Ala., has been appointed General Freight Agent of the Atlanta & West Point and the Western of Alabama with office at Montgomery, Ala., succeeding A. R. Smith, recently promoted.

Canadian Pacific.—O. O. Winter, Division Superintendent at Fort William, Ont., has resigned.

Chicago & Alton.—C. A. King, First Assistant General Freight Agent at Chicago, has been appointed General Freight Agent, succeeding Frederick Wann, resigned. R. D. Yoakum, Assistant General Freight Agent at St. Louis, succeeds Mr. King. C. J. Chisam, Assistant General Freight Agent at Peoria, Ill., succeeds Mr. Yoakum. G. W. Quackenbush, Assistant General Freight Agent at Chicago, succeeds Mr. Chisam.

G. L. McDonald has been appointed Signal Engineer with headquarters at Bloomington, Ill.

Chicago Great Western.—H. W. Church, Engineer of the Northwest division, has resigned. E. M. Grime, Division Engineer at Clarion, Iowa, succeeds Mr. Church, with headquarters at St. Paul.

Chicago, Rock Island & Pacific.—M. E. Sebree, Division Superintendent at Dalhart, Tex., has resigned. C. M. Jones succeeds Mr. Sebree.

G. W. Rourke, hitherto Superintendent of the Fort Worth & Denver City, has been appointed Superintendent of Terminals at Kansas City.

J. M. Brown, Division Engineer at Cedar Rapids, Iowa, has been appointed Engineer of the Central district, with office at Davenport, Iowa. G. Davis, Principal Assistant Engineer, with office at Cedar Rapids, has been appointed Engineer of the Northern district, remaining at his former headquarters.

Columbia Southern.—W. W. Cotton has been appointed General Attorney; M. J. Buckley, General Superintendent; J. F. Graham, Superintendent of Motive Power; G. W. Boschke, Chief Engineer; R. Koehler, General Purchasing Agent; R. B. Miller, General Freight Agent, and A. L. Craig, General Passenger Agent of this new road.

Evansville & Terre Haute.—J. O. Crockett, formerly General Superintendent of the Southwestern district of the Chicago, Rock Island & Pacific, has been appointed Superintendent of the Evansville & Terre Haute, the Evansville & Indianapolis and the Evansville Belt, succeeding J. S. Douglas, resigned. The position of Chief Engineer has been abolished and maintenance of way matters will be handled by the Superintendent.

Guthrie, Fairview & Western.—George Cowies has been appointed Chief Engineer, and William C. McKee, Superintendent of Bridges and Buildings of this new road.

Mexican Central.—E. R. Walter has been appointed Superintendent of the Coahuila & Pacific division. Mr. Walter was General Superintendent of the Coahuila & Pacific before its acquisition by the Mexican Central.

Mexican National Construction.—The former Board of Directors and officers have resigned, and the following elections have been made: A. A. Robinson, President; H. R. Nickerson, Vice-President; C. A. Browne, Treasurer and Transfer Agent; James Piper, Secretary; and Frank M. Souther, Registrar.

Midland Valley.—J. F. Elder, General Manager, has been appointed Traffic Manager, and the position of General Manager has been abolished. John H. Harris has been appointed General Superintendent in charge of operation and maintenance.

Missouri Pacific.—H. K. Mudd, General Foreman of the Wabash at St. Louis, Mo., has been appointed District Master Mechanic, with headquarters at Little Rock, Ark.

J. H. Abrams, Superintendent of Terminals at Little Rock, Ark., has resigned.

Oregon Short Line.—The jurisdiction of T. M. Schumacher, Traffic Manager, has been extended over the lines of the Southern Pacific east of and including Sparks, Nev., and the lines of the Nevada & California.

Panhandle & Gulf.—Nicholas J. O'Brien has been appointed General Manager with headquarters at Sweetwater, Tex. This road is part of the Kansas City, Mexico & Orient and has just been opened.

Paris & Great Northern.—E. W. Dickson has been appointed General Superintendent, succeeding C. Griffith, transferred.

St. Louis Southwestern of Texas.—J. W. Flanagan, General Passenger Agent, has resigned. J. H. Lehane, General Freight Agent, will resume his former title of General Freight & Passenger Agent.

Savannah & Statesboro.—See Seaboard Air Line, below.

Seaboard Air Line.—H. B. Grimshaw, hitherto Superintendent of the Savannah & Statesboro, has been appointed Superintendent of the Fifth division, succeeding Walter Hale, transferred.

Southern Pacific.—T. H. Goodman, General Passenger Agent, has resigned, effective September 30, having been in poor health for some time.

LOCOMOTIVE BUILDING.

The Southern, it is reported, has placed orders for 90 additional locomotives.

The Chicago, Milwaukee & St. Paul is building 10 freight locomotives at its Milwaukee shops.

The Central New England has ordered 15 locomotives from the American Locomotive Company.

The Philadelphia & Reading, it is reported, will soon build ten freight locomotives at its own shops.

The Duluth & Iron Range, and the *Duluth, Missabe & Northern* are reported in the market for locomotives.

The Spokane & Inland is reported to have ordered six electric locomotives from the Westinghouse Electric Company.

The Canadian Pacific denies that it will shortly be in the market for locomotives, as reported in our issue of September 15. It expects to order a number of locomotives for 1906 delivery, but as yet serious consideration has not been given to the matter.

The Isthmian Canal Commission, as reported in our issue of Sept. 1, opened bids Sept. 19 on 120 mogul locomotives. One hundred of these are for June, 1906, delivery. These weigh 128,000 lbs., with 100,000 lbs. on drivers; cylinders, 19 in. x 24 in.; diameter of drivers, 54 in.; extended wagon top boiler; working steam pressure, 180 lbs.; tubes, 2 in. in diameter and 11 ft. long; firebox, 98 in. x 34 in.; tank capacity, 4,000 gallons; coal capacity, six tons. The remaining 20 engines are for March, 1906, delivery, and these each weigh about 140,000 lbs., with 120,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 63 in.; extended wagon top boilers; working steam pressure, 180 lbs.; tubes, 2 in. in diameter by 12 ft. 3 in. long; firebox, 108 in. by 40 in.; tank capacity, 4,000 gallons; coal capacity, six tons.

The Union Pacific and the Southern Pacific, as reported in our issue of August 25, have ordered 72 simple consolidation (2-8-0) locomotives, 23 simple Atlantic (4-4-2) locomotives, 10 simple Pacific (4-6-2) locomotives, and 35 simple switching (0-6-0) locomotives from the Baldwin Locomotive Works, delivery beginning in November. The consolidation locomotives will weigh 208,000 lbs., with 187,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 3,403 sq. ft.; 413 tubes, 2 in. in diameter and 15 ft. long; firebox, 108 in. x 66 in.; grate area, 49.5 sq. ft.; tank capacity, 7,000 gallons; coal capacity, 14 tons, and oil capacity, 2,940 gallons. The Atlantic type locomotives will weigh 196,000 lbs., with 105,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 81 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 2,649 sq. ft.; 297 tubes, 2 in. in diameter and 16 ft. long; firebox, 108 in. x 66 in.; grate area, 49.5 sq. ft.; tank capacity, 9,000 gallons; coal capacity, 10 tons, and oil capacity, 2,835 gallons. The Pacific type locomotives will weigh 222,000 lbs., with 141,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 77 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 3,048 sq. ft.; 245 tubes, 2¼ in. in diameter and 20 ft. long; firebox, 108 in. x 66 in.; grate area, 49.5 sq. ft.; tank capacity, 9,000 gallons; coal capacity, 10 tons, and oil capacity, 2,835 gallons. The switching locomotives will weigh 140,000 lbs.; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in.; straight boiler, with a working steam pressure of 175 lbs.; heating surface, 1,557 sq. ft.; 237 tubes, 2 in. in diameter and 11 ft. 6 in. long; firebox, 108 in. x 40¼ in.; grate area, 30.2 sq. ft.; tank capacity, 4,000 gallons; coal capacity, six tons, and oil capacity, 1,020 gallons. The special equipment for all will include: Gollmar bell ringers, Damascus brake-beams, Sargent Diamond "S" brake-shoes, Climax couplers, Handlan-Buck headlights, Monitor injectors, U. S. piston and valve rod packings, Crosby safety valves, Maryland sanding devices, Nathan sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Consolidated steam heat equipment for Atlantic and Pacific type locomotives, Standard driving, truck and tender wheel tires and cast-steel wheel centers.

CAR BUILDING.

The Seaboard Air Line is reported in the market for 15 passenger cars.

The Mexican International, it is reported, will build 175 cars at its own shops.

The Chicago Electric Traction Company is in the market for ten double truck cars.

The Evansville & Mt. Vernon Traction Company, it is reported, is in the market for cars.

O'Gara, King & Company, Chicago, are considering the purchase of 500 or more coal cars.

The Chicago, Burlington & Quincy has ordered two dining cars from the Pullman Company.

The South Side Elevated, Chicago, has ordered 30 cars from the American Car & Foundry Company.

The Toledo, Ann Arbor & Detroit has ordered 10 cars from the Niles Car & Manufacturing Company.

The Erie has ordered 1,000 steel hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Duluth & Iron Range and the *Duluth, Missabe & Northern* are in the market for 1,500 freight cars.

The Central of Georgia has ordered 50 ballast cars from the Rodger Ballast Car Co. for October delivery.

The Kansas City Southern has ordered 100 stock cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Philadelphia & Reading, it is reported, has ordered 1,000 cars of 100,000 lbs. capacity from the Standard Steel Car Co.

The New York, New Haven & Hartford is having two all-steel mail and express cars built by the Standard Steel Car Co.

The Chicago & Alton is in the market for four baggage, three passenger and baggage, and three passenger and mail cars.

The Chicago, Lake Shore & Eastern is in the market for 1,000 gondola and box cars of 100,000 lbs. capacity with steel underframes.

The Salem, Falls City & Western has purchased three 41-ft. second-hand flat cars of 60,000 lbs. capacity from the Interstate Car Co., of Indianapolis, Ind.

The Central of New Jersey, as reported in our issue of September 1, has ordered 50 all-steel ore cars of 80,000 lbs. capacity from the Pressed Steel Car Co.

The Erie, as reported in our issue of August 25, is reported to have ordered 500 box cars from Barney & Smith, and 1,500 box cars from the Standard Steel Car Co.

The Southern has ordered three steel passenger cars from the Pressed Steel Car Company, and is reported as being in the market for 10 mail baggage and express cars.

The Kansas City Southern, as reported in our issue of Sept. 8, has ordered five chair cars and two combination passenger and mail cars from the American Car & Foundry Company.

The Chicago, Burlington & Quincy is asking bids on 2,000 box cars of 80,000 lbs. capacity. These box cars will be 40 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements.

The Philadelphia Rapid Transit Company has ordered 40 steel passenger cars from the Pressed Steel Car Co. The cars will be built at the company's new passenger car department at Pittsburg.

The Southern Pacific, as reported in our issue of September 15, has ordered 15 passenger cars from the Pullman Co. The order consists of four baggage cars, four observation cars and seven dining cars.

The Peet Brothers Manufacturing Company, Kansas City, has ordered eight steel tank cars of 80,000 lbs. capacity, and three steel tank cars of 100,000 lbs. capacity from the Bettendorf Axle Company.

The Grand Trunk has ordered 17 standard first class coaches and eight standard smoking cars from the Canada Car Company, and is building three standard café parlor cars and four standard baggage cars at its Montreal shops.

The Southern, as reported in our issue of Sept. 1, has ordered 750 flat and 750 gondola cars of 100,000 lbs. capacity from the American Car & Foundry Company, and 300 Hart convertible cars and six distributing cars from the Rodger Ballast Car Company.

The Granite City, Alton & Eastern has ordered 25 all-steel tank cars of 7,500 gallons capacity from the Bettendorf Axle Co. for January, 1906, delivery. The inside dimensions of the tanks are 27 ft. long x 84 in. in diameter. The cars will have steel underframes and the special equipment includes: Bettendorf axles and bolsters, Monarch brake-beams, Walsh's brake-shoes, Westinghouse brakes, Ajax plastic bronze brasses, Tower couplers, Cardwell draft rigging, Harrison dust guards, Bettendorf boxes, Union Spring & Manufacturing Co.'s springs and Bettendorf trucks. It was previously reported in our issue of September 1 that the St. Louis Syrup & Preserving Co., Granite City, Ill., were in the market for the above cars.

The Duluth, South Shore & Atlantic has ordered 200 box cars of 60,000 lbs. capacity, as reported in our issue of Sept. 15, and 100 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co., for November delivery. The box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The flat cars will be 40 ft. long and 8 ft. 9 in. wide, over all. The special equipment for both will include: Common Sense bolsters, Chicago Railway Equipment Co.'s brake-beams, Congdon brake-shoes, Westinghouse automatic air-brakes, Fulton Brass Manufacturing Co.'s brasses, Trojan couplers, Gould draft rigging, Harrison dust guards, Symington journal boxes, Chicago metal roofs, Railway Steel Spring Co.'s springs, Diamond trucks, and American Car & Foundry Co.'s wheels.

The Central of Georgia, as reported in our issue of September 15, has ordered 500 steel hopper coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for February, 1906, delivery; 450 ventilated box cars of 60,000 lbs. capacity from the South Atlantic Car & Manufacturing Co., for delivery within 90 days, and 400 flat cars of 60,000 lbs. capacity from the Pullman Co., for January, 1906, delivery. The coal cars will be 30 ft. long and 9 ft. 6 in. wide, inside measurements. The box cars will weigh about 35,000 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The flat cars will be 40 ft. long and 9 ft. wide, over all. The special equipment for all will include: Simplex bolsters and brake-beams, Lappin or Herron brake-shoes, Westinghouse air-brakes, Ajax brasses, Tower couplers, Dunham door fastenings for coal cars and Jones door fastenings for box cars, Miner tandem draft rigging for coal and flat cars, Butler tandem draft rigging and Symington dust guards for box cars, McCord journal boxes for coal and flat cars, Symington journal boxes for box cars, Sherwin-Williams or Lowe Bros.' paint for box and flat cars, Murphy improved Winslow roofs for box cars, Railway Steel Spring Co.'s springs, arch-bar trucks and M. C. B. cast-iron wheels.

BRIDGE BUILDING.

Aurora, Ill.—Plans are being made by M. J. Tarbell, Engineer, for two concrete steel bridges to cost about $50,000.

Beaufort, N. C.—A contract has been given to the General Construction & Engineering Co., of New York, for building the substructure and the superstructure of a trestle bridge with two steel draws 8,500 ft. long for the Atlantic & North Carolina Railroad at a cost of $200,000 over the Newport river connecting Beaufort with Morehead City, N. C.

Bloomfield, Ind.—The Indianapolis Southern on its new Indianapolis line near this place will build a viaduct 2,800 ft. long and (at the highest point) 175 ft. high.

Chattanooga, Tenn.—Plans are being made for a bridge to be built over the Belt Line tracks at Eleventh street, for which an appropriation of $12,000 has been made.

Cincinnati, Ohio.—Three ordinances have been passed by the City Council looking to the abolition of all grade crossings within the city limits by the building of viaducts or subways. On the Cincinnati, Hamilton & Dayton there are 35; on the Baltimore & Ohio 18, and on the Big Four 11.

Findlay, Ohio.—Hancock County Commissioners have under consideration the question of building a steel bridge at Mt. Blanchard to cost about $10,000. J. O. Sutton is County Engineer.

London, Ont.—The Southwestern Traction Co. will build a steel bridge east of Richmond street at a cost of about $18,000.

Manitowoc, Wis.—The present bridge over the river at Tenth street will be repaired at a cost of $15,000 or a new structure will be built at a cost of $60,000.

Ottawa, Ont.—The Dominion Minister of Public Works has directed the Chief Engineer of the department to report on the cost of building a tunnel under Northumberland straits to connect Prince Edward Island and New Brunswick.

Pierre, S. Dak.—Work will soon be commenced, it is said, on a new bridge over the Missouri River at this place by the Chicago & North-Western.

Purcell, Ind. T.—Plans have been made and funds have been subscribed to build a bridge between this place and Lexington, at a cost of $30,000. J. W. Hooker, is interested.

Racine, Wis.—The City Council is having plans made for building a bridge over Root river 240 ft. long, with a double draw at the foot of Main street.

Redbluff, Cal.—The Board of Supervisors has under consideration the question of building a bridge over the Sacramento river at Tehama to cost about $50,000.

Rensselaer, Ind.—The Board of Commissioners of Jasper County will receive bids October 2 for building a steel bridge 40 ft. long with a 16-ft. roadway in Jordan township. James M. Leatherman is County Auditor.

Richmond, Ind.—The Pennsylvania has agreed to pay 60 per cent. of the cost of building a viaduct in West Richmond so that a new city street may pass beneath its tracks. The city is to pay the remainder.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

CANADIAN PACIFIC.—This company has given several additional contracts for double tracking its road between Winnipeg and Fort William. Foley Brothers & Larsen have the contract to pierce a 400-ft. tunnel through solid rock; Fred Peterson & Co. have been given a contract for building the line from Ostersund to Busteed, and Hoagland & Sharpe have the contract to change the line at Eagle River for a distance of four miles.

CHICAGO & ALTON.—Announcement has been made that this company has bought the Peoria & Pekin Terminal Railway, which operates 10 miles of railroad from Peoria, Ill., south to Pekin, and 1.5 miles from the latter place to Crescent; also leases the Peoria Terminal Railroad from Iowa Junction to Eaton street, Peoria, nine miles; has trackage rights over the Central Railroad of Peoria from the city limits to the center of the city of Peoria, five miles, giving a total of 25.5 miles, of which nine miles are double track. The road uses steam locomotives for freight and through passenger service, the Chicago & Alton and other roads entering Peoria over its tracks, and also has considerable electrical equipment which is used for local passenger traffic. This purchase gives the Alton valuable terminals at Peoria. The Alton will, it is said, build a line from Washington, Ill., southwest to Grove, where connection will be made with its southern line, a distance of about 15 miles.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Bids are wanted September 28 for grade reduction work on the St. Louis division of this road from Carbon, Ill., east to Coal Bluff, a distance of about five miles. The work includes the excavation of 500,000 cu. yds. of earth. W. M. Duane is Superintendent of Construction, Cincinnati, Ohio.

CORDOVA & HUATUSCO.—Grading work on this road has been in progress for some time. It is a narrow-gage line that extends north from Cordova, State of Vera Cruz, through the coffee-growing district of the State. It will be about 75 miles long. One of the bridges which is being built over an arroyo on this road will be 213 ft. above high-water mark. This bridge will be 408 ft. long.

DENVER, KANSAS & GULF RAILWAY.—An officer writes that this road, which was recently incorporated in Kansas, will build about 300 miles of main line with branches in that state, connecting with the Denver, Enid & Gulf. (August 25, p. 62.)

DENVER, NORTHWESTERN & PACIFIC.—This company has recently opened its extension to Hot Sulphur Springs, in Grand County, Colo. (See Construction Record.)

DULUTH, SOUTH SHORE & ATLANTIC.—This company is planning to extend its Mineral Range line northeast to Keweenaw Point, a distance of about 30 miles.

GALVESTON, HARRISBURG & SAN ANTONIO (S. P.).—An officer writes confirming the report that a contract has been let to W. O. Robertson, of San Antonio, Tex., for building the proposed extension from Stockdale, in Wilson County, Tex., southeast through Smiley, in Gonzales County, to Cuero, in De Witt County, a distance of 47 miles. Grading has been commenced. The maximum grades will be 1 per cent., and maximum curves 4 degrees; there will be two steel bridges, one of 150 ft. and the other of 190 ft. (See Southern Pacific, September 15, p. 88.)

GALVESTON TERMINAL COMPANY.—Under this name a company has been organized in Texas to build a terminal railroad for the St. Louis & San Francisco in Galveston, from the eastern shore of Galveston Bay over the island to the western limits of the city. The incorporators include: S. Lazarus, of St. Louis, Mo.; M. Marx, B. Adone, I. H. Kempner, Abe Blum, E. R. Chessbrough, R. Markwell, John Sealy, Charles Fowler and Leon Blum, all of Galveston.

GULF, SANTA FE & NORTHWESTERN.—This company has been organized in Texas with a capital of $475,000, as a part of the Santa Fe system, to build a railroad from Brownwood to Texico, a distance of 350 miles, and a branch from Lubbock County to Canyon, Tex., 125 miles. The board of directors include: E. P. Ripley, of Chicago, President of the Atchison, Topeka & Santa Fe; J. E. Hurley, of Topeka, Kan., General Manager of the same road; and Avery Turner, D. A. Sweet, J. C. Paul and others, of Amarillo, Tex.

JOHNSON CITY SOUTHERN (SOUTHERN).—A contract has been given by this company to W. J. Oliver, of Knoxville, Tenn., to build its road. The proposed route is from Marion, N. C., to Johnson City, a distance of about 80 miles. The work will be heavy, as the road passes through the Blueridge Mountains. It will reach valuable coal fields in Virginia. (June 30, p. 215.)

JONESBORO, LAKE CITY & EASTERN.—This company, operating 55 miles of road in Arkansas, has filed an amendment to its charter increasing its capital from $225,000 to $525,000. The increase is made for the purpose of building a branch line from Dell, Mississippi County, Ark., south through Luxora and Osceola, a distance of 20 miles, at an estimated cost of $300,000.

MIDLAND VALLEY.—Train service has been opened on this road from Skiatook, Ind. T., northwest to Pawhuska, 34 miles, completing the line from Fort Smith, Ark., to Pawhuska. The road will eventually be continued northwest to Arkansas City, Kan., 62 miles from Pawhuska.

MISSOURI PACIFIC.—See St. Louis, Iron Mountain & Southern below.

MOBILE, JACKSON & KANSAS CITY.—On September 5, this road was opened from Newton, Miss., north to Middletown, Tenn., completing a through line from Mobile to Middletown, a distance of 367 miles. The construction work was completed at the Pearl river bridge, in Neshoba County, a structure 1,237 ft. long with approaches from the north by two trestles of 947 and 960 ft. each. The road will eventually be extended north to Jackson, Tenn., 41 miles beyond Middletown.

NEW YORK, NEW HAVEN & HARTFORD.—Plans are being made by this company for a tunnel 4,700 ft. long at Pequabuck in Litchfield County, Connecticut, on the Highland division which will cost approximately $1,000,000.

OKLAHOMA & TEXAS.—Arrangements have been made by this company to secure money, and contracts for building the road, it is said, will be let by the first of next month. The proposed route is from Oklahoma City, Okla. T., to Wichita Falls, Tex., a distance of approximately 200 miles. (April 7, p. 110.)

PENNSYLVANIA.—An ordinance will be introduced in the Philadelphia City Council to grant the Pennsylvania Railroad a right of way for a low-grade freight line within the city limits. The proposed route starts at the intersection of 56th street and the main line, and runs west under 62d street and Lancaster avenue, paralleling Malvern avenue; thence under 63d street, Gross street, 64th street and 66th street to a point west of the east-bound thoroughfare. Thence it will curve to the north, passing over 68th and 69th streets; thence southward, crossing over 73d and under Haverford avenue, Westminster street, Vine street, over Race, Arch and Ashhurst streets to the city line at Cobb's Creek, between Coleman avenue and Woodbine street. The ordinance provides that no street shall be crossed at grade, and that a tunnel shall be built from Lancaster avenue to Gross street. Work will be commenced by the railroad as soon as Councils approve the ordinance.

PHILADELPHIA & READING.—This company has prepared plans to make a tunnel through Brood Mountain near Pottsville, Pa., and surveys are being made. The project has been under consideration for a number of years. The tunnel, if built, will be eight miles long and cost about $7,000,000.

Work has been begun by this company on the subway to be built under the tracks at Rutherford station and one between Rutherford and Boyd stations. The company is gradually abolishing grade crossings and building subways on its line entering Harrisburg, Pa. Work will be commenced shortly by the Central Pennsylvania Traction Co. on a subway to pass under the Reading tracks at Paxtang avenue, Paxtang, and work is now in progress building a subway under the Reading tracks near Beaver station.

PUYALLUP VALLEY TRACTION.—An officer writes that contracts will be let about October 1 for the grading and bridge work on its proposed road from Tacoma, Wash., east to Puyallup, a distance of 9 miles. The character of the work will be light, as there are no cuts and only a few slight fills. The maximum grade in Tacoma will be 7½ per cent., and on the balance of the road, .2 per cent. In both cities there will be curves of 50-ft. radius, but outside of the city, 8 degrees will be the sharpest. The total curvature between the two cities will be 88 degrees. There will be three bridges of 120, 220 and 240 ft., respectively, and about 1,550 ft. of trestle at bridge approaches. Fred J. Chamberlain, of Puyallup, is President, and L. A. Nicholson, Chief Engineer, Tacoma, Wash.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN (M. P.).—This company has completed five miles of its northwestern-southern cut-off from Guerdon to Greenwood, Ark. The present contract provides only for an extension to a point 40 miles north of Guerdon, but the road will eventually be extended. A contract will shortly be let for extending the line northwest to Greenwood, where the branch to Fort Smith is already in operation.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—A contract has been given by this company to the Utah Construction Co. for building the first 120 miles of its proposed road from Des Moines, N. Mex., on the Colorado & Southern, to the Elizabethtown and Baldy mining districts. The new road will furnish an outlet to Texas and the east for the company's coal mines in the Raton district, and also open up a coal mining region at the eastern base of the Rocky Mountains. The maximum grades will be 1 per cent., and the maximum curves 8 degrees, except in the Cimarron Canyon, where higher grades and sharper grades will be necessary. A contract has already been given to the Colorado Fuel & Iron Co. for rails, and it is ex-

pected ot have the road in operation to Moreno Valley next year Henry Koehler, Jr., of St. Louis, Mo., is president. (July 21, p. 23.)

San Saba & Colorado Valley.—An officer writes that surveys are being made by this company for building its proposed railroad from Lometa, Tex., on the Gulf, Colorado & Santa Fe, west to San Saba, a distance of 22 miles. There will be one steel bridge over the Colorado river about 150 ft. long. The company will use steam locomotives for freight trains and gasolene motor cars for passengers. Orton G. Campbell, of Dallas, Tex., is interested.

South & Western.—The Supreme Court of Virginia has just handed down a decision sustaining the charter of this company, and it is said that the company will now begin building its proposed line through Guest River Valley from Clinchport, Va., to Toms Creek, 15 miles, penetrating rich coal fields. (April 7, p. 111.)

Active work has been started in the digging of the tunnel through Clinch Mountain near Speer's Ferry, Va., by this company. The contractors, Messrs. Walton of Knoxville, have bound themselves to complete the work within 18 months.

Southern.—See Johnson City Southern above.

This company is making surveys to locate a line around Lynchburg, Va. The new line will be used by freight trains to avoid entering the city over the heavy grades. Two routes are being surveyed, one above and one below the city, and it is said that construction work will be begun soon.

Southern Pacific.—See Galveston, Harrisburg & San Antonio above.

Wichita Valley.—A contract, it is said, has been given by this company to build about 60 miles of its proposed extension from Seymour in Baylor County, Texas.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—The New York Stock Exchange has listed $2,000,000 additional Pittsburg, Lake Erie & West Virginia system refunding mortgage 4 per cent. bonds of 1941, making the total amount listed to date, $31,347,000. Of these $2,000,000 bonds, $1,623,000 were issued to retire underlying bonds and the remaking the total amount listed, $37,350,000.

Central of New England.—The annual report for the year ending June 30, shows a deficit of $86,491, an increase of $67,268, as compared with the previous year. The gross earnings were $973,422, an increase of $125,671 over last year; but there was a great increase in operating expenses.

Chicago & Alton.—The New York Stock Exchange has been asked to list $5,362,000 additional 3 per cent. 50-year bonds of 1929, making the total amount listed, $37,350,000.

Chicago Terminal Transfer.—The annual report for the year ended June 30 shows a deficit of $169,045, a decrease of $32,896, as compared with the preceding year. The gross earnings were $872,524, and other income, $667,589. Expenses were $963,859, and taxes and interest, $745,300, bringing the total expenses up to $1,709,159. The total capital stock of the company is $30,000,000, and the funded debt is $16,239,000.

Kansas City, Mexico & Orient.—This road will receive the second instalment of subsidy from the Mexican Government, amounting to $1,200,000 Mexican money, as soon as the Mountain division from Minaca southwest toward El Fuerte is completed, which, it is estimated, will be in from 60 to 90 days.

Lake Shore Electric.—The receiver of this road has reported to the court that the entire debt of the company has been paid, and that a large amount more has been earned; therefore, he advises that the receivership should cease.

Nashville, Chattanooga & St. Louis.—The annual report for the year ending June 30, shows net earnings of $2,579,337. The gross earnings were $10,113,056; operating expenses, $7,552,650, and other income, $18,930. Interest, taxes, etc., were $1,836,612, leaving a net income of $742,725. The bonded debt is $16,008,000. Two semi-annual dividends of 2½ per cent. each were declared on the $10,000,000 capital stock. The total length of the company's lines is 1,226 miles.

National of Mexico.—This company has arranged to extend its 5 per cent. gold notes of October 1, 1905, for two years at the rate of 5 per cent. per annum, subject to redemption, on any interest date, on 60 days' notice.

New York, New Haven & Hartford.—This company has formally absorbed the following roads, which it has for several years controlled and operated: The New England, stock, $25,000,000; New Haven & Derby, stock, $447,000; bonds, $575,000; Danbury & Norwalk, stock, $600,000; bonds, $650,000; Middletown, Meriden & Waterbury; Rockville Railway Co.; Rhode Island & Massachusetts; Providence & Springfield, stock, $517,000; and the Providence & Pascoag.

Northern Texas Traction (Electric).—A controlling interest in this road has been sold by the Bishop-Sherwin syndicate, of Cleveland, Ohio, to Stone & Webster, of Boston, at a price said to be $45 a share. The road has 30 miles of track between Dallas, Tex., and Fort Worth, and 37½ miles in Dallas and Fort Worth. The capital stock is $2,500,000.

Portland & Rumford Falls.—The gross earnings of this company for the year ending June 30, were $658,663, an increase of $75,264. Operating expenses were $377,953, an increase of $68,608. The total income was $345,164, an increase of $36,005, against which there were fixed charges of $93,492, leaving a net income of $251,672, from which, after the deduction of $141,666 for sinking fund and dividends, there is left a surplus of $110,006.

Toledo & Ohio Central.—The annual report for the year ended June 30, shows gross earnings of $3,766,651, an increase of $167,967 over the preceding year. Expenses and taxes were $2,927,809, an increase of $125,588, making net earnings $838,842, an increase of $42,379. Charges, less other income, leave a surplus of $430,373, a decrease of $927.

Toledo, Peoria & Western.—The annual report for the year ending June 30, shows a deficit of $32,872. In the preceding year the road showed a surplus of $1,547. The gross earnings were $1,281,443, a decrease of $27,273 over last year, and the operating expenses and taxes, $1,077,041, an increase of $1,027, making net earnings of $204,402, a decrease of $28,294, against which there were charges of $273,274, an increase of $6,125. The cost of road and equipment is given as $9,427,685, and total assets as $10,063,085; liabilities, capital stock, $4,076,900, and funded debt, $4,895,000. The controlling interest in the capital stock of this company is held jointly by the Pennsylvania and the St. Louis, Keokuk & Northwestern.

Wabash.—President Ramsey's advertisement to stockholders and holders of debenture bonds which is referred to in our editorial columns this week, is as follows: "During my service of 10 years to you, as General Manager, Vice-President and President of your company, the lines of your railroad have been extended to the cities of Omaha and Des Moines on the west and to Buffalo and Pittsburg on the east, over its own and its leased and controlled lines; the tracks have been relaid with heavy rails; many miles of wooden trestles have been filled in with solid embankments or replaced with iron bridges; over 70 miles of double main track have been built; nearly the whole of the old and obsolete motive power and equipment replaced with the best modern types, and more than doubled in power and capacity for handling traffic; and your properties brought to a high standard as operative railroads. Of the cost of this work at least 12 millions of dollars was paid out of net earnings. I think I may fairly claim that all of the improvements and extensions mentioned, have been made by or carried out at my suggestions, or by my initiative. During the period named above, the gross earnings of your properties have increased from eleven millions five hundred and fifty thousand dollars to twenty-five millions of dollars per annum. Under this statement of the results of my administration, I feel that I am entitled to ask you to honor me with your proxies, for use at the annual election of directors, to be held on October 10th next.

"I realize fully the responsibility assumed by me in making this request; and should you honor me with your confidence, I shall use the power you confide in me, in an endeavor to elect such directors, as will fully recognize the obligations assumed by them, as representatives of all the owners of your properties. I question if anyone is better acquainted with the Wabash Railroad, its capabilities and its possibilities, than myself, after my long connection with its management; and I do not hesitate to say, that with prudent, conscientious and impartial operation, there should be at an early date some pecuniary return to its owners.

"Having been denied access to the stock books of the company I take this method of reaching you; and therefore ask you for your proxies in my name as above described with full power of substitution, and with a revocation of any proxies heretofore given by you; or, I will forward blank proxies to you in proper form on receipt of your addresses. My address for the above purposes will be at the Holland House, New York City, New York."

Western Maryland.—The shareholders will vote on October 18 on the formal merging, by the purchase of franchises and properties, of the Western Maryland Tidewater, the Potomac Valley, the Potomac Valley of West Virginia, the Piedmont & Cumberland, the Piedmont & Cumberland of West Virginia, the West Virginia Central & Pittsburg, the West Virginia Central & Pittsburg in Maryland, the Belington & Beaver Creek and the Coal & Iron railroads. All these roads are already controlled by the Western Maryland.

Western Pacific.—See review of the Denver & Rio Grande annual report on the Editorial page.

GENERAL NEWS SECTION

NOTES.

The Grand Trunk has joined the Central Passenger Mileage Bureau.

The forces at the shops of the Pennsylvania Railroad have this month been increased about 20 per cent.

The Southern Railway has put the block system in effect on the line between Knoxville and Chattanooga, 111 miles. Fifty-four additional operators have been employed.

The business of the 18-hour Pennsylvania Special, between New York and Chicago, is so good that the company has put on a fourth car. Over those portions of the line where a dining-car is run this makes a five-car train.

The Enterprise Transportation Co., running steamboats between New York and Fall River, has bought from the Eastern Steamship Co. the freight and passenger steamer "Kennebec" and the new vessel will run regularly after September 21, alternating with the "Frank Jones."

Indiana papers report that the question of the legality of free passes and of the right of the State Railroad Commission to require reports of passes is to be tested in that state by a suit in the courts, which is to be prosecuted by the Pennsylvania Company, acting in behalf of itself and the other roads.

The Consolidated (electric) Railway Co., of Connecticut, repeating the action of last year, has set aside two funds of $500 each to be divided among the conductors and motormen at the end of the year, according to their records, the intention being to give premiums to all those having clear records; or, if there are none whose records are clear, to those standing highest in the scale.

A New Kind of "Cheek."

The English police recently had to deal with a beneficiary of unlawful discrimination. John Henry Richardson, a clerk out of work, for some time past has traveled about England without paying fares. Posing as a locomotive inspector, he would board an engine, issue directions to the driver, direct his operations, and in general comport himself with the semblance of real authority. The drivers, apparently, made no demands as to his credentials, for Richardson was wise, kind and authoritative. He proceeded unmolested on his footplate career over the North-Western system. On the strength of his bogus inspectorship, he borrowed money from stationmasters and barmaids, a gold watch and silk handkerchief were entrusted to him by a young lady of Manchester, and from a locomotive foreman he accepted the loan of a mackintosh, which he afterwards pawned for half a sovereign.

Disastrous Collision at Paoli.

In a rear collision of eastbound passenger trains at Paoli, Pa., on the main line of the Pennsylvania Railroad, 19 miles west of Philadelphia, last Monday afternoon, four employees of the mechanical department of the road, and a guest, five in all, were killed and 13 persons were injured, most of them passengers. The killed were in the general manager's private car, which had just been attached to the rear of a local passenger train for a short trial trip. This train, standing at the station on track No. 1, preparatory to beginning its trip, was run into at the rear by an express train. It is said that the express was running at moderate speed; but the private car was crushed for 10 ft. at its rear end, and it was forced half way through the day car ahead of it, which was empty. The express had run through a cross-over track from track No. 2 to track No. 1. Only a short distance back, in the same yard, the express had crossed from track No. 1 to track No. 2, and appears to have over-run the signal of the second cross-over, set at stop to protect the local train while it was crossing from track No. 4 to track No. 1. Engineman Broomall, of the express, is mentioned in the newspaper reports as "a new man at the throttle."

A British Railway's Strange Predicament.

The serious decline of late years in the dividends of the North London Railway has started an influential body of its stockholders agitating for the absorption of the North London Railway by the London & North Western, or, alternatively, that the North London should be leased at a fixed rental. Formerly the North London paid a regular 7½ per cent. dividend, and the ordinary stock ranged in price from 200 to 230. Now, by drawing upon reserve, it is only possible to pay a 5 per cent. dividend, while the ordinary stock is quoted at about 120. This serious decline is attributed to electric railway and tramway competition. At the recent half-yearly meeting, the chairman said it was practically impossible for North London to attempt to meet this competition by the electrification of its lines, until electric traction was first introduced on the suburban lines of the London & North Western and other companies. Thus the North London is in a peculiarly unfortunate position. Both the cause of its misfortunes and the remedy are officially admitted, but nothing can be done until other railroads permit its directors to do so. Thus, failing electrification, the suggestion of the private stockholders that the North Western should take over the line, seems the only alternative remedy to what is to them a really serious state of affairs. Of course, to the North Western, which owns £1,328,730 North London ordinary stock out of a total of £2,034,400, a local line such as the North London Railway is useful in other ways than as mere dividend earner; but this is not the case with the private stockholders. Of the ten directors of the North London, six, including the chairman, are nominees of the North Western.

Rolling-Lift Bridges.

It is interesting to note the amount of substitution of rolling-lift bridges for swing bridges, due to the fact that for an increase in the number of tracks the swing bridge must be taken out and scrapped or sold, while the lift system is elastic and single or double-track lifts can be added:

Some of the notable Scherzer rolling lift bridges that have been built in place of center-pier swing bridges are:

4-track, Metropolitan Elevated, Chicago.
8-track, Pennsylvania and other lines, Chicago.
2-track, Chicago Terminal Transfer, Chicago.
1-track, C., C., C. & St. Louis, Cleveland.
2-track, L. S. & M. S., Cleveland.
2-track, N. & S. S., Cleveland.
2-track, B. & O., Cleveland.
2-track, C. R. R. of N. J., Newark Bay.
2-track, C. R. R. of N. J., Newark Bay.
2-track, Boston, Rev. B. & L.
6-track, South Terminal, Boston.
4-track, N. Y., N. H. & H., Bridgeport.
2-track, S., E. & C., Swale River, England.

BEING BUILT.

4-track, N. Y., N. H. & H., Cos Cob, Conn.
4-track, N. Y., N. H. & H., Westport, Conn.
4-track, N. Y., N. H. & H., Stratford, Conn.
4-track, N. Y., N. H. & H., Atlantic, Mass.
2-track, N. Y., N. H. & H., Lyme, Conn.
6-track, N. Y., N. H. & H., Bronx and Hutchinson Rivers, New York City.
2-track, F. & R., Suir River, Ireland.
3-track, Dutch State Rys., Holland.
2-track, B. A. Gt. So., Riachuelo River, Buenos Aires.

The more than forty Scherzer bridges already built for electric roads are nearly all double-track and multiple track structures.

Baltimore & Ohio Shop Improvements.

The Baltimore & Ohio has given contracts for extensive improvements at Riverside (Baltimore), to Edward Brady & Son, of Baltimore, to cost about $500,000. The work includes the construction of two 26-stall roundhouses, one to be used for passenger and the other for freight engines; two 80-ft turntables and pits; also a 540-ton coal tipple and two depressed ash pits, 155 ft. long; an oil house 30 x 55 ft., and a two-story machine shop and power building 100 x 250 ft. In the latter building will be located the stores department, carpenter shop, tin shop, machine shop, blacksmith shop, engine and boiler room and part of the second floor will be used by the general yard offices. All the buildings are to be built of concrete, brick and steel, heated throughout with steam and equipped with the latest and best machinery, and everything will be of the most modern make.

President Diaz's Review of Mexican Railroads.

In his recent message to the National Congress of Mexico, President Diaz gave a review of the progress of railroad construction in that country as follows:

"The additions to the railroad system of the Republic during the past six months have aggregated 236 kilometers (146 miles), the largest extensions being those of the railroad from Carpio to Temosachic, completed, 87 kilometers; from Chihuahua to Ojinaga, 60 kilometers; from Linares to the San Jose mining district, 35 kilometers, and the Atlamajac line, 20 kilometers. The total length of the railroads of Mexico is now 16,866 kilometers (10,456 miles). The Pan-American has continued its work and has laid twenty kilometers of track. On the railroad that is being built by the Mexican Central from Guadalajara to Manzanillo, construction work was recently resumed. On the National Tehuantepec the work of substituting heavy for light rails has continued and the new bridge at Santa Lucrecia has been completed. There will be submitted to the National Congress for its sanction a contract entered into for the construction of a railroad uniting the states of Sonora, Sinaloa, Jalisco and the territory of Tepic with the other railroads of the country."

The Trump Concrete Measuring and Mixing Machine.

The accompanying illustrations clearly show the principle and operation of the Trump concrete measuring and mixing machine made by the Link Belt Engineering Company, Philadelphia, Pa. The machine consists essentially of a horizontal revolving table, on which the material to be measured rests, and a stationary knife set just above the table and pivoted on a vertical shaft just outside of its circumference. This knife is adjusted so as to extend the proper distance into the material on the table, and at each revolution of the table it peels off a certain amount of the material which falls over the table edge and into the chute, as shown in Fig. 1. As the material is peeled off by the knife, it is replenished, so that the pile on a certain part of the table is filled in to approximately the same shape and size by the time it has recrete, etc., the machines are made with two or more tables, set one above the other, and mounted on the same spindle so that they revolve together, each table having its own storage cylinder above it, and the cylinders placed one within the other as shown in Fig. 4. Each table is provided with a knife and with its own adjusting mechanism, thus the percentage of each material in a mixture can be varied at will. As the materials flow together constantly and regularly in small streams as they drop down the common chute, each infinitesimal amount of one ingredient is accompanied by the proper amounts of the other ingredients, and the particles become intimately mixed.

In feeding materials to the storage cylinders of these machines a conveyor can be employed; they can be delivered by gravity from a storage bin, or they can be shoveled; and it is only necessary

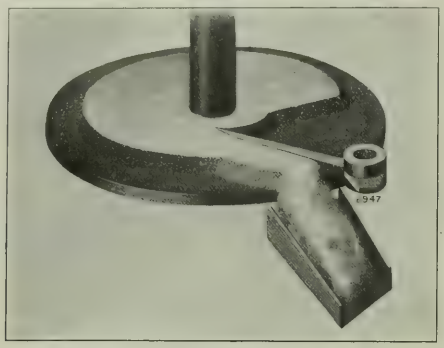


Fig. 1.

Fig. 3.

Fig. 2.

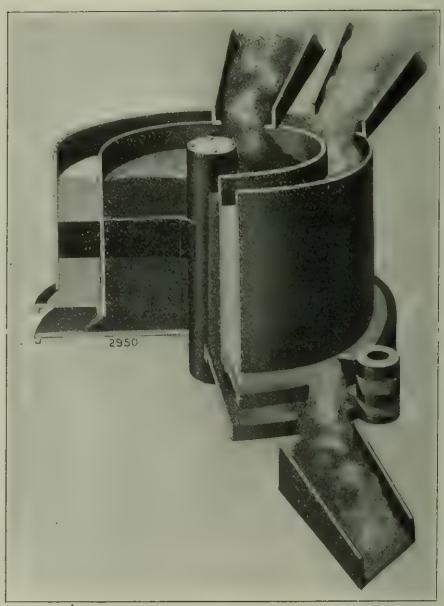


Fig. 4.

The Trump Concrete Measuring and Mixing Machine.

volved so as to be again presented to the knife. This is accomplished, as shown in Fig. 2, by placing a bottomless storage cylinder, somewhat smaller in diameter than the table and revolving with it, with its lower edge a short distance above the table so that the material flows out from under the edge of the cylinder and assumes a conical shape. The factors determining the amount measured off are the distance between the bottom of the cylinder and the top of the table, the width of the knife and its depth of cut, and the speed of rotation of the table. The depth of cut of the knife is adjusted by swinging the knife around on its pivot, so that it extends a greater or less distance into the material. This swing is controlled by a screw attached to an arm, cast as part of the knife, and a micrometer scale with pointer shown in Fig. 3 indicates the amount of the movement. Where it is desired to measure off and mix two or more materials, such as in mixing concrete, it is necessary to see that enough is kept in the storage cylinders so that the amount which the knives peel off will be constant. With some finely powdered materials, which flow very freely, it is necessary to place feeding-seals at the top of the storage cylinders to regulate the density and pressure on the material below, so that it will not pack or flow out at the bottom too rapidly and flood the table.

The tables and storage cylinders are all mounted on and driven by the same center sleeve, which is carried on a dirt-proof step bearing with hard bronze and steel washers and proper oiling device. The lowest table has a bevel gear cast on the under side, and is driven by a pinion mounted on a countershaft. The casings of the machine are made dust-proof to avoid any possibility of leakage or pollution of the air by finely powdered materials, and the whole is mounted on a substantial base, thus making the machine entirely self-contained. The countershaft can be connected

up to an electric motor by direct gearing, or can be driven by means of a belt and pulley.

British Railway Employees' Hours of Labor.

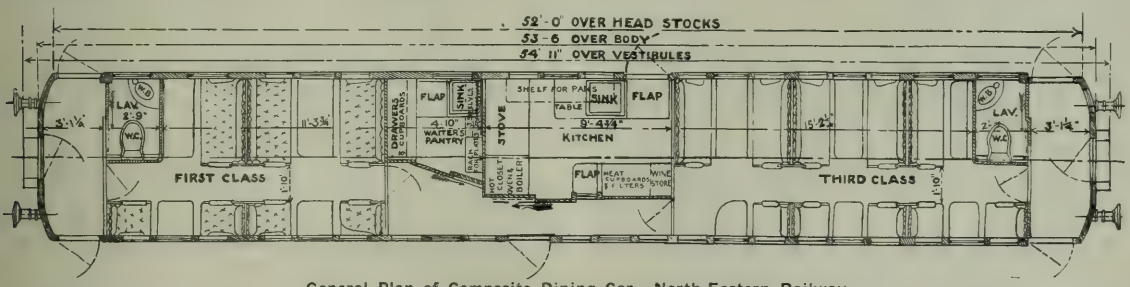
The twelfth annual report of the British Board of Trade on railroad employees' hours of labor in the United Kingdom for the year ended July 27 last, records that complaints totalled 47; the total since the passing of the act being 766. This is an increase on the two preceding years, but less than the average since 1893, the number of cases inquired into since the passing of the act being as follows: 1894, 72; 1895, 156; 1896, 97; 1897, 76; 1898, 50; 1899, 46; 1900, 41; 1901, 19; 1902, 123; 1903, 28; 1904, 11; 1905, 47. Only seven signalmen complained of long hours, while the most frequent complaints came from drivers and firemen (15), and from guards and brakesmen, also 15.

Composite Dining Cars on the North Eastern of England.

The North Eastern Railway has introduced on its express services between Leeds and Scarborough, and York and Newcastle-on-

Composite Dining Car—North-Eastern Railway.

Tyne, a number of new composite dining cars, in substitution of the refreshment cars previously used. The first class saloon portion is 14 ft. 2 in. in length, and has seats for 10 passengers. The third class portion, which is 17 ft. 11 in. in length, has a seating accommodation for 20 passengers, and is finished in oak. The



General Plan of Composite Dining Car—North-Eastern Railway.

kitchen and waiters' pantry are placed in the middle of the car, as shown in the plan, and the first class dining portion is at one end and the third class at the other. The kitchen is fitted with cooking-ranges and all up-to-date appliances for serving dinners or luncheons. The cars are steam-heated throughout and lighted with incandescent gas. The underframe is of the North Eastern Railway standard pattern, with the Buckeye coupler in connection with a Pullman vestibule. These cars weigh 30 tons 7 cwts.

Report on Elevated Railroad Disaster.

The New York State Railroad Commission has made a report on the recent accident at Ninth avenue and Fifty-third street, New York City, in which one car of an elevated train fell off the structure to the sidewalk, causing the loss of twelve lives and injuries to forty persons.

The recommendations are:

1. That the two signals at and near the switch-point connecting the Ninth avenue and Sixth avenue southbound tracks be replaced by a double bladed semaphore signal, one of these blades to govern the Ninth avenue trains southbound, the other the Sixth avenue trains. The size of these blades, and lights to be used in connection with them to be approved by this board.

2. That a stationary "slow" sign be placed at a proper point in a manner to make it conspicuous, and so that it can be seen and read by motormen of all southbound trains.

3. That all southbound trains on the local track come to a full stop before reaching the above mentioned semaphore.

4. That a rule to the above effect be issued, properly posted, and a copy of it properly delivered to every motorman, conductor, trainman, and all employees in any manner connected with the operation of the Sixth avenue and Ninth avenue lines.

5. That the above rule be rigidly enforced.

The Commission finds that the towerman was at his post of duty "about one minute before the accident occurred," giving the inference that he left his post of duty with the switch and signals set for a Sixth avenue train. The report says, further:

"We find that this accident was caused by the motorman, Paul Kelley, violating the company's rules in running by a cautionary signal without reducing speed, and by running by a signal showing that the switch was set for a Sixth avenue train, he running a Ninth avenue train, one carrying proper signals for that line.

"We also find that Cornelius A. Jackson, the towerman, contributed to the cause of the accident by having the switch and signal set for a Sixth avenue train, when a Ninth avenue train, displaying proper signals, was approaching the junction."

Railroad Education at the University of Chicago.

By co-operation between the University of Chicago and a number of railroad officers, a four-year course in railroad education has been established at the university.

An advisory board composed mostly of railroad men, has been established, with E. W. McKenna, assistant to President Earling, of the Chicago, Milwaukee & St. Paul, as chairman, and Daniel Willard, second vice-president of the Burlington, as vice-chairman. Among those who form the board are: A. C. Bird, A. F. Banks, W. C. Brown, F. A. Delano, J. T. Harahan, J. N. Faithorn, S. M. Felton, W. A. Gardner, S. T. Fulton, J. Kruttschnitt and B. Thomas. These men will shape the courses and also deliver lectures as occasion requires.

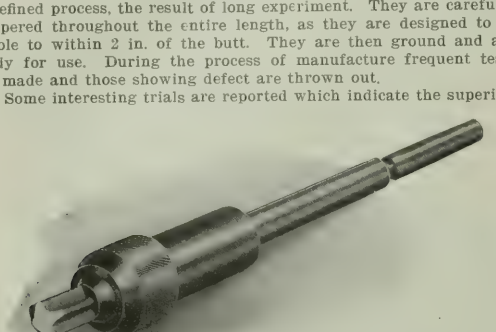
An outline published in the newspapers says that the first year's course will be devoted to railroad conditions in the United States, and the second year to freight service, transportation, law and rate regulation. During the third year the following branches will be covered: Passenger service, statistics and georgraphy, signaling and

train service, auditing and finance, and terminals. During the fourth year motive power, car equipment, track, railway development abroad, and the economics of railroad locomotion will be studied.

High-Speed Steel for Rail Drilling.

Although the general use of high-speed steel has revolutionized machine shop practice in the past few years, efforts to produce satisfactory twist drills from it have not been fully successful. The Rich flat drill has been produced recently, however, and it is said that it will outwear 10 to 15 twist drills. It is made from a rolled bar of selected air-hardened steel. Suitable lengths are cut and put through a highly refined process, the result of long experiment. They are carefully tempered throughout the entire length, as they are designed to be usable to within 2 in. of the butt. They are then ground and are ready for use. During the process of manufacture frequent tests are made and those showing defect are thrown out.

Some interesting trials are reported which indicate the superior-



Rich Flat Drill Bit and Special Chuck.

ity of air-hardening steel for drilling purposes, and show its remarkable endurance. At one of the Carnegie Steel Company's rail mills, in a set of six Rich flat drills each drilled 1,600 holes, 1 in. in diameter, in 80-lb. steel rails without being reground. That a great deal depends on the proper tempering and refining of air hardening steel in the production of a drill bit, was shown by a test at the Illinois Steel Company's mill, South Chicago, Ill., where the Rich drill was tested with forged flat drills of the same material. It was found that the Rich bit drilled twice as many holes at 50 per cent. greater speed. Another interesting experiment was made on armor plate in the Brooklyn navy yard. The Rich drill bit drilled ten holes in the armor plate turrets of the battleship "Connecticut" 1¼ in. in diameter without re-sharpening, while eight twist drills were used without finishing one hole.

The Rich flat drill requires a special chuck. The jaws, which are adjustable, are arranged to hold the bit true and firm by means of a clamping unit. The end of the bit is supported by an adjustable thrust block within the barrel, which may be changed to compensate for the wearing off of the point in grinding. One important feature which reduces the likelihood of the drill's breaking is the depth of the barrel, which allows the bit to recede into it until only enough is presented to penetrate the work before it.

A special Rich spindle, chuck and drill is made for use on Paulus track drills. The spindle is interchangeable with the older style which accommodated the straight shank twist drill. Paulus drills now in use may therefore easily be supplied with the Rich chuck and drill.

The Buda Foundry & Manufacturing Company, Chicago, is the exclusive selling agent.

Circle Electric Trains in London.

Electric trains have started running round the inner circle of the underground railways in London. Though there has been an electric service on the underground since the beginning of July, this service has only been between the east and west ends of the city.

No Passenger Cars Next to Engines.

An order just posted in the Pittsburg yards of the Pennsylvania Railroad reads as follows: "In making up passenger trains no coaches or sleeping cars shall be placed next to the locomotive. In all instances a baggage car, whether the car is needed for baggage purposes or not, must be the first car of the train. This rule applies to excursion and regular trains. In the case of a combination baggage and smoking car the baggage end must be first. The only possible deviation from this order is on those divisions where no provision is made for turning trains at the end of a suburban run. This is the only time when an excuse will be accepted.—*Pittsburg Leader.*

Lincoln's Car.

The historic passenger car used by Abraham Lincoln, and which has been standing neglected many years at Omaha, has been sold to Thomas Lowry, of Minneapolis, Minn., President of the Minneapolis, St. Paul & Sault Ste. Marie Ry., and it is said that it is to be presented to the city of Minneapolis, with a view to having it placed permanently in one of the parks.

Y. M. C. A. Lectures on Electricity.

The Railroad Young Men's Christian Association of New York City announces three courses of study for railroad men in electricity as applied to railroads; elementary, intermediate and advanced, and Secretary George A. Warburton, of 361 Madison avenue, has issued a circular giving the list of subjects. The director and principal teacher is Mr. Sidney Aylmer-Small, E.E. The lectures begin October 10 and run to March 13, and will be given mostly on Tuesday and Wednesday evenings. Some of them will be given at the Railroad Men's building, 361 Madison avenue, and some at the Toucey Memorial building, Mott Haven. Trainmen and other railroad employees are invited to join the classes with a view to preparing themselves for efficient service when the steam locomotives shall be superseded by electric locomotives on the lines running into the Grand Central Station. The course of studies is intended to be very thorough, taking in everything from elementary magnetism and batteries to power houses and all the details of motors. The fees are low. The association committee in charge of educational work consists of DeForest Lillis, James C. Irwin and Frank Davidson.

Italian Railroads.

Although the Italian railroads passed into the hands of the state on the last day of June, the system of management is as yet far from complete and will probably only come into full working order at the end of this year, until which time the old order of the former companies will more or less remain in force.

The central direction will be established in Rome. The departmental offices will be at Turin, Milan, Rome, Genoa, Naples, Florence, Venice and Palermo. At Turin and Milan will be the two most important departments, each numbering some 15,000 employees; the remaining departments will consist of some 12,000 employees, with the exception of Palermo, which will number about 6,000, all that are required for the Sicilian lines.

The main lines of Italian railroads will thus in the future be divided into eight departments—Turin, Milan, Rome, Genoa, Naples, Florence, Venice and Sicily—in the place of their former division into three companies—the Mediterranean, Adriatic and the Sicilian. These state departments will control some 11,000 kilomèters of railroad and about 96,000 employees.

There will remain in the hands of private companies some 2,000 kilomèters of secondary lines, and in the hands of the Adriatic Company 2,000 kilomèters of the old southern lines, its own former property. It is more than likely that the Government is actuated by a desire to keep the Adriatic Company in existence, even in a diminished form. If it should find the state management of the railroads an impossible enterprise there will then be at least one already organized company with whom it may possibly treat for relief from some portion of its charge.—*London Times.*

Manufacturing and Business.

Mr. August Ziesing, Western Manager of the American Bridge Co., of New Jersey, has been elected President, succeeding Mr. Alfred J. Major, who resigned on account of ill health.

Mr. Frank H. Alfred, M. Am. Soc. C. E., heretofore Chief Engineer of the Pere Marquette R. R., has been appointed General Manager of the Canadian White Company, Ltd., with headquarters at Montreal, Que.

The Union Switch & Signal Co. has declared the usual quarterly dividend of 2½ per cent. on the preferred and 2 per cent. on the common stock of the company, payable by check October 10th to holders of record Oct. 1, 1905.

The Westinghouse Machine Company state that during the past month orders have been received for 51 Roney mechanical stokers, ranging in size from 54 in. x 20 grate to 132 in. x 26 grate. The largest order was that of the Pennsylvania Railroad for six 132 in. x 26 grate stokers and five 100 in. x 20 grate stokers.

Mr. R. R. Shuman has resigned his position of Western Editor of the *Iron Age* to engage in the business of designing and writing trade paper advertising, at 1270 Old Colony Building, Chicago. Prior to his connection with the *Iron Age* Mr. Shuman had twelve years of experience in the advertising business, having been successively advertising manager for the Deering Harvester Co., Carson, Pirie, Scott & Co., and Jos. T. Ryerson & Son, all of Chicago.

Mr. Daniel Royse has resigned as Editor of the *Street Railway Review*, Chicago, to take effect October 14th. Mr. Royse joined the *Street Railway Review* staff in December, 1896, and since February, 1901, has served as Managing Editor of the journals owned by the Kenfield Publishing Company, including for a time *Steam Engineering*, *Street Railway Review*, and *Brick*. Mr. Lawrence E. Gould, who for some time has been Associate Editor, will succeed Mr. Royse as Editor.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Iowa Railway Club.

At the regular monthly meeting of this club to be held in Des Moines, October 9, a paper on "Making a Time Card" will be read by W. H. Giben, Superintendent of the Des Moines Valley division of the Rock Island. The secretary reports the present membership of the club as being larger than at any previous time since its organization.

ELECTIONS AND APPOINTMENTS.

Ann Arbor.—F. A. Durban, President of the Detroit, Toledo & Ironton, has been also elected President of the Ann Arbor, succeeding Joseph Ramsey, Jr., resigned.

Atchison, Topeka & Santa Fe.—J. H. Keefe, Chief Clerk to the General Manager, has been appointed Assistant to the Second Vice-President and General Manager, with headquarters at Galveston, Tex.

Chicago, Milwaukee & St. Paul.—E. W. McKenna, Assistant to the President, has been elected Second Vice-President, with office at Chicago.

Chicago, Rock Island & Pacific.—H. S. Ray, General Eastern Passenger Agent, has been appointed Assistant General Passenger Agent, with headquarters at St. Louis.

Cincinnati, Hamilton & Dayton.—Eugene Zimmerman, President, has resigned.

Cincinnati, New Orleans & Texas Pacific.—M. W. Maguire, Superintendent of the Chattanooga division, has resigned. H. M. Waite, Superintendent of the Cincinnati division, succeeds Mr. Maguire. C. E. Rickey, Superintendent of Car Service of this road and of the Alabama Great Southern, succeeds Mr. Waite. The title of Superintendent of Car Service is changed to Superintendent of Transportation, to which office R. E. Boswell is appointed. These appointments take effect October 1.

New York, New Haven & Hartford.—The office of F. E. Byrnes, Assistant to the President, has been transferred from Boston to New Haven. F. S. Curtis, Second Vice-President, is relieved of all connection with construction and maintenance and his office is transferred to Boston, where he will represent the President with full authority. E. H. McHenry, Fourth Vice-President, will take charge of the construction and maintenance work hitherto done by Mr. Curtis. Calvert Townley, First Vice-President of the Consolidated (Electric) Railway, will take charge of matters pertaining to the Consolidated Company, formerly within the jurisdiction of Mr. McHenry.

Pere Marquette.—F. H. Alfred, Chief Engineer, has resigned.

Seaboard Air Line.—W. W. Gwathmey, Jr., Chief Engineer, has resigned. W. L. Seddon, Assistant Engineer, has been appointed Chief Engineer, succeeding Mr. Gwathmey.

Texarkana & Fort Smith.—C. E. Swindell, General Passenger and Ticket Agent, has resigned. S. G. Hopkins, City Ticket Agent at Texarkana, Tex., succeeds Mr. Swindell.

Wabash-Pittsburg Terminal.—See Wheeling & Lake Erie.

Wheeling & Lake Erie.—R. Blickensderfer, General Manager of this road and of the Wabash-Pittsburg Terminal, has resigned, and will become Consulting Engineer for both companies. The change was made at his own request. H. W. McMasters, Superintendent of both roads, has been appointed General Superintendent.

LOCOMOTIVE BUILDING.

The Erie is reported as in the market for a large number of locomotives.

The Louisville & Nashville will build about 12 locomotives at its own shops.

The Atchison, Topeka & Santa Fe will build 10 locomotives at its own shops.

The Toledo & Western has ordered one simple locomotive, which will weigh 50 tons and have cylinders 16 in. x 24 in.

CAR BUILDING.

The Brooklyn Rapid Transit has asked bids on 150 cars.

The Grand Trunk, it is reported, will order at once about 2,000 freight cars.

The Chicago, Milwaukee & St. Paul will build 19 baggage cars at its own shops.

The Central New England has ordered 10 cabooses from the Wason Manufacturing Co.

The New York, New Haven & Hartford has ordered 2,000 box cars from the Standard Steel Car Co.

The Chicago, Milwaukee & St. Paul, it is reported, will build 1,000 freight cars at its Milwaukee shops.

The Philadelphia Rapid Transit is reported to have ordered 40 steel cars from the Pressed Steel Car Co.

Street's Western Stable Car Line (Chicago), it is reported, will shortly be in the market for horse cars.

The Mobile & Ohio has ordered 100 Rodger ballast cars and 100 hopper cars from the American Car & Foundry Co.

The Duluth, South Shore & Atlantic has ordered 200 box cars and 100 flat cars from the American Car & Foundry Co.

The New Orleans Great Northern has ordered 25 Hart convertible cars from the Rodger Ballast Car Co. for October delivery.

The Central of New Jersey, it is reported, is asking bids on 1,000 box cars, 1,000 coal cars, 1,000 wood gondolas and 50 stock cars.

The Fourche River Valley & Indian Territory, it is reported, will shortly place orders for both freight and passenger equipment.

The Des Moines, Iowa Falls & Northern has ordered two 36-ft. Hart convertible cars of 80,000 lbs. capacity from the Rodger Ballast Car Co.

The Canadian Pacific is building 25 parlor, sleeping and dining cars, 90 passenger coaches and 3,000 freight cars at its Angus, Montreal, shops.

The South Bend & Southern Michigan (Electric) has ordered 10 cars from the St. Louis Car Co., part of which are to be delivered this fall and the rest in the spring.

The Chicago & Alton, as reported in our issue of September 22, has ordered four baggage, three passenger and baggage and three passenger and mail cars from the Pullman Co.

The Darien & Western has ordered 30 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will measure 36 ft. over all and the bodies and underframes will be of wood.

The Mexican Car & Foundry Company has orders for eight coaches from the *Oaxaca & Ejutla*, 10 flat cars from *Durango Central* (Mexico), one private car from *Tehauntepec National*, 10 freight cars from the *Mexican Central*, 175 coal cars from the *Mexican International*, 50 mining and six box cars from the *Cordoba & Huatusco*, and 10 box and 25 narrow-gage cars from the *National of Mexico*.

The Chicago & Southern Traction Co. has ordered 66 passenger cars and one baggage car from the St. Louis Car Co., for delivery Dec. 20 and May 1. The passenger cars will weigh 57,000 lbs., and measure 51 ft. long over all. The special equipment will include: St. Louis Car Co.'s axles, bolsters, brake-beams, brake-shoes, brasses, couplers, seats and trucks, National Electric Co.'s air-brakes, Hartshorn curtain fixtures, Pantasote curtain material, Hastings heating system and Railway Steel Spring Co.'s springs.

The Pennsylvania, it is reported, has ordered upwards of 15,000 cars. Of these, 500 are hopper cars, 10,000 are gondolas, 3,400 are box and 1,100 are stock cars. They are all to be of 100,000 lbs. capacity. The order is distributed among the following makers: The American Car & Foundry Co., the Pressed Steel Car Co. and the Standard Steel Car Co. It is also reported that the Pressed Steel Car Co. will make 800 steel underframes, for which the Middletown Car Works will make 300 bodies and the Western Steel Car & Foundry Co. will make 500 bodies.

The Toledo & Western has ordered one coal dump car of 80,000 lbs. capacity from the National Coal Dump Car Co., two stock cars of 50,000 lbs. capacity from the W. A. Zelnicker Car Co., and is building one stock car of 50,000 lbs. capacity and three gondola cars of 60,000 lbs. capacity at its company shops. Also ordered 10 Hart convertible gondola cars of 80,000 lbs. capacity from the Rodger Ballast Car Co. to be built by the American Car & Foundry Co. These cars will weigh 35,200 lbs. and measure 34 ft. long over all. The special equipment includes: Westinghouse air-brakes, Climax couplers, and American Car & Foundry Co.'s trucks and wheels.

BRIDGE BUILDING.

DAYTON, OHIO.—Plans are being made by City Engineer F. M. Turner, and bids will be asked probably the latter part of next month by the Board of County Commissioners for building a combined street railroad bridge to consist of a 200-ft. span steel structure with concrete abutments, to cost about $300,000.

HURDMAN'S BRIDGE, ONT.—The County Council has decided to build a steel and concrete bridge here to cost $15,000.

KINGSVILLE, TEX.—The St. Louis, Brownsville & Mexico will build a new bridge over the Arroyo Colorado.

MCKEESPORT, PA.—A combined highway and electric railroad bridge is to be built over the Youghiogheny river at Thirteenth avenue. Former Mayor Robert R. Caruthers is said to be interested.

MIDLAND, S. DAK.—Bids are wanted October 6 by the County Commissioners for building a bridge over Bad river. M. P. Kennedy is County Auditor, Ft. Pierre.

MILWAUKEE, WIS.—The Council has passed a resolution to submit to the voters the question of issuing $200,000 of bonds for building a new bridge on East Water street.

PERU, IND.—Bids are wanted by the County Commissioners, October 2, for some bridge work in Miami County. C. W. Macy is County Auditor.

RICHMOND, IND.—The County Commissioners will soon give contracts for building a number of small bridges in Wayne County.

SHORT CREEK, ALA.—The Ensley Southern, on its extension from this place to Parrish, in Walker County, will build two bridges over the Warrior river at a cost of about $200,000.

SWISSVALE, PA.—An ordinance has recently been signed for building two crossings to pass under the Pennsylvania tracks; also for two bridge crossings over the same tracks; to cost about $180,000.

WINNIPEG, MAN.—The Canadian Northern has decided to build a steel combined highway and railroad bridge over the Assiniboine river a few miles west of this place.

Other Structures.

ASH FORK, ARIZ.—The Atchison, Topeka & Santa Fe will put up a combined hotel and station of brick two stories high, 50 ft. by 460 ft., to cost approximately $75,000.

BIRMINGHAM, ALA.—Plans have been adopted for a new $1,000,000 passenger station, which the railroads entering this place, with the exception of the Louisville & Nashville, will build in the eastern part of the city. Work is to be started at once.

BRISTOL, TENN.—The freight house owned jointly by the Norfolk & Western and the Southern, was destroyed by fire on the 14th inst. Loss about $50,000.

FAIRFIELD, ME.—The Waterville & Fairfield Electric road will build a two story brick car barn at this place.

GOLDSBORO, N. C.—Plans are being made by the railroads to build a new passenger station.

LONDON, ONT.—The Grand Trunk, it is said, will build a combined station and hotel here at a cost of about $2,000,000.

NORWICH, ONT.—The Grand Trunk will divert its line through this place and build a large station here.

OGDENSBURG, N. Y.—The New York Central will put up a brick passenger station, 40 by 100 ft., to cost $20,000.

PITTSBURG, KAN.—The Kansas City Southern shops at this place are to be enlarged to double their capacity. The plans include the building of a large machine shop, a 30-stall roundhouse and the converting of the present machine shop building into a big tank, boiler and blacksmith shop, and a number of other structures.

PORTLAND, ORE.—The Northern Pacific, it is said, has bought 23 acres of land north of its terminal, to be used for shops and other purposes.

SALEM, ILL.—The Chicago & Eastern Illinois has bought ground at this place as a site for large freight yards. The work includes the building of a roundhouse.

WATERVILLE, ME.—The Maine Central, it is said, will build a large extension to its car shops at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA SHORT LINE.—Under this name, a company will ask for incorporation in Washington by J. T. Cornforth, formerly of Denver, to build a railroad from Illianna, on Cook Inlet, northwest to Anvik. The proposed line will be 380 miles long and its highest elevation 960 ft. above sea level, crossing the mountains through the only natural gap which exists.

ARKANSAS, LOUISIANA & GULF.—This company, which is planning to build a road from Pine Bluff, Ark., about 125 miles southward, reaching a point in Louisiana, will, it is said, at once begin construction work. P. B. Stewart, President of the Colorado, Title & Trust Co.; E. A. Sunderlin, J. M. Parker, W. A. Otis and others are interested.

BAY SHORE & PACIFIC.—Articles of incorporation have been filed by this company in California, with a capital of $2,000,000, to build a railroad from a point near the southern boundary of San Diego to Pacific Beach and LaJolla, and thence to the northern boundary of San Diego. This line is to be the first portion of the proposed railroad to Imperial and Humor. The directors include: H. T. Richards, C. R. Hammond, William Crouse, S. Connell, I. D. Stewart and H. C. Oatman, of San Diego, and N. H. Rodgers, of Denver.

BEAUMONT & GREAT NORTHERN.—A contract has been given by this company to Lamb & Hansen, of San Antonio and Houston, for building the first 20 miles of its proposed road, which is to run from Trinity, Tex., via Livingston to Beaumont. This is said to be a Gould project.

BRANDON, SASKATCHEWAN & HUDSON'S BAY.—Grading work has been commenced by Contractor Richards on this new road from the international boundary to Hudson's Bay.

CANADIAN PACIFIC.—This company is making surveys for a new line from Austin, Man., west, to eliminate the heavy grades on the existing line between that place and Carberry. The new line will parallel the line of the proposed Grand Trunk Pacific, being only about 150 ft. distant from the proposed route of this road, which passes about eight miles north of Carberry.

Foley Brothers, Larson & Co., who have the contract for double tracking this road between Winnipeg and Fort William, have sublet the following contracts: Two miles at Cross Lake, to John E. Bostrom; two miles at Kilmar, to include a tunnel about 400 ft., to Larson Bros.; three miles between Ostersund and Busteed, to Fred Peterson & Co.

Grading has been begun by Contractor James Cowen on the link that will connect this company's Hudson Bay line with the main line in St. Charles, a few miles from the city of Winnipeg. The new line will run from a point where the Hudson's Bay line intersects the Canadian Pacific through St. James, crossing over the Assinniboine river and running through St. Charles to the Canadian Northern main line, connection being made near Fort Whyto. On the road further west, the construction work is progressing rapidly and grading is finished to Edmonton, N. W. T.

CENTRAL BRANCH & ST. JOSEPH.—See Missouri Pacific.

CENTRAL OF GEORGIA.—A contract has been given by this company to W. J. Oliver & Co., of Knoxville, Tenn., to build an extension from Greenville to Noonan, Ga., a distance of about 20 miles. Work is to be commenced at once. (September 8, p. 79.)

CHICAGO & NORTH-WESTERN.—See Pierre, Rapid City & Northwestern below.

CHICAGO, BURLINGTON & QUINCY.—This company is pushing work on its extension from Centralia, Ill., south to Herrin. The proposed road will run through Woodlawn, Waldronville, Christopher and Plumfield, and is to be ready for operation by December 1 of this year. The company is planning to build an extension from Valier, on this line, north of Christopher, in Franklin County, northwest to St. Louis. The survey from Valier runs in a northwesterly direction through the counties of Franklin, Perry, Washington and St. Clair, a distance of about 70 miles. Connection will be made at Belleville with the St. Louis & O'Fallon, which will be extended to that point. (June 30, p. 215.)

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—Surveys are being made by this company for a line from Kismet, in Morgan County, Tenn., southwest to South Pittsburg, a distance of about 133 miles, passing through a rich timber and coal district.

CORDELE, HAWKINSVILLE & NORTHEASTERN.—Application will be made by a company under this name in Georgia with a capital of $250,000 for a charter to build a railroad in that state 35 miles long. Surveys have not been made as yet, but the road is proposed to run from Cordele northeast to Hawkinsville, in Pulaski County. Hon. J. Polk Brown, former member of the Railroad Commission of Georgia; P. H. Lovejoy, H. N. Parsons, J. J. Harvard, C. W. Jordan, Jr., and E. J. Henry, of Gainesville, are interested.

DARIEN & WESTERN.—This company, which operates 41 miles of road in Georgia, is planning to build an extension from Darien south to Brunswick, a distance of 20 miles.

DENVER & RIO GRANDE.—The Durango-Farmington branch of this road has been completed to Aztec, in San Juan County, and has been formally opened. The balance of the road to Farmington, a distance of about 15 miles, will be completed the first of next month and trains will be regularly run by the 15th. The new branch, which is 50 miles long, Durango to Farmington, has been the subject of dispute between the Harriman and Gould interests during the past summer, the former having obtained an injunction to prevent the building of the road. A stay of the injunction having been secured, work is being rushed on the road, with the hope of having regular trains running over the line before the court takes further action.

ELMIRA, CORNING & WAVERLY (ELECTRIC).—An officer writes that this company, which was recently granted a charter in New York to build 37 miles of road, will connect the Corning & Painted Post Street Railway with the Elmira Water, Light & Railroad Company's line, and will also connect the latter road with the Waverly, Sayre & Athens Traction Co.; all these properties, with the exception of the Elmira concern, are to be consolidated under the name of the Southern Tier Railway Co. Joseph A. Powers, of Troy, N. Y., is President.

ERIE.—An officer writes in regard to new work between Lakewood, N. Y., and Columbus, Pa., that this company is planning to build a new line from Lakewood through Ashville, Watts Flats, Niobe and Lottsville to Columbus, 21.6 miles, of which eight miles, from Lakewood to a point east of Niobe, is to be double track, and from that point to Columbus, 13.6 miles, single track. This line is to be finished in 1906. Contracts for grading are to be let within the next thirty days. The contract for part of the masonry has been given to Smith-McCormick Company, of Easton, Pa. No grading has been done. The curves are light, but some of the grading is heavy. Maximum grades are .2 per cent. eastbound, and .3 per cent. westbound. (Sept. 15, p. 87.)

A contract has been given to the McGinty Contracting Co., of Minerva, Ohio, at about $50,000, to build a concrete subway at the eastern end of its yards at Randall.

FORT WORTH & MINERAL WELLS (ELECTRIC.)—A charter has been filed by a company under this name in Texas, with a capital stock of $250,000, to build an electric railroad from Fort Worth, Tex., to Mineral Wells, a distance of about 50 miles. The board of directors includes: Cicero Smith, D. M. Howard, H. N. Frost, E. J. Warren and Albert Stevenson, all of Mineral Wells.

GREAT NORTHERN.—This company has filed a map showing the definite location of the right of way of its proposed extension from Summers, in Flathead County, Mont., east to Holt, thence along the east side of Flathead lake to the northern side of Flathead reservation, a distance of about 60 miles.

Surveys are being made by this company for a line to be built from St. John, N. Dak., to Brandon, Man. In addition, a spur is to be built from the former place to Fish Lake.

See Portland & Seattle.

GULF, COLORADO & SANTA FE.—According to reports from Davis, in the Chickasaw Nation, Indian Territory, this road will build a line from that point, east to the coal fields in the Choctaw nation.

ILLINOIS CENTRAL.—See Yazoo & Mississippi Valley below.

INTERSTATE TUNNEL RAILROAD.—A charter has been granted to a company under this name in the states of New Jersey and New York to operate a tunnel railroad from Jersey City under the North river to the Borough of Manhattan, New York City. Application has been made to the city authorities for a franchise to extend the tunnel from the North river at the foot of Chambers street east to Park Row. John B. McDonald is President of the new company, and S. L. F. Deyo, Chief Engineer. The plans of the company are before the Rapid Transit Commission for their consideration. Further particulars are given in another column.

KANSAS SOUTHERN & GULF.—This company, which operates eight miles of road from Blaine, Pottawatomie County, Kan., south to Westmoreland, has obtained a charter to extend its road from the southern terminus south to Alma, in Wabaunsee County, a distance of about 35 miles. O. J. Collmann, Westmoreland, Kan., is General Manager.

LOUISIANA EAST & WEST.—This company is reported ready to let contracts for building its proposed line from Bunkie, La., to South Villeplatte, a distance of 20 miles. C. J. Carpenter, Bunkie, is Superintendent.

MANHATTAN & LONG ISLAND (ELECTRIC).—Incorporation has been granted to a company under this name in New York, with a capital of $10,000,000, to build an electric railroad 80 miles long, connecting Long Island City and Northport, L. I. The directors include: Edward Mackey, D. T. Meyer, H. H. Boutell, S. Y. Sauber, F. M. Walter and George E. McArdle, all of New York, and William R. Stockwell, of Yonkers, N. Y.

MISSOURI, OKLAHOMA & GULF.—This company, which operates 62 miles of road in Indian Territory, it is said, has completed surveys for an extension of its road from the northern terminus at Wagoner, Ind. T., north for a distance of 70 miles to Afton; construction work is to be commenced at once. (March 31, p. 102.)

MISSOURI PACIFIC.—Regarding the improvements which it was recently reported would be made by this company in St. Louis County, Mo., an officer writes denying the report.

Announcement has been made that this company will extend its line from Atchison, Kan., to St. Joseph, Mo. Incorporation papers have been issued to the Central Branch & St. Joseph for this purpose. Two routes are under consideration, one on the Missouri side of the river and the other on the Kansas side. Surveys have been completed for both, but it has not yet been determined which will be used. The Missouri Pacific has been using the Burlington's tracks since 1880, and its lease, which expired nearly a year ago, has not been renewed. It is also stated that the company has bought a large plot of ground in St. Joseph as a site for terminals.

MORELIA & TACAMBARO.—Reports from Guadalajara, Mex., state that the state of Michoacan has agreed to pay a subscription of $400,000 to this proposed road to build the line from the Mexican Central station at Ira Puato to Tacambaro, in the state of Michoacan. Announcement has also been made that the construction work will be commenced during the present year. The company is being financed by A. J. Peyton & Co., of New York.

NAPA & LAKEPORT.—Application has been made by a company under this name in California, with a capital of $2,000,000, to build a railroad from Lakeport, Cal., southeast to Napa City, a distance of 90 miles, with a branch from the latter place to Monticello. The road will parallel the California Northwestern for most of its distance, and for part of the way it will also parallel the Southern Pacific. Harding & Sargent, of San Francisco, are attorneys for the company.

NEW YORK, NEW HAVEN & HARTFORD.—This company has completed surveys for building a cut-off from Yalesville, on the Hartford division, northwest for a distance of eight miles to Plantsville, on the Northampton division. By such a line the freight traffic of the Northampton division could reach the Cedar Hill freight yard and thus the yard in the city would be relieved.

NORTHERN PACIFIC.—See Portland & Seattle.

NORTH MISSISSIPPI & BAY SPRINGS.—Application has been made in Mississippi to incorporate this company and grant it the rights of an old charter for a railroad from Burnsville, in Tishomingo County, to Warren Mill, between Tishomingo and Itawamba Counties, a distance of about 30 miles. The road will pass through a rich timber territory. At Burnside, connection will be made with the Southern Railway.

OREGON SHORT LINE.—See Yellowstone Park below.

PAULS VALLEY.—A charter has been granted this company in Oklahoma, with a capital of $5,000,000, to build a railroad from Ada, Ind. T., southwest to Wichita Falls, Tex. The directors include: J. C. Amendt, Chicago, President; W. M. Freeman, Vice-President; Albert Kennie, Secretary and Treasurer; J. B. Thompson, S. J. Garwin and J. C. Hybarger, of Pauls Valley, and A. P. Williams, John Upshaw and P. J. Stovall, of Wanetta.

PIERRE & FORT PIERRE BRIDGE-RAILWAY COMPANY.—Articles of incorporation have been filed in South Dakota by a company under this name, with a capital of $10,000, to build a railroad three miles long from the western terminus of the lines of the Chicago & North-Western, in the city of Pierre, over the Missouri river to the eastern terminus of the lines of the Pierre, Rapid City & Northwestern, in the town of Fort Pierre. The estimated cost of the work will be $300,000 a mile. It is also announced that work on the bridge over the river will be commenced at once. The incorporators are: R. W. Stewart, O. H. McCarty, of Huron; Marvin Hughitt, John M. Whitman and J. B. Redfield, all of the Chicago & North-Western.

PIERRE, RAPID CITY & NORTHWESTERN (C. & N.-W.).—Under this name, a company has been incorporated in North Dakota by officials of the Chicago & North-Western to build a railroad from Pierre, N. Dak., west through Stanley and Lyman Counties to Rapid City, in Pennington County, a distance of about 160 miles. The company, it is said, has bought the franchises of the old Rapid City, Missouri River & St. Paul, and will at once begin work east of Rapid City. Contracts for the grading work reported let to John Chamberlain and Owens & Loveless.

PORT ARTHUR & HOUSTON SHORT LINE.—This company has not as yet decided which route it will follow after crossing the river at Wallisville, Tex., on its proposed road now under construction from Port Arthur to Houston, Tex. Contracts will shortly be let for building 56 miles of road. (April 21, p. 131.)

PORTLAND & SEATTLE.—Announcement has been made by the Northern Pacific that this projected road has been bought for the joint account of that company and the Great Northern. It is proposed to at once build the road from Kennewick, Wash., on the Columbia river, opposite Pasco, west along the north bank of the Columbia river to Vancouver, Wash., a distance of about 200 miles. The grading contract has been let and work started; the work includes a tunnel 2,000 ft. long at Cape Horn and bridges over the Columbia and Willamette rivers. When completed, this line will give both roads a much more direct line from the east to Portland and at the mouth of the Columbia river. This will parallel the Oregon Railroad & Navigation Company's line which runs along the south bank of the Columbia river from Wallula west to Portland.

Rockville, Westport & Northwestern.—This company, which operates about 45 miles of railroad in Ontario from Brockville to Westport, has made a preliminary survey for 100 miles on its proposed extension to Sault Ste. Marie, a distance of about 450 miles. Permanent surveys have been completed for the first 20 miles.

Seaboard Air Line.—This company, it is reported, is making surveys to build a line from Jacksonville, Ala., south to Aniston, a distance of 12 miles.

Sioux Falls & Western.—Articles of incorporation have been filed by a company under this name in South Dakota, with a capital of $10,000,000, to build 210 miles of railroad. The plans of the company include the building of two lines from Sioux Falls, one to Greenwood through the counties of Minnehaha, McCook, Hutchinson, Douglas and Charles Mix, and the other from Sioux Falls through Minnehaha, Lincoln, Yankton and Bonhomme counties to Bonhomme.

Southern.—This company has given a contract to William J. Oliver, of Knoxville, Tenn., at $1,000,000 to double track its line from Morristown to Knoxville and build a line from Chattanooga, Tenn., southwest to Stevenson, Ala.

Southern Traction.—An officer writes that bids for building this proposed road will be let October 15. The route runs from Altoona, Pa., south through South Altoona, Eldorado, Canan Beryl, Duncansville, Newry, Freedom and McKees to Roaring Springs, with a loop starting from a point on the main line at Beryl and running east through Hollidaysburg, and thence west to the main line at Duncansville. The work will be easy, with light grades and curves. It includes one overhead crossing and nine small steel bridges. F. G. Patterson, Pittsburg, Pa., is President, and H. C. Gwin, of Altoona, Pa., Chief Engineer.

Texas, Oklahoma & Northwestern.—A charter has been granted to a company in Oklahoma under this name, with a capital of $2,500,000, to build a railroad 450 miles long. The proposed line runs from a point on the boundary line between the Chickasaw nation and Caddo County, in Oklahoma Territory, northwest to a point on the Cimarron river, in Woodward County, traversing the counties of Caddo, Custer, Dewey and Woodward; also an eastern line through the counties of Blaine, Kingfisher and Logan to Guthrie, and a western line through the counties of Roger Mills and Day. Connection will be made with the Lindsay, Washita & Western, giving connection with western Oklahoma, Texas and Kansas for the coal deposits along the latter road. The directors are: A. H. Huston, John Deveraux, Charles Seeley and C. E. Carpenter, of Guthrie, and Henry Knapp, of New York.

Tonopah.—This company, which operates a road from Sodaville, Nev., on the Carson & Colorado division of the Southern Pacific southeast to Tonopah, a distance of 65 miles, has filed an amendment to its charter, seeking permission to build an extension from Goldfield, to which point it is now building, to Bullfrog, a distance of about 80 miles. Work is to be started at once.

Union Pacific.—Plans, it is said, have been completed by this company to double track its main line for a distance of about 70 miles in Wyoming. Surveys are also being made locating a cut-off from South Omaha west to Valley, a distance of about 25 miles.

Vincennes, West Baden & Louisville Traction.—This company has let a contract to a Pennsylvania contractor to build its line from Vincennes, Ind., via Jasper to French Lick at about $2,000,000. A contract has also been given to a Philadelphia company to build the power works, either at Pittsburg or Otwell, for about $300,000.

Virginia Roads.—A corporation has been formed, with headquarters at Newport News, Va., for the purpose of building a railroad from that place to Yorktown. The company, which is capitalized at $300,000, proposes to use gasoline motor cars. W. A. Post, President of the Citizens' Railway, Light & Power Co., is named as President; J. L. Patton, Vice-President; C. M. Graves, Jr., of Norfolk, Secretary, and Arthur Lee, Treasurer.

Western Ohio (Electric).—This company has completed its line from Findlay to Lima, Ohio, giving an indirect electric road from Cincinnati to Cleveland. The route from Cincinnati to Dayton is by the Cincinnati, Dayton & Toledo. (April 7, p. 111.)

Yazoo & Mississippi Valley (Ill. Cent.).—An officer writes confirming the report that this company is building a branch line from Philipp, in Tallahatchie County, Miss., north into the Delta country for a distance of 14.66 miles. (See Illinois Central, Sept. 8, p. 79.)

Yellowstone Park (Oregon Short Line).—Under this name, a company has been incorporated to build a railroad from St. Anthony, in Freemont County, Idaho, southeast through the town of Marysville and over the main divide of the Rocky Mountains by way of Rea's pass through the section forming the western boundary of Yellowstone Park, a distance of about 75 miles; also to build a line from a point on the Oregon Short Line at St. Anthony east for a distance of 20 miles and thence south 50 miles to Victor, in Bingham County. The offices of the company will be at Pocatello, and the incorporators include: W. H. Bancroft, E. Buckingham, P. L. Williams, William Ashton and others, of Salt Lake, and T. J. Duddleson, of Pocatello.

RAILROAD CORPORATION NEWS.

Boston & Maine.—The Connecticut River, which is leased by the Boston & Maine, has purchased the Vermont Valley, 24 miles long, running from Bellows Falls, Vt., south to Brattleboro and controlling the Sullivan County, which runs from Bellows Falls, north to Windsor, 26 miles. This gives the Boston & Maine a continuous line from Springfield, Mass., to Windsor, Vt., except between South Vernon, Vt., and Brattleboro, 13 miles, over which the Boston & Maine has trackage rights on the Central Vermont. From Windsor north to the Passumpsic division at White River Junction, 14 miles, the track of the Central Vermont is used.

Chicago Electric Traction.—This company has been sold to a syndicate of Indiana capitalists for the equivalent of $650,000 cash and $200,000 in stock of the Interurban Electric Co., of Indiana. It is said that through this sale the latter company will obtain a Chicago terminal as soon as its line from Harvey, Ill., to Kankakee is built.

Chicago, Indianapolis & Louisville.—The gross earnings of this company for the year ended June 30 were $5,609,750, an increase of $309,127, and net earnings, $1,979,710, an increase of $95,256. The total income was $2,140,142, and the surplus, $1,104,948. The company paid 4 per cent. dividends on its $5,000,000 preferred stock and 2½ per cent. on its $10,500,000 common stock, leaving a balance of $628,198, a decrease of $130,664. The operating ratio was 64.7 per cent. This company is controlled by the Louisville & Nashville and the Southern, who acquired 93 per cent. of the common stock and 77 per cent. of the preferred stock in 1902.

Kansas City, Mexico & Orient of Texas.—The Panhandle & Gulf, which is the completed portion in Texas of the Kansas City, Mexico & Orient, has filed an amendment to its charter changing its name to the Kansas City, Mexico & Orient of Texas.

Kentucky & Tennessee.—H. C. Barroll & Co., Chicago, are offering at 100 and interest $650,000 of this company's first-mortgage 6 per cent. serial bonds issued in 1905. The Stearns Salt & Lumber Co. guarantees the principal and interest of these bonds, which are part of an authorized issue of $850,000. The proposed road is to run from Stearns, Ky., westerly and southwesterly into Tennessee for 60 miles. The bonds are also secured by timber lands, coal mines, mills and other structures owned by the company in Tennessee and Kentucky.

Manistique, Marquette & Northern.—This company, with the car ferry operated in conjunction with it, has been sold under foreclosure proceedings for $1,250,000 to the Union Trust Co., of Detroit, this price being $130,000 more than the bonded indebtedness. It is not unlikely that the road will be acquired by the Grand Rapids & Indiana.

New York Central & Hudson River.—In the quarter ended September 30 (figures for this year partly estimated), the gross earnings of the entire system east of Buffalo were $23,281,500 an increase of $2,266,100 over 1904. Operating expenses increased $1,848,600, leaving an increase of $417,500 in net earnings, which were $7,452,000. The operating ratio for the whole was 67.99 per cent., while the operating ratio on the additional business gained over last year was 81.6 per cent. For the nine months ended September 30, gross earnings were $62,471,100, an increase of $4,982,900. Operating expenses increased $3,010,300, leaving an increase of $1,972,600 in net earnings, which were $18,401,400. The operating ratio for the whole was 70.54 per cent., while the ratio on the nearly $5,000,000 of increased business was 60 per cent. For the nine months, the balance available for dividends was 4.80 per cent., out of which dividends of 3.75 per cent. were paid.

Oregon Short Line.—Kinnicutt & Potter, of New York, are offering at 96 and interest $500,000 4 per cent, refunding gold bonds of 1929. These bonds are a part of an authorized issue of $100,000,000.

Panhandle & Gulf.—See Kansas City, Mexico & Orient of Texas.

Temiskaming & Northern Ontario.—This company is negotiating in London for the direct issue of $7,000,000 bonds. Of this amount, $6,000,000 will be used to refund the original loan from the government and the remaining $1,000,000 will complete the payment of the floating debt that has been incurred for building the line to its present terminus, which is 100 miles north of New Liskeard.

GENERAL NEWS SECTION

NOTES.

It is reported that the survey camps along the Grand Trunk Pacific lines under construction east of Winnipeg, are to be put into communication with headquarters by wireless telegraph.

Oregon papers say that the Oregon Railroad & Navigation Company is to use oil for fuel in locomotives between Umatilla and Huntington; also that the roadbed will be oiled to keep down the dust.

A press despatch from Washington says that Mr. Garfield, Commissioner of Corporations in the Department of Commerce and Labor, is to investigate transportation corporations in the same way that he has investigated the beef industry.

The Senate Committee on Interstate Commerce—the Elkins Committee—is to meet at Washington, October 15. It is said that the record will not be reopened for any general hearing, but an exception to this rule will be made in favor of Mr. E. P. Bacon.

A press despatch from Austin says that the principal railroads of Texas have begun injunction proceedings against the state authorities to prevent the enforcement of the law, recently passed, taxing the railroads one per cent. on their gross receipts.

At Little Rock, Ark., the St. Louis, Iron Mountain & Southern is being prosecuted in court for issuing free transportation to State officials and members of the legislature, contrary to the law, which prescribes a fine of from $200 to $250 against both the railroad and the officials in such cases.

The Secretary of War, who has just returned from the Philippine Islands, traveled from Yokohama to Washington in 14 days, 8 hours, the shortest time on record for that journey. From Chicago to Washington (788 miles) Secretary Taft was carried in a special train in 18 hours, 57 minutes.

An officer of the Pan-American Railway Company, the lines of which lie in the hot regions of Mexico, is quoted as saying that during June, July and August not a single employee of the company missed a day of work on account of sickness. This happy result is attributed to the rigid enforcement of hygienic rules.

The Missouri Pacific in replying to a citation for contempt of court tells the United States Circuit Court at Kansas City in substance that it is not guilty of the charge of paying rebates to the Hutchinson & Arkansas River Railroad. A through rate agreement was made with this road on the belief that it was a genuine railroad, and when it was found to be only a yard track of the Hutchinson & Kansas Salt Company the agreement was cancelled.

According to Pittsburg papers, the superintendent of the Middle division of the Pennsylvania has issued an order forbidding employees to accept gifts from shippers. This order has not been occasioned by the discovery of "graft" in connection with some hundred thousand dollar contract; but, according to the reports, is due to trouble which somebody has had over four quarts of milk, at a station where some shipper of milk happened to be unusually generous.

Near Ballard, Washington, on the night of October 2, a passenger train of the Great Northern was stopped by robbers and the express car was blown up with dynamite. It is said that the robbers secured about $1,000. While the robbers were breaking open the safe in the express car, two boys, who had been riding with them on the "blind baggage," but who say they were not members of the gang, went through the passenger cars and "held up" the passengers for their valuables. It is said that the boys had no firearms. The boys were arrested but the dynamiters escaped.

The fall movement of freight appears now to be heavy in all parts of the country. A scarcity of freight cars is reported at Chicago and many other places, and of locomotives at some places. In the bituminous coal traffic to the Atlantic seaboard the strife among shippers for cars is said to be severe. The New York Central, the Reading and the Baltimore & Ohio have issued orders forbidding the loading of their coal cars to points off their own lines. The Reading is short of cars for the anthracite trade also. The movement of iron and steel from Pittsburg is said to be the heaviest in the history of the city.

It is announced in Washington that Interstate Commerce Commissioner Joseph W. Fifer, formerly Governor of Illinois, has resigned, the resignation to take effect three or four months hence. The reports say that the resignation is due to conditions in Mr. Fifer's family and his desire to avoid spending another winter in Washington; but on the same day that this announcement is published the news comes from Chicago that ex-Governor Yates of Illinois is to have Commissioner Fifer's place, Mr. Yates having accommodatingly taken himself out of the way of Senator Cullom's plans for re-election to the Senate.

Testifying before the Interstate Commerce Commission at Chicago last week President E. P. Ripley, of the Atchison, Topeka & Santa Fe, said that the rate on dressed beef between Kansas City and Chicago should be 150 per cent. higher than the rate on livestock. He said it cost less to carry livestock than packing-house products. He read a table showing the cost of hauling carload lots of livestock, dressed beef and packing-house products from Kansas City to Chicago, as follows: "Car of dressed meat, Kansas City to Chicago, $82.19; packing-house products, $85.03, and livestock, $64.77." Mr. Ripley claimed that his company lost money on every car of dressed beef hauled between Kansas City and Chicago.

The State Railroad Commission of Georgia has issued a rule requiring railroads to reweigh carloads of coal and lumber at destination if the consignee so requests. The request must be made within the free time for delivery, and must be accompanied with a deposit of $2, which money is to be refunded if the actual weight proves to be more than 500 lbs. different from the billed weight. The weighing must be done by a sworn weigher in the presence of the consignee and must show the tare—which apparently means two weighings. In case the billed weight is found correct, the two dollars apparently goes to the railroad company. The most beautiful flower of state regulation to be found in this order is, however, a paragraph at the end, which says that the free time for unloading reweighed cars shall begin the next day after the weighing. Where the free time is 48 hours, the consignee who desires 96 hours can at the forty-seventh hour request the reweighing, and his second free-time period will begin the next morning at seven o'clock.

Railroad Y. M. C. A.

At the annual convention of the Railroad Young Men's Christian Associations, at Detroit, last week, it was stated that the number of paying members of such associations is now 74,000, an increase of 12,000 in two years. Associations for street railroad men are now running in three cities. Six traveling railroad secretaries are employed by the International Committee.

Next, an Otoloryngologist.

Officers of the St. Paul and the Illinois Central will grant, it is reported, the request of the Brotherhood of Locomotive Engineers for experienced oculists to ride on engines to determine the condition of the engine drivers' and firemen's sight.—*Exchange.*

In the Bottom Drawer of the President's Desk.

President Roosevelt has returned to Washington and is crowded with business. On his first day Senators Foraker, Dick, McCumber, Burkett, Hemenway and Fulton were among the scores of visitors granted interviews. All came away with one distinct impression—that the President is determined in his stand for practical, adequate and uncompromising rate legislation. He has written that part of his message which deals with this subject, and it has been laid away as a finished product not to be disturbed or revised. The best part of the summer was spent upon it, and the argument is believed by those who have been taken into the President's confidence to be complete and unanswerable. The majority in the Senate will have difficulty in evading the responsibilities that the President puts upon them.—*Washington despatch.*

The Wisconsin Railroad Law.

The new Wisconsin railroad law was framed under the personal direction of Mr. E. P. Bacon, and had the full approval of Governor La Follette; and a majority of the people of the state gave it express or tacit approval by electing Mr. La Follette Governor. But the citizens have not found perfect satisfaction in their new law. One of its provisions was the prohibition of free passes, but now they find that this works against the interests of the state. Large areas of vacant lands in the north have been settled by immigrants who were brought there by real estate agents, and the real estate agents were able to carry on their business because the railroads gave them free or reduced-rate transportation, but they don't get the passes and the immigrants don't come. The railroads are also forbidden to make reduced rates for harvest hands and a farmer must go without the temporary help which he has depended upon in the harvest season. Persons traveling for pleasure can no longer stop over in Wisconsin, the new law forbidding

stop-overs. Even the inmates of soldiers' homes have been chilled by the new law, as they now have to pay their fare when they ride. As for freight rates, the shippers of the state are trembling in their shoes lest somebody shall precipitate a lot of reductions which will deaden manufacturing business.—*Milwaukee Correspondent of the New York Journal of Commerce.*

The Stiles Locomotive and Car Journal Bearings.

The accompanying illustrations, Figs. 1 and 2, show the Stiles locomotive driving bearing made by the A. C. Stiles Anti-Friction Metal Company, New Haven, Conn. The crown of this bearing is formed with a longitudinal groove, from which a number of passages lead transversely to longitudinal channels formed in the inner face of the bearing. Lubricant is applied through the groove in the crown and passes through the inner passages to the longitudinal channeds at the side opposite to the way in which the journal revolves and is carried up between the rubbing surfaces, lubricating the whole surface of the bearing. The usual oiling method provides a channel or oil holes feeding the lubricant at the crown of the bearing. This, it is claimed, causes two troubles; first, it weakens the bearing at the crown, the point where the wear is the greatest; second, the journal sets closest at this point, affording the least possible opportunity for the lubricant to feed. As the revolution of the journal is down from the oil holes and so little of the lubricant can feed on account of the pressure there, it follows that by the time the journal has revolved its last quarter, the lubricant has been pretty well used up. With the Stiles method of feeding from the side the oil is fed at a favorable point on the upper thrust and is carried up and over the entire bearing surface. If desired the channels on one side of the bearing can be filled with tallow, which will remain in place until the journal becomes hot, which might occur on account of neglecting to oil the journal at the proper time. Should this occur, the tallow would supply lubricant for a time and thus prevent a hot journal.

Fig. 3 shows the Stiles car journal bearing. It consists of a bronze shell which is claimed to be of exceptional durability. The bearing point is of the same curvature as the journal, so that should the babbitt be melted out from any cause, the journal would find a perfectly fitting body to run in. Babbitt is interlocked to the shell as shown in the cut, and as the journal wears the babbitt lining it rests in a bed fitted to it at all times. Even after the bronze shell has begun to wear the journal is at all times protected. This is shown in Fig. 4, which is a reproduction of a Stiles bearing which ran upwards of 72,000 miles. In this case the babbitt was completely worn down and the bronze shell had begun to wear. Several of the large railroads are experimenting with this new bearing and interesting results are looked for.

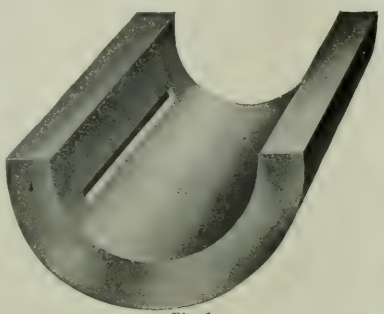


Fig. 1.

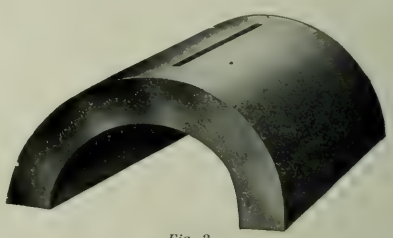


Fig. 2.

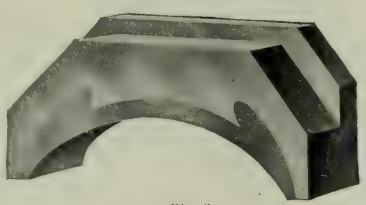


Fig. 3.

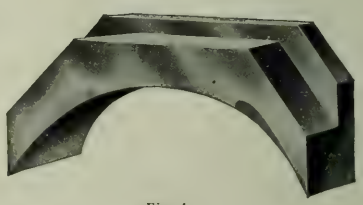


Fig. 4.

The "Stiles" Locomotive and Car Journal Bearings.

B. & O. Improvements on Staten Island.

The Staten Island Rapid Transit Company (controlled by the Baltimore & Ohio), is now engaged in a large amount of new construction work. A dock 476 ft. long by 51 ft. wide, a lighterage pier 485 ft. long and 30 ft. wide, and a car unloader and a new double track foreign freight pier are to be built at Tompkinsville, the freight pier being 800 ft. long and 100 ft. wide. The New York State Construction Company has the contract for building an extension of dock No. 2 and the extension of stone dock No. 5, which, when completed, will give a storage capacity for about 400 cars of stone. The General Contracting and Engineering Company, of New York, is building a new lighterage pier, stone dock and bulkhead at St. George; the pier will be finished about Oct. 15, and the stone dock by Nov. 1. The contract for the new covered pier at Tompkinsville, which will cost in the neighborhood of $300,000, will probably be awarded in the near future.

The entire line from Clifton Junction to Arthur Kill bridge has already been relaid with 85-pound steel rails, and the Rockland Lake Trap Rock Co., of New York, has the contract to furnish the ballast. The trestles at Livingston and Port Richmond and on the east side of the Arthur Kill bridge are being filled, requiring about 5,000 carloads of material to do it. The entire Rapid Transit Division is now automatically block signaled from South Beach to Arlington. A new freight station has been built at Tompkinsville, and a coal and ash handling plant for coaling locomotives at St. George. New waiting sheds and platforms have been built at Port Richmond and Stapleton, and five new switching engines have been ordered for use at St. George. On the Baltimore & New York Railway, which is a part of the Rapid Transit Railway running between Arthur Kill bridge and Cranford Junction, the line has been double tracked for a mile east of Cranford and the entire line will be ballasted with stone. About 3,000 carloads of material have been used in filling the long trestle over the Pennsylvania Railroad at Linden Junction, N. J., and the new eastbound yard at Cranford Junction will be completed by Oct. 15.

Local But Important.

It was rumored yesterday that the Oregon Railroad and Navigation Company was going to put in three new ties and a frog in the yards here. Realizing the error of our ways in the past on railroad news, we determined to follow the example set by the only authoritative railroad sheet in the State, and accordingly we telephoned Mr. J. P. O'Brien (General Manager of the road), the Oregon boy, whom to know is to love, and received the following, which made us feel as if an annual pass wasn't so far off, after all: "No truth in the rumor as to frog. Ties correct." There you are.—*Baker City* (Oregon) *Herald.*

Summary of British Railroad Returns for 1904.

The returns relating to the capital, traffic, receipts and expenditure of the railroad companies of the United Kingdom for 1904 and the Board of Trade report thereon, show that the total amounts of railroad capital at the end of 1904, compared with the corresponding amounts at the end of 1903, mark an increase of 114⅛ million dollars. The proportions which these various classes of stock bore to the total paid-up capital differed, however, but slightly from those that had been obtained at the end of the previous year. In 1903 the increase over 1902 was 136 million dollars. The following table shows the amounts paid up at the end of 1904, and nominal additions:

	Total paid-up capital.		Amt. in paid-up capital*	
Class of stock.	1904. Million $.	Increase in 1904 over 1903. Million $.	1904. Million $.	Increase in 1904 over 1903. Million $.
Ordinary stock	2,330	37.8	428.	5.83
Guar. and preferred stock	2,170	44.7	296.	2.43
Loans and debenture stock	1,650	31.6	215.	2.92
Total	6,150	114.1	939.	11.18

*Amount included in paid-up capital, representing nominal additions on the consolidation, conversion and division of stocks.

The average dividends paid on the various classes of capital in 1904 were practically the same as in 1903, with the exception of the rate of interest on loans, and were approximately 3¼ per cent. on the ordinary capital, 3½ per cent. on the preference, 4 per cent. on the guaranteed, and 3½ per cent. on the debenture stock. The rate of interest on loans, however, fell from 4.46 to 4.11 per cent. The proportion borne by the actual net earnings to the total capital was 3.36 per cent. as compared with 3.40 per cent. in 1903.

Excluding the nominal additions to capital, however, the proportion would be 3.97 per cent.

The gross receipts of the companies from passenger and freight traffic as compared with 1903, are shown below:

Receipts from	1904. Million $.	Increase Amount. Million $.	Increase Per cent.
Passenger traffic	235.	1.95	0.9
Freight traffic	269.	1.46	0.5
Total	504.	3.40	0.7

In passenger traffic a slight decrease in the receipts from ordinary passengers was more than balanced by an increase in season ticket receipts:

Receipts from	1904.	Increase (+) or decrease (—) Amount.	Per cent.
Ordinary passengers:			
First-class	$16,700,000	(—) $481,000	(—) 2.8
Second-class	15,900,000	(—) 325,000	(—) 2.0
Third-class	143,000,000	(+) 528,000	(+) 0.4
Season ticket holders	19,400,000	(+) 679,000	(+) 3.6
Parcels, mails, horses, etc.	40,400,000	(+) 1,640,000	(+) 4.2
Total	$235,400,000	(+) $2,041,000	(+) 0.9

The average receipts for all classes fell from 14.8 cents to 14.6 cents.

Receipts from each branch of freight traffic in 1904 and 1903 are shown in the table below:

Receipts from	1904.	Increase (+) or decrease (—) Amount.	Per cent.
Minerals	$125,000,000	(+) $1,560,000	(+) 1.3
General merchandise	138,000,000	(+) 170,000	(+) 0.1
Live stock	6,840,000	(—) 321,000	(—) 4.5
Total	$269,840,000	(+) $1,409,000	(+) 0.5

The tonnage of minerals conveyed was 349.6 million tons, an increase of 5.9 million tons, or 1.7 per cent., while that of general merchandise was 100.3 million tons, an increase of 0.3 million tons, or 0.3 per cent.

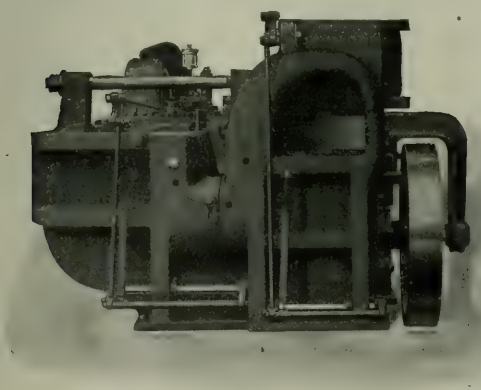
The total operating expenses in 1904 amounted to $336,000,000, an increase of $2,970,000, or 6.9 per cent., but the proportion of expenses to receipts was the same as in 1902 and 1903, namely, 62 per cent. In 1901 the proportion was 63 per cent., the highest ever reached. Below will be found a comparison in different items of expenditure:

	1904. Million $.	Million $.
Maintenance of way	51.4	(+) 0.34
Locomotive power	89.8	(—) 0.146
Carriages and wagons	27.4	(+) 0.243
Traffic expenses	99.4	(+) 0.585

The total increase under these four heads was $1,020,000, which compares with an increase under the same heads in 1903 of $1,850,000. The mileage of railroads open for traffic in 1904 was 22,634 miles, as against 22,435 in 1903, of which totals 12,590 miles and 12,500 miles respectively were double line or more. Net earnings in 1904 (after deducting working expenditure) were $207,000,000, representing an increase of $1,620,000, or 0.8 per cent., but the proportion of net earnings to total capital shows a decline of 0.04 per cent.

The New Ajax Universal Forging Machine.

The new Ajax universal forging machine shown in the accompanying illustration, while retaining all the features of the well-known Ajax heading, upsetting and forging machine, has in addition a powerful vertical press which can be used for forging, bending and trimming. This press has a vertical movement of from 3 in. to 5 in., according to the size of the machine. There is a screw adjustment to the stroke of the head which enables the operator, when setting the dies, to bring them to the exact point desired. The vertical movement of the head is obtained by heavy links connected at the lower end with levers on which are eccentric hubs which give the head the desired throw or stroke. These levers in turn are connected to a slide placed horizontally in the machine and actuated by an eccentric shaft in the back end of the machine. The mechanism that operates the vertical forging press is entirely separate and independent of that which operates the forging machine, although both are in the one bed. The forging press is operated by depressing the pedal shown on the right of the machine. This allows the lock, between the eccentric shaft and header slide, to drop into place and the operator can give one or more blows as desired. On taking the foot off the pedal the lock is released automatically and the forging press comes to a stop with the dies wide open.

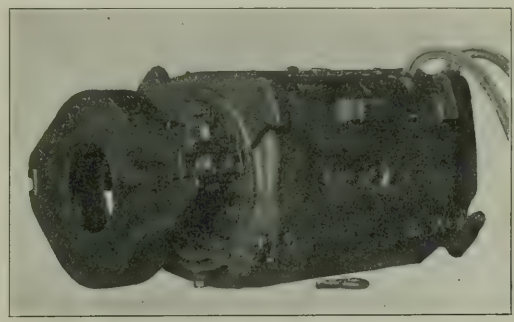


The New Adjax Universal Forging Machine.

The locking device for the forging press is the same as used in the Ajax heading, upsetting and forging machine. By using this machine it is claimed that forgings can be made at a much lower cost than formerly through the saving of heats and handling, and many intricate forgings heretofore impossible to make on forging machines can be readily turned out by this tool. These machines are built in seven sizes, known to the trade as A, B, C, D, E, F and G, and the bed is of the box form type, cast solid in one piece. The weights of the machines vary from 18,000 lbs. for the A machine to 180,000 lbs. for the G machine. This tool is made by the Ajax Mfg. Co., Cleveland, Ohio, and is the invention of J. R. Blakeslee, Jr., General Manager of the company.

A New Design of Railroad Motor.

The accompanying illustration shows a new design of railroad motor made by the Westinghouse Electric & Mfg. Co., New York. The smallest motor of the new design has a capacity of 75 h.p. and the largest 200 h.p., with a number of sizes between the two. Limitations are naturally placed on the size and construction of a railroad motor by the amount of available space on the truck of the car; therefore a frame of square cross-section has been adopted as utilizing this space most advantageously. All motors in this line have cast-steel frames split at an angle of 45 deg. with the horizontal. The axle bearings are carried by the lower half of the field frame and are divided at an angle of 35 deg. with the perpendicular, so that the weight of the motor is supported almost entirely by the part of the frame extending over the axle rather than by the axle cap bolts. By lifting off the upper half of the field casting the armature may be removed from the frame without taking the motor from the truck; or the motor may be removed from the truck by simply taking off the gear case and axle caps. The housings for the armature bearings are circular in form and are turned slightly larger in diameter than their seats in the frames so that when clamped in place all the advantages of a press fit are obtained. Finished shoulders on the housings prevent any lateral movement and also take the entire end thrust of the armature instead of imposing this severe strain on the clamping bolts.



A New Westinghouse Railroad Motor.

The armature bearings are made of solid phosphor-bronze bushings, with a $^{3}/_{32}$-in. lining of babbitt metal. Both oil and waste lubrication are provided. The waste comes in contact with the bearings on the low pressure side and is supplied with oil from separate pockets from below; in this way it is filtered before reaching the bearing. The amount of oil in the reservoirs may be gaged so that it may be kept at the proper level for economical service. With intelligent care, it is claimed that these bearings will run 100,000 to 150,000 miles.

The axle bearings are similar in construction to those of the commutator, except that split bushings are used. Pole pieces are built up of punchings of soft steel, and are bolted to the top, bottom and sides of the motor frame, which being almost square in cross-section permits the use of flat field coils. The armature core is also built up of steel punchings and is keyed on a cast-steel spider which carries the commutator. The shaft is forced

into the finished armature and is keyed to it, and may be removed, should necessity arise, without disturbing the windings or commutator. The armature coils are strap wound and made in two parts. As the top coils are more liable to injury this design makes it possible to remove the damaged part without disturbing any other part of the winding. The coils are liberally insulated with mica, and sealed and further insulated by dipping in varnishes which are oil-proof and moisture-repelling. On each end the armature slots are made deeper and wider, thereby providing space for mica cells, which greatly reinforce the insulation at these points. As a further protection fiber strips are taped to the upper sides of the top coils. A bell-shaped flange at the pinion end and a cylindrical flange on the commutator end form rigid supports for the windings. Countersunk bands of steel wire on the core and wide bands outside the core hold the coils firm and secure. Openings through the spider and core allow a free passage of air, which is thrown forcibly against the field coils, thus maintaining a low temperature throughout the motor. The commutators are made up of a number of hard drawn copper bars with short necks, carefully insulated from each other and held securely between insulated V rings. The brush holders are of the sliding type with springs of phosphor-bronze. The tension of the spring may be adjusted without removing the holder from the motor. The brush holder proper is bolted to an insulated guide and may be removed without disturbing the insulation or connections. Leads of flame-proof flexible rubber-covered cable are brought out at the front of the motor over the commutator through insulating bushings. Access to the brushes and brush-holders is provided through a large opening in the frame over the commutator which extends well down the side, making inspection easy from the pit. A hole in the rear end bell and an opening under the commutator provide means for inspecting the clearance between the armature and field poles.

Manufacturing and Business.

The Madison plant of the American Car & Foundry Company has added to its equipment 100 "Boyer" long stroke riveting hammers, made by the Chicago Pneumatic Tool Co., Chicago.

At a meeting of the Board of Directors of the Railway Steel-Spring Company, New York, held September 29, 1905, Mr. F. F. Fitzpatrick was elected Vice-President of the company and manager of its Sales Department.

The Enterprise Railway Equipment Company, Chicago, has filed papers of incorporation at Springfield, Ill., for the purpose of making railway supplies. The incorporators are: James T. Milner, Argyle Campbell and Ambrose Risdon.

The Ingersoll-Rand Company, New York, has opened a branch office at Houghton, Michigan, under the management of Mr. T. F. Lynch. At the new office a complete stock of repair and duplicate parts for all Ingersoll-Rand machinery will be carried.

Mr. O. A. Stranahan has been appointed as sales manager and M. C. Miller has been appointed as assistant sales manager of the Allis-Chalmers Co., Milwaukee, Wis. W. T. McCaskey has also been appointed as special representative of the above company in matters pertaining to the equipment of interurban railroads and hydro-electric projects.

Compressed Air, a modest monthly publication at No. 11 Broadway, New York, has in its September issue a full description of the method of working the Iselin colliery of the Pittsburg Gas Coal Company. The illustrations show in detail not only the methods of using compressed air, but also the interesting engineering features of this considerable undertaking. It is worth while to those who are interested in this subject.

The International Acheson Graphite Company, of Niagara Falls, N. Y., has doubled the capacity of its plant for creating graphite in the elctric furnace, and has contracted with the Niagara Falls Power Company for another 1,000 h.p. of electrical energy in addition to the 1,000 h.p. previously used. The commercial importance of this artificial graphite may be estimated from the fact that the United States Geological Report for 1904 states that for that year the value of Acheson graphite produced was $217,790, while all the graphite mined in this country amounted to $341,372. New York state, which is considered rich in deposits, according to the official report of 1904 produced natural graphite worth $119,509. Acheson graphite is largely used in the manufacture of metal protective paints, dry batteries, stove polish, packing and as a lubricant. The electro-chemical processes also consume an extensive supply.

Iron and Steel.

The Illinois Central is ready to order 75,000 tons of rails, and the Rock Island 60,000 tons.

The Colorado Southern, New Orleans & Pacific has ordered 31,000 tons of rails to be delivered at Fort Worth.

The Grand Trunk Pacific has inquired in Scotland for 30,000 tons of rails. This company recently ordered delivered 5,000 tons of rails of the United States Steel Corporation.

Efforts are being made by car companies to place blanket contracts for structural shapes and plates for delivery during the first half of 1906. One company is in the market for upward of 25,000 tons, and is finding difficulty in placing the contract.

The Jones & Laughlins Co. has plans ready for the extension of its mills on the South Side (Pittsburgh). No. 13 mill is to be enlarged. It is reported that the company is preparing to remove its bridge department from the South Side Works to Colonia, near Monaca.

Business in structural material continues brisk, railroads being the largest buyers. The American Bridge Co. has booked an order for about 1,200 tons of steel for a new bridge for the Birmingham & Atlantic. It is expected that the contract for supplying the 12,000 tons of steel for the new Ohio river bridge at Ironton, Ohio, will soon be let. The 160,000 tons required by the New York Central is said to have been ordered. The Carnegie Steel Co. has just booked orders for 50,000 to 60,000 tons of rails for 1906 delivery and it is estimated that the total tonnage of rails booked by the mills for 1906 delivery is now between 1,800,000 and 2,000,000 tons, of which the Illinois Steel Co. has secured more than half. The Republic Iron & Steel Co. also has obtained some big orders within the last week. Contracts for steel plates are being placed in large volume. Orders for plates and small shapes, aggregating about 50,000 tons, for 10 additional lake ore boats, have just been taken by the Carnegie Steel Co. and the Illinois Steel Co., and orders for 50,000 tons additional will soon be given by shipbuilders.

PERSONAL.

—Mr. S. M. Prevost, Third Vice-President of the Pennsylvania, died at his home in Philadelphia last Saturday at the age of 61. He was born in Philadelphia. He graduated from the Polytechnic College there and entered railroad service as rodman in an engineer corps engaged in the construction of the Philadelphia & Erie. In 1871, he was appointed Assistant Engineer of Maintenance of Way on the Philadelphia division of the Pennsylvania, and in 1874 was promoted to be Superintendent of the Bedford division. He advanced through various positions until May 1, 1885, when he was made General Superintendent of Transportation of the Pennsylvania Lines East of Pittsburg. He was appointed General Manager in 1895, and elected Third Vice-President in 1897. He was a director of the Baltimore & Ohio, the Chesapeake & Ohio, the Norfolk & Western, and of other companies.

—Mr. W. H. Newell, who was recently made Superintendent of Transportation of the First division of the Atlantic Coast Line, was born in 1857, and began railroad work on that road in 1877 as telegraph operator. He was successively agent-operator, freight conductor, passenger conductor and station master until 1893, when he was made trainmaster at Norfolk, Va. In 1898, he was appointed Assistant Superintendent of the Norfolk district, and in 1902, Superintendent of that district. He was transferred to the Charleston district last April, and now leaves that place to accept his present appointment.

—Mr. W. E. Knox, who has been appointed General Freight Agent of the Atlanta & West Point and the Western of Alabama, entered railroad service in 1879 as a telegraph operator on the Cincinnati & New Orleans. In 1887, he became Superintendent and General Freight and Passenger Agent of the Tennessee & Coosa. In 1888, he went to the Anniston & Cincinnati. This road was soon consolidated with the Louisville & Nashville, and in August, 1893, Mr. Knox was made Superintendent of the Louisville & Nashville at Anniston, holding that position until August of this year, when he was appointed general agent at the same place. He was appointed to his present position on September 17.

—Mr. J. M. Brown, who was recently appointed Engineer of the Central district of the Chicago, Rock Island & Pacific, began railroad work in a surveying party of the Burlington, Cedar Rapids & Northern in 1879. He was in charge of some construction for that road and was also engaged in office and maintenance of way work until 1890, when he was made Division Engineer. During the three years beginning in 1899 he had charge of construction of lines in northern Iowa and Minnesota and of terminals at St. Paul and Minneapolis. In 1903, he went to the Rock Island, where he took charge of the construction of the Moline shops. In 1904 he was appointed Engineer of the Cedar Rapids division, where he remained until appointed to his present position.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—P. J. Harrigan, General Foreman at Connellsville, Pa., has been appointed Master Mechanic, retaining his former headquarters.

Buffalo, Rochester & Pittsburg.—W. R. Shoop has been appointed Purchasing Agent, with office at Rochester, N. Y.

Canadian Pacific.—O. O. Winter, Division Superintendent at Fort William, Ont., has not resigned, as was reported.

Chicago, Rock Island & Pacific.—W. L. Darling, Chief Engineer, has resigned, effective on the appointment of a successor.

W. J. Leahy, Assistant General Passenger Agent at St. Louis, has been appointed First Assistant General Passenger Agent with office at Chicago.

Columbia Southern.—J. P. O'Brien, Vice-President and General Manager of the Oregon Railroad & Navigation, has been also elected President of the Columbia Southern.

Cumberland Valley.—A. J. Cassatt, President of the Pennsylvania, has also been elected President of this road, succeeding the late Thomas B. Kennedy.

Erie.—Robert Bacon, who was recently appointed Assistant Secretary of State, has resigned from the board of directors of the Erie.

Grand Trunk.—The lines and branches heretofore known as the Canada Atlantic are now operated as the Ottawa division of the Grand Trunk. It is divided into three districts, to be known as the Thirtieth district, 175 miles; Thirty-first district, 151 miles, and Thirty-second district, 134 miles.

M. Donaldson has been appointed Superintendent of the Ottawa division, and James Ogilvie, Master Mechanic, both with headquarters at Ottawa, Ont.

Great Northern.—H. A. Kennedy, Assistant General Superintendent with headquarters at Spokane, Wash., has been appointed Acting General Superintendent during General Superintendent T. Slade's extended leave of absence.

Marietta, Columbus & Cleveland.—J. T. Blair, President of the Little Kanawha, has been also elected President of the Marietta, Columbus & Cleveland, succeeding D. I. Roberts, resigned. A. H. Blair has been elected Secretary and Treasurer. Samuel D. Brady, Chief Engineer of the Little Kanawha, has been also appointed Chief Engineer of the Marietta, Columbus & Cleveland. The general offices are at Marietta, Ohio.

Mexican Central.—James Piper has been elected Secretary.

Missouri Pacific.—The lines of this company and of the St. Louis, Iron Mountain & Southern are now operated in three grand districts. The Northern district, operating 2,487 miles, consists of the line from St. Louis to Pueblo, Colo., via Kansas City; from Kansas to Omaha and intermediate branches; from Kansas to Virginia, Neb., including the Leavenworth branch; from Atchison to Lenora and intermediate branches, and from Topeka to Fort Scott and the Great Bend branch.

The Southern district, operating 1,864 miles, consists of the line from St. Louis to Texarkana via Little Rock, with intermediate branches in Missouri; from Thebes to East St. Louis and intermediate branches; from Knobel to Helena; from Bald Knob to Memphis; from Little Rock to Alexandria; from Latour to Clayton; from Arkansas City, Ark., to Warren; from White to Vidalia, and from Gurdon to Eldorado.

The Central district, operating 1,991 miles, consists of the line from Pleasant Hill to Joplin and intermediate branches; all lines in Kansas south of the main Kansas City-Pueblo line, except the line from Fort Scott to Topeka and Great Bend branch, but including the Kanopolis branch; also the line from Coffeyville to Fort Smith Crossing, including intermediate branches, and from Carthage to Diaz, including intermediate branches.

E. A. Gould, heretofore General Superintendent of the Missouri Pacific at Kansas City, is General Superintendent of the Northern district with office at Kansas City, Mo. W. T. Tyler, heretofore General Superintendent of the St. Louis, Iron Mountain & Southern, is General Superintendent of the Southern district with office at Little Rock, Ark. A. DeBernardi, heretofore Superintendent at Osawatomie, Kan., is General Superintendent of the Central district with office at Coffeyville, Kan.

K. G. Morley, Division Superintendent at McGehee, Ark., has resigned. J. W. Dean has been appointed Superintendent of Terminals at Little Rock, Ark., succeeding J. A. Abrams, resigned.

S. M. Dolan, Master Mechanic at the Baring Cross, Ark., shops, has been transferred to the new shops at Sedalia, Mo. B. E. Stevens, General Foreman of the Locomotive Department of the Illinois Central, succeeds Mr. Dolan. A. M. Machin, Master Mechanic at Baring Cross, Ark., has resigned. A. McCormick, Master Mechanic of the Colorado Springs & Cripple Creek districts, succeeds Mr. Machin.

Norfolk & Southern.—Marsden J. Perry has been elected President, and Frank L. Gannon, Vice-President, succeeding R. S. Scoville, resigned.

M. W. Maguire, who recently resigned the position of Superintendent of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific, has been appointed General Superintendent of the Norfolk & Southern, having charge also of maintenance of way and equipment.

Northern Pacific.—J. P. Morgan, Jr., has been elected director, succeeding the late Daniel S. Lamont.

Oregon Short Line.—J. A. Reeves, Assistant General Freight Agent, has been appointed General Freight Agent with office at Salt Lake, Utah.

Wabash.—H. H. Wellman, Purchasing Agent, has resigned. C. A. How, Supply Agent, succeeds Mr. Wellman.

Wheeling & Lake Erie.—The lines of this road, the Wabash-Pittsburg Terminal and the West Side Belt, east of and including Sherodsville, Ohio, are now operated as the Pittsburg division. The lines west of Sherodsville, including Navarre, Ohio, and the Huron branch, are operated as the Toledo division.

C. V. Wood, heretofore Superintendent of Terminals at Pittsburg, Pa., has been appointed Superintendent of the Pittsburg and Cleveland divisions with headquarters at Canton, Ohio. C. A. Van Dusen, heretofore Assistant Superintendent at Toledo, Ohio, has been appointed Superintendent of the Toledo division with office at Canton, Ohio. C. W. Coe, Trainmaster at Columbia, Ohio, has been appointed Assistant Superintendent of the Pittsburg division with headquarters at Rook, Pa.

LOCOMOTIVE BUILDING.

The Northern Pacific is in the market for some locomotives.

The Oliver Mining Company (Duluth) is in the market for some locomotives.

The Grand Trunk Pacific, it is reported, has placed a large order for locomotives with the Montreal Works of the American Locomotive Co.

The Midland Steel Company has ordered two six-wheel switching locomotives from the American Locomotive Co. The total weight of each engine will be 150,000 lbs.

The Isthmian Canal Commission, as reported in our issue of September 22, has ordered 120 locomotives from the American Locomotive Co. Of these, 100 are for March, 1906, delivery, and the remaining 20 are to be delivered in June, 1906.

The New York, New Haven & Hartford has ordered 25 electric locomotives from the Westinghouse Electric & Manufacturing Co. A brief description of these locomotives was printed in the *Railroad Gazette* September 29. They will be operated by the single-phase alternating current system without the use of a third rail.

The Chicago, Milwaukee & St. Paul, as reported in our issue of September 22, is building 10 simple 10-wheel (4-6-0) locomotives at its West Milwaukee shops, for delivery beginning December 1. These locomotives will weigh 244,700 lbs., with 228,000 lbs. on the drivers; cylinders, 21 in. x 30 in.; diameter of drivers, 69 in.; wagon top boilers, with a working steam pressure of 200 lbs.; heating surface, 2,919 sq. ft.; 350 National Tube Co.'s tubes, 2 in. in diameter and 15 ft. long; firebox, 9 ft. 11⅝ in. long and 3 ft. 5⅛ in. wide; grate area, 34.16 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 10 tons.

The Central of New England, as reported in our issue of September 22, has ordered 10 simple consolidation (2-8-0) locomotives from the Rogers Locomotive Works, for delivery November 15 to December 1. These locomotives will weigh 244,700 lbs., with 228,000 lbs. on the drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 50 in.; extended wagon top boilers, with a working steam pressure of 180 lbs.; heating surface, 2,187.43 sq. ft.; 312 charcoal iron tubes, 2 in. in diameter and 12 ft. 6 in. long; steel firebox, 104⅛ in. x 42¾ in.; grate area, 31.02 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, eight tons. The special equipment includes: Westinghouse air-brakes, Gollmar bell ringers, Sterlingworth brake-beams, Tower couplers, Dressel headlights, Ajax journal bearings, Jerome piston and valve rod packings, Leach sanding devices, Nathan sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, American steam gages and Latrobe driving wheel tires.

CAR BUILDING.

The Northern Pacific has asked for bids on 5,000 box cars.

The Maine Central, it is reported, is asking bids on 250 box cars.

The Louisville & Nashville will build 1,000 coal cars at its own shops.

The New York Central & Hudson River is reported as figuring on box cars.

The Southern, it is reported, has ordered 1,500 cars from the Detroit Car Works.

The Erie has ordered five refrigerator express cars from the Pullman Co.

The Cleveland Electric, it is reported, is in the market for 50 passenger cars.

The Canadian Pacific is reported to be asking prices on about 3,000 cars in the United States.

The Duluth & Iron Range has ordered 750 steel hopper cars from the Pressed Steel Car Co.

Street's Western Stable Car Line, it is reported, is asking prices on upwards of 1,000 stock cars.

The Pittsburg & Lake Erie has ordered 200 drop bottom gondola cars from the Pressed Steel Car Co.

The Chicago, Rock Island & Pacific has asked prices on about 1,000 box cars and 250 furniture cars.

The Chicago, St. Paul, Minneapolis & Omaha is reported to be in the market for about 53 passenger cars.

The Philadelphia & Reading is reported to have ordered 2,100 of the 6,000 cars for which they are in the market.

The Toledo & Ohio Central, it is reported, has ordered 500 drop bottom gondola cars of 100,000 lbs. capacity from the Ralston Car Co.

The Chicago, Milwaukee & St. Paul is in the market for about 25 coaches, 10 sleepers, four tourist and some dining and observation cars.

The Chicago & Southern Traction Co. has ordered 10 passenger cars from the St. Louis Car Co., instead of 66 cars, as reported in our issue of September 29.

The Johnson Automatic Refrigerator Line, as reported in our issue of September 15, has ordered 250 refrigerator cars from the American Car & Foundry Co.

The Baltimore & Ohio has ordered 10 horse express cars from the Pullman Co., and is also reported as having ordered 500 coal cars from the American Car & Foundry Company.

The St. Louis, Brownsville & Mexico has ordered 15 passenger cars from Barney & Smith and 100 stock cars, 50 box cars and 40 refrigerator cars from the American Car & Foundry Co.

The New York, New Haven & Hartford, it is reported, has ordered 2,000 box cars from the Standard Steel Car Co., and 500 box cars from the Keith Manufacturing Company.

The Duluth, Missabe & Northern has ordered 500 steel hopper cars from the Pressed Steel Car Co., and is said to be figuring on about 300 flat cars, 25 box cars and 25 refrigerator cars.

The Chicago, Lake Shore & Eastern, as reported in our issue of September 22, has ordered 200 flat cars and 800 gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Choctaw Railway & Lighting Co. has ordered two interurban 34-ft. steel channel bottom semi-convertible cars from the St. Louis Car Co. Arthur Underwood, Marquette Building, Chicago, is President.

Wm. J. Oliver, Contractor, Knoxville, Tenn., has ordered 20 Hart convertible cars and one Rodger distributing car from the Rodger Ballast Car Co. The 20 convertible cars are to be used in construction service.

The Mobile & Ohio has ordered 100 60,000 lbs. capacity hopper coal cars and 100 80,000 lbs. capacity Rodger ballast cars from the American Car & Foundry Co. The special equipment includes: Steel axles, Scullin-Gallagher bolsters, Damascus brake-beams, Westinghouse brakes, Ajax brasses, Chicago couplers and Miner D.174 draft rigging.

The Atchison, Topeka & Santa Fe has ordered 13 cabooses from the American Car & Foundry Co. These will be 33 ft. 1⅝ in. long over buffer beams and 9 ft. 1½ in. wide over sills. The special equipment includes: Kewanee brake-beams, Westinghouse air-brakes, R. E. Janney couplers, Miner draft rigging and McCord journal boxes.

The Chicago, Milwaukee & St. Paul, as reported in our issue of September 29, is building 700 gondola cars of 100,000 lbs. capacity at its West Milwaukee shops. The cars will weigh 42,000 lbs., and measure 42 ft. long, 10 ft. 1½ in. wide and 8 ft. 6⅝ in. high, over all. The special equipment includes: Congdon brake-beams, New York air-brakes and Hennessey double friction couplers.

The Nashville, Chattanooga & St. Louis has ordered six wide vestibule passenger cars from the Pullman Co. They will be 68 ft. long, 10 ft. ¼ in. wide and 14 ft. 2¼ in. high over all. The special equipment includes: Pullman axles, bolsters, brake-shoes, brasses, dust guards, journal boxes, paint and vestibules; "Diamond" special brake-beams, Westinghouse air-brakes, National couplers, Forsyth curtain material, Westinghouse friction draft rigging, Pintsch light, Railway Supply Co.'s springs and Paige wheels.

The Canadian Pacific, as reported in our issue of September 29, will build 29 65-ft. suburban cars, 27 67-ft. colonist cars, 25 65-ft. first class cars, 14 72-ft. sleeping cars, 10 60-ft. baggage and express cars, eight 60-ft. baggage and mail cars, eight 65-ft. café cars, five 72-ft. dining cars, five 60-ft. fruit express cars, four 72-ft. parlor cars, four 65-ft. café parlor cars, four 65-ft. baggage and smoking cars, 1,136 box cars of 60,000 lbs. capacity, 653 flat cars of 60,000 lbs. capacity, 524 stock cars of 60,000 lbs. capacity, 500 Rodger ballast cars, 50 refrigerator cars, 35 coal cars of 80,000 lbs. capacity, and five snow plows at its Angus, Montreal, shops; also, will build 37 standard vans at its Farnham shops.

BRIDGE BUILDING.

Aberdeen, Wash.—A contract has been let to the Pacific Steel Co. for building a steel bridge over the Wishkah river at Heron street. P. F. Clark is City Clerk.

Booneville, Mo.—Heavy rains and high water in Cooper County recently destroyed highway bridges which it will cost about $500,000 to replace.

Camden, N. J.—Bids are wanted by the county collector Oct. 30 for a bascule highway and electric car bridge to be built over Coopers Creek, at this place. Fred W. George, Court House, will furnish information.

Durango, Colo.—This city is planning to build a bridge over the Ammas river, at Main avenue. The proposed bridge will consist of two spans of 60 ft. each, with 34 ft. roadway and 5 ft. sidewalks. Plans are to be submitted for a steel or a concrete and stone structure.

Evansville, Ind.—Bids are wanted by the Board of County Commissioners October 9 for building six concrete bridges and one steel bridge in Vanderburg County. Harry Stinson is County Auditor.

Gainesville, Ga.—The County Commissioners have under consideration the question of building a new bridge over the Chattahoochee river at New Bridge, three miles north of this place.

Harrison, N. J.—At a recent meeting of the joint committees on free bridges of Essex and Hudson County Board of Freeholders, it was decided to build a new bridge over the Passaic river at Clay street. The proposed bridge is to have a draw of the rolling lift type and is to cost about $125,000. The Public Service (street railroad) Corporation will be asked to pay one-third of the cost of this structure.

Hillsdale, Ind.—Bids are wanted by H. T. Payne, county auditor at Newport, Oct. 19, for building two steel or concrete bridges, 50 and 37 ft. respectively.

Norfolk, Va.—The Tidewater Railroad has given a contract to Bates & Rogers, of Chicago, for building its double track bridges over the southern and eastern branches of the Ely river, at this place, to cost about $250,000.

Pensacola, Fla.—The date for receiving bids for the steel bridge to be built over the Perdido river, in Escambia County, has been postponed to July 1, 1906. A. M. McMillan is county clerk.

Philadelphia, Pa.—Plans have been completed for building four bridges, for which bids will soon be asked by City Engineer Webster. The cost is to be paid for out of the $16,000,000 loan provided for bridge work. Bridges will be built over the Wissahickon at Allen's lane; on Wyoming avenue over the Philadelphia & Newton tracks; at Twenty-fifth street over the Pennsylvania tracks, and at Front street over the Pennsylvania tracks. One-third of the cost of the Wyoming avenue bridge is to be paid by the railroad, and the Philadelphia Rapid Transit Co. will pay for paving and grading. The Pennsylvania will share with the city the cost of the bridges over its tracks.

Spokane, Wash.—The Board of Public Works has reported to the City Council the estimated cost of building a new bridge over the third channel of the river at Howard street, as furnished by City Engineer McIntyre, as follows: For a steel highway bridge with 35-ft. roadway and two 7½-ft. sidewalks, $18,755; a heavier bridge of similar construction to carry street cars, $24,920; for a combined wood and steel structure heavy enough to carry street cars, $13,453.

Trenton, N. J.—Pennsylvania papers report that the Pennsylvania Railroad is to build another bridge across the Delaware, between Trenton, N. J., and Morrisville, to carry a freight line which is to run around the City of Trenton. The proposed location of the new line is south of the present main line stone arch bridge which was completed a year or two since.

Van Buren, Ark.—Plans have been completed for the proposed bridge to be built over the Arkansas river to carry the tracks of an electric railroad. The bridge will consist of 10 spans; total length, 2,200 ft.

Vancouver, B. C.—The Eleventh avenue bridge, which was re-

cently condemned by City Engineer Clements, will soon be replaced by a concrete structure.

WASHINGTON, D. C.—The lowest bid submitted for building a concrete steel bridge, 162 ft. long between abutments, 202 ft. over all and 64 ft. wide, to consist of three spans, over the head of the Washington channel, which will form part of the Washington approach to the Potomac highway bridge, was that of the Penn Bridge Co., of Beaver Falls, Pa., whose bid was $97,367, with a higher bid amounting to $109,500 if stone facing is to be used, the work to be completed by Oct. 15, 1906. There were about nine other bidders, whose bids ranged from this figure to $204,000 without stone facing and $226,000 with stone facing, with a time limit for the completion of the work to August 31, 1907.

YARDLEY, PA.—According to Pennsylvania newspapers, the high bridge of the Philadelphia & Reading across the Delaware at this place is to be superseded by a four-track stone arch bridge. The present bridge is 80 ft. above the water. Nine arches will be required to cross the river, and shorter spans will be built over the railroad tracks, wagon roads and canals on the shores of the river.

Other Structures.

BARING CROSS, ARK.—The Missouri Pacific, which now operates the St. Louis, Iron Mountain & Southern as its Southern district, has appropriated $400,000 for improvements and additions to be made to its shops at this place.

CLEBURNE, TEX.—A contract has been given by the Gulf, Colorado & Santa Fe to H. D. McCoy, of this place, for adding 12 stalls to its present engine house at a cost of about $30,000.

KINGSTON, ONT.—The Grand Trunk is planning to build a large hotel at Rideau Lake, near this place.

NEWPORT, PA.—Announcement has been made by the Pennsylvania that the company will put up a new brick passenger station 25 x 65 ft. at this place.

NEW YORK, N. Y.—The Hudson & Manhattan Co. has started condemnation proceedings to secure land as a site for the terminal for its proposed tunnel, which will be situated on the west side of Church street between Cortland and Fulton streets. After the completion of its tunnel, the company expects to put up a large office building on this site 20 stories high, 200 x 250 ft., to cost approximately $3,000,000. The Hudson river tunnel loop and underground passage will be extended from the building east to Broadway, where connection will be made with the present Interborough subway line.

OKLAHOMA CITY, OKLA. T.—The Denver, Enid & Gulf terminals to be built at this place will cost about $200,000, and will be used jointly by this company, the Fort Smith & Western, and the Guthrie, Plainview & Western.

PUTNAM, CONN.—The New York, New Haven & Hartford has given a contract to William Paterson, of New Haven, for putting up a stone passenger station, 28 by 132 ft., at Putnam.

PORT HURON, MICH.—The Grand Trunk, it is said, will enlarge its car shops at this place.

ST. MARCOS, TEX.—The International & Great Northern, it is said, has decided to put up a new brick freight house and to make other improvements at this place.

SYRACUSE, N. Y.—The Delaware, Lackawanna & Western has filed a map with the County Clerk showing the proposed works which the company is to build on the land bounded by Harbor Brook, West Fayette, Magnolia and Marcellus streets. The work will cost about $100,000 and will include an engine house with 19 stalls, oil house, shops 35 x 156 ft., cinder pits, switches, and a storage house 24 ft. x 80 ft. There will be three engine tracks and six car tracks. The latter will be able to hold 42 cars for storage and repair purposes. The work will be practically a duplicate of the company's new works at Utica.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—See Jasper & Eastern.

ATLANTIC & BIRMINGHAM.—Wright, Williams & Co., who have the contract for building a part of this road through La Grange, Ga., to Talladega, Ala., will, it is said, sublet some of the work.

BANGOR TERMINAL.—Application will be made by a company under this name in Maine for incorporation, with a capital of $36,000, to build a railroad from a connection with the Seaport Railroad between Fuller Road and Hermon Junction to a point in Bangor, a distance of about six miles. The directors include Arthur Chapin, C. D. Stanford, L. C. Tyler, and others, of Bangor.

BEAUMONT, SOUR LAKE & WESTERN.—Surveys, it is reported, have been completed by this company for its proposed extension from Sour Lake west to Houston, Tex., a distance of about 65 miles, on which construction work will be commenced shortly. This road was recently reported sold to the St. Louis & San Francisco, and later to the Colorado Southern, New Orleans & Pacific, formed to operate the several Hawley-Yoakum roads. (Aug. 11, p. 47.)

BROWNWOOD, WACO & NORTHERN.—Application will be made by a company under this name in Texas to build a railroad from Brownwood, Tex., via May and Rising Star, north for a distance of about 50 miles. The proposed road will pass through a rich fruit-growing section. The cities of Rising Star and May will give $30,000 and a right of way to the company. Brooke, Smith & Co., of Brownwood, can give particulars.

COAL BELT.—Articles of incorporation have been filed by a company under this name in Utah, with a capital of $100,000, to build a railroad from Spanish Fork, in Utah County, Utah, southeast via Spanish Fork canyon east to Tie Fork, up Indian creek over Soldier Summit, and through Emma Park, along the Brook Cliffs to the coal fields in Carbon County, a distance of 89 miles. S. B. Milner is President, and G. E. Jenkins, Secretary.

COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—See Beaumont, Sour Lake & Western.

DELAWARE & EASTERN.—Contracts, it is reported, have been let by this company to John R. Lee, of Paterson, N. J., and to John F. Dolan, of Elizabeth, N. J., for a 25-mile section of its proposed road near Arkville, N. Y. Sub-contracts may shortly be let from the New York office, 5 Nassau street. (March 31, p. 101.)

DENVER & RIO GRANDE.—General Manager A. C. Ridgway of this road announces the opening, Sept. 22, of its new line from Durango, Colorado, to Farmington, New Mexico, which will be known as the Farmington branch.

ELDORADO & WESSON.—Charter has been granted a company under this name in Arkansas with a capital of $50,000 to build a railroad from Eldorado, in Union County, southwest to Wesson, a distance of about 10 miles. Incorporators include C. V. Edgar, A. B. Banks, J. R. Eakin, and others.

GOTHENBERG & NORTHERN.—Incorporation has been granted a company under this name in Nebraska, with a capital of $500,000, to build a railroad from Gothenberg, Neb., on the Union Pacific, northwest to Gandy, a distance of about 40 miles. Incorporators include W. D. Griffith, H. L. Williams, J. H. Kelly, and others.

GREEN BAY, OSHKOSH, MADISON & SOUTHWESTERN.—This company, which is building a line from Madison, Wis., north to North Crandon, a distance of about 200 miles, has plans ready to begin construction work and surveys are in progress near Shawano, Galesburg, Crandon and Bear Creek. Charles H. Hartley is General Superintendent, with office at Oshkosh. (August 18, p. 54.)

INDIANAPOLIS, CRAWFORDSVILLE & WESTERN TRACTION.—Bids are wanted by this company for grading and track laying on the first section of its proposed line from Indianapolis, northwest to Crawfordsville, Ind., a distance of 42 miles. Work is to be commenced soon. W. D. Ball, First National Bank Building, Chicago, Ill., is the engineer in charge of the work.

JASPER & EASTERN (A. T. & S. F.)—The route of this extension of the Gulf, Beaumont & Kansas City has been changed, it is said, to run southeast to Oakville, La., on the Kansas City, Watkins & Gulf, instead of building it to Alexandria, La. (See Construction Record.)

LAKE SUPERIOR & SOUTHERN.—A company has been granted a charter under this name in Michigan with a capital of $75,000 to build a railroad from Huron Bay, in Baraga County, southwest via Lake Michigamme, thence south through Marquette and Iron Counties to the Wisconsin State line, a distance of about 85 miles. The proposed road will run within 35 miles of the copper country and across the iron range. The company owns 30,000 acres of rich timber land and two large docks at Huron Bay, one of which is equipped for handling ore. The officers are: M. C. Phillips, of Oshkosh, President; R. B. Brunson, Ishpeming, Vice-President; W. K. Ridout, Treasurer, and J. O. Maxey, of Marquette, Secretary.

MISSISSIPPI & ALABAMA.—This company, recently incorporated, it is said, has surveys completed for its line. The proposed route is from a point near Corinth, Miss., south through Alcorn, Prentiss, Tishomingo and Itawamba Counties, approximately 80 miles. J. T. Savage, Edward Mayes and others, of Jackson, Miss., are interested.

MISSOURI PACIFIC.—Contracts have been given by this company to C. D. Smith & Co., of Memphis, and to Scott & Sons, of St. Louis, for double tracking 25 miles on its Southern district (formerly the St. Louis, Iron Mountain & Southern). The main line is to be double tracked seven miles north and eight miles south of Little Rock, and ten miles north of Texarkana. The work south of Little Rock will be heavy, necessitating the removal of about 50,000

cu. yds. of rock and about 500,000 cu. yds. of earth. A contract has also been given to Smith & Co. for making yards and other betterment work at Paragould and Helena, Ark., and other places. The work includes a yard at Lexa.

New York & Jersey.—This company announces the completion of the second one of its twin tunnels under the Hudson river, from the foot of Morton street, Manhattan, New York, to the foot of Fifteenth street, Jersey City. There is much additional work yet to be done, including an extension from the eastern end in the Borough of Manhattan, northeast to Thirty-fourth street and Sixth ave. The tunnels will probably not be placed in operation until May, 1907.

North Mississippi & Bay Springs.—Application has been made in Mississippi by a company under this name for a charter to build a railroad from Burnsville in Tishomingo County south to the Itawamba County line, a distance of about 30 miles. Incorporators include F. J. Ozanne, E. B. Causey and others, all of Memphis, Tenn.

Ohio & Marshall.—This company has filed plans for its proposed road through Ohio and Marshall Counties, W. Va. The road will run from Wheeling, east of the tracks of the Baltimore & Ohio, east through Mount de Chantal, along the creek to Elm Grove, thence up Big Wheeling, over to Ten-Mile creek, and through Viola to Waynesburg, Pa., about 40 miles. J. V. Thompson, of Uniontown, who is building a road from that place west to Waynesburg, and who owns large coal fields in that section, is interested in the company. (June 16, p. 199.)

Philadelphia & Reading.—Surveys have been under way for the past four months by this company for a railroad to supersede a line with two heavy grades between Pottsville and Shamokin. The plan provides for a road to leave the Schuylkill river at Schuylkill Haven and to use the Minehill branch via Cresson, West Wood Junction and Middle Creek, a suburb of Tremont. A tunnel will have to be built from Middle Creek to the North river, but it will be only half as long as the tunnels heretofore planned in the vicinity of Minersville. West from this tunnel the line would pass through Valley View and Hegins, and run thence via Klingerstown to the Susquehanna river. This would give a route from Clinton to Sunbury, 15 or 20 miles shorter than the present.

Philadelphia Rapid Transit.—This company will at once begin to lay track in the Market street subway.

Sacramento & Lake Tahoe.—Articles of incorporation have been filed by this company in California, with a capital stock of $7,500,000. The incorporators are: Chas. Wesley Reed, W. S. Graham, Leo Alexander, Thos. H. Nicholls, Jas. H. Swift, T. O. Sadler, E. F. Haas, John A. Black and H. G. Raybould.

St. Louis & Northeastern Traction.—The East St. Louis City Council has granted a franchise to this company which is a branch of the McKinley syndicate of electric road that will enter the city from the northeast.

St. Louis, El Reno & Western.—This company, which operates a line from Guthrie, Okla. T., southwest 42 miles to El Reno, is planning to build an extension from its southern terminus. Surveys are being made from that point through Canadian, Caddo and Kiowa Counties.

St. Louis, Vandalia, Terre Haute & Eastern Traction.—A mortgage has been filed by this company for $6,000,000 with the Chicago Title & Trust Co., and a certificate of incorporation filed in Illinois showing capital of $1,000,000. The company intends to connect St. Louis with Terre Haute by an electric road and has leased the right of way from the latter place to the Illinois state line. It is also stated that the company has secured the right of way from St. Louis to Effingham. Construction work is to be commenced at the Terre Haute end shortly. The directors include: Peter Chase, of Decatur; Lewis H. Bissell, Effingham; C. W. Mills, H. J. Wanner and W. B. Baldwin, Chicago. W. B. Wanner is Secretary, 119 LaSalle street, Chicago.

Seaboard Air Line.—An officer writes that this company will let contracts about the 10th inst. for building an extension of the Tallahassee South-Eastern from Wacissa, Fla., southeast to Perry, about 80 miles. The maximum grades will be .2 per cent., with a curvature of 3 degrees.

South & Western.—An officer writes that this proposed road will be built from the coal fields of southwest Virginia, in Wise, Dickinson and Buchanan Counties, south through Virginia, Tennessee and North Carolina to connections in South Carolina with the Southern, the Seaboard Air Line and the Atlantic Coast Line, a total distance of 300 miles of main line. Thirty locating parties are now in the field and the company will be ready to let contracts within a month. The maximum grades southbound will be 26 ft. to the mile. There will be a number of bridges. George L. Carter is President, and G. A. Kent, Chief Engineer, Bristol, Va. (Sept. 22, p. 96.)

South Carolina Roads.—Announcement has been made by Dr. W. Gill Wylie, President of the Southern Power Co., of Chester, S. C., that this company will build a railroad from Harmony, S. C., on the Seaboard Air Line, southeast to Camden, a distance of about 60 miles. Connection will be made at Fort Lawn with the line running to the company's works at Catawba Falls. Surveys are to be started at once and the cost of the work will be about $600,000.

Spartanburg & Northern.—A charter has been granted a company under this name in South Carolina to build a railroad from Spartanburg, S. C., north to Rutherfordton, N. C., a distance of about 50 miles, where connection will be made with the Seaboard Air Line and the Southern. The directors are: J. C. Cleveland, R. K. Caran and George W. Nichols, of Spartanburg.

Texas Roads.—Application has been made by a company in Texas to build a railroad from Dayton, in Liberty County, to the oil fields, a distance of about eight miles. M. Eastham, R. A. Grear, T. H. Bass and R. Silverman, all of Beaumont, are the incorporators.

Wabash & Rochester Traction.—Bids are being asked by this company for the completion of roadbed and track from Wabash, Ind., northwest to Rochester, a distance of 30 miles. The original line has been shortened and straightened, and new franchises have been granted in the various towns through which the road will pass. R. S. Vivian, 107 Dearborn street, Chicago, Ill., has charge of the work.

RAILROAD CORPORATION NEWS.

Canada Atlantic.—See Grand Trunk, below.

Chicago & Eastern Illinois.—Redmond & Co. and J. & W. Seligman & Co., New York, are offering at 96 $5,000,000 refunding and improvement mortgage 4 per cent. gold bonds of 1955. This is part of an authorized issue of $50,000,000, of which $5,000,000 are outstanding, $34,626,000 reserved to retire bonds issued and to be issued under prior liens, and $15,374,000 to be issued for other purposes.

The railroad company has sold to Blair & Co., New York, $2,500,000 4½ per cent. equipment bonds, series E, payable in 20 semi-annual installments of $125,000 each.

Consolidated (N. Y., N. H. & H. electric lines).—This company has bought the Hartford Street Railway, the stock of which it has controlled for several months, for $2,850,000. The Hartford Street Railway, operating 92 miles of line in and about Hartford, Conn., has $1,000,000 capital stock outstanding, and a funded debt of $2,960,000.

Grand Trunk.—This company took over the operation of the Canada Atlantic on October 1. (See also p. 109.)

New York, Ontario & Western.—At the annual meeting of the stockholders, the proposed leases of the Port Jervis, Monticello & Summitville; the Ellenville & Kingston, and the Pecksport Connecting railroads were approved. (August 25, p. 54.)

Pennsylvania Company.—The Pennsylvania Co., controlling the Pennsylvania Lines West of Pittsburg and Erie, has authorized an issue of $20,000,000 new stock, making its total stock $60,000,000. The Pennsylvania Railroad Company, the Pennsylvania Company's sole shareholder, takes the entire new issue, paying for it with part of the proceeds of the recent sale of $100,000,000 3½ per cent. convertible bonds. The money goes toward paying the $50,000,000 of notes due October 1. (April 8, 1904, p. 282.)

The Pennsylvania Company has sold to New York bankers $2,000,000 first-mortgage 4 per cent. gold bonds of 1943 of the Ohio Connecting Railway. The Ohio Connecting Railway owns the bridge over the Ohio river at Birmingham, Pa.

Quebec Southern.—Sealed bids will be received by the Registrar of the Exchequer Court of Canada until November 2 for the purchase of this road, which has 144 miles of track and has been in the hands of a receiver since March 21, 1904.

Reidsville & Southeastern.—This road has been bought by George D. Mackay, of the New York banking firm of Mackay & Co. The Reidsville & Southeastern is 16 miles long, running from Reidsville, Pa., to Glennville. The project for connecting it with the Darien & Western at Ludowici, Pa., by 25 miles of construction has been blocked, because of suits instituted to decide which company should do the building. Mr. Mackay also owns the Darien & Western, and this new purchase will solve these difficulties. An extension is being built from Reidsville to Vidalia, on the Macon, Dublin & Savannah.

Wheeling & Lake Erie.—The stockholders have authorized the abandonment of the proposed issue of $50,000,000 bonds and the substitution therefor of $35,000,000 4 per cent. 50-year bonds, the smaller amount being deemed sufficient to meet all present requirements. (May 5, p. 152.)

GENERAL NEWS SECTION

NOTES.

A press despatch from Sioux City, Iowa, says that those telegraph operators of the Great Northern who did not join in the recent strike on that road received checks for the month of September amounting to just double the amount they had earned.

At Houston, Tex., recently a switching engine of the International & Great Northern took fire, while its tender was being filled with fuel oil, and every combustible part of the engine and tender was entirely consumed. The fire is said to have started at a leak in the pipe leading from the tender to the firebox.

Reports from Seattle say that the Oregon Railroad & Navigation Company has notified the Railroad Commissioners of the State of Washington that it will claim the right to make its own freight rates, thus ignoring the new law empowering the commission to regulate freight rates.

The Chicago & Alton has taken off the "interurban" passenger trains which were put on a few months ago between Carlinville, Ill., and Springfield, 38 miles. The company has been unable to finish the double tracking of this part of the line and on a single track the new passenger trains interfere too much with the heavy freight traffic.

Probably Got a C. L. Rate.

The railroad cars and locomotives ordered in the United States early this year by the Japanese Government are now being shipped by way of the Pacific coast. The carrier "Dakota," of the Great Northern Steamship Company, sailed from Seattle on September 20 with 900 freight cars and nineteen 50-ton locomotives. These cars and engines are narrow gage, the cars being 16 ft. long, with a capacity of 10 tons.

Incidents of a Derailment.

Ed Carey, a former resident of Wichita, was a passenger on the California Limited which was wrecked near Walton Wednesday night about half-past 9 o'clock. Mr. Carey describes the wreck as follows:

"I went into the barber shop, which is in the buffet car, and was sitting down waiting for my turn, a woman being in the chair having her face massaged. Suddenly the coach gave a lurch and seemed to stand on end, then began to bump and create a terrible noise. . . . The woman scrambled to her feet and began to scream, at the same time making frantic efforts to jump out of a window. I caught her in my arms and thus saved her from jumping to instant death, all the time expecting the crash to come, as I thought we were in some kind of a collision. Britt, the brother of the prize-fighter, fought like a demon to get out. The car suddenly left off its bumping and plowed into the south bank of a cut, lying over on its side. The woman, whom I still held, kept repeating: 'Oh, the bridge, the bridge,' no doubt recalling to mind some past wreck. I finally succeeded in quieting the woman and hurried to the rescue of others. Everyone was terribly excited except one old invalid lady, who was calmly sitting down on the side of the car in which she was riding and asking for her father, who was on the train but escaped uninjured. The conductor of a freight following about one mile behind saw the train leave the track and he said that it looked as if on fire, and that the noise could be heard that far back very distinctly."

Mr. Carey said that the railroad men treated them all very nicely with the exceptoin of the conductor, who through a misunderstanding of his duties tried to make the passengers sign a release of all damage claims before he would haul them into Newton. . . . It was laughable to see the passengers feign injuries after mention of damages was made.—*Wichita (Kan.) Eagle.*

Rate Regulation vs. Government Ownership.

Professor Ripley in the *Atlantic* says that it is not the immediate question of railroad rates which most concerns Mr. Roosevelt. He is made anxious by the strength of the movement for government ownership of railroads. "Will it not be better that the attention of this huge electorate should be diverted from such issues by the prompt application of really remedial legislation, before the question is too widely advertised in a Presidential contest? The President of the United States is neither demagogue nor socialist. He realizes the irresistible force of public opinion when once fully roused; he is well aware that public ownership of railroads is no mere dream of idle theorists, but an accomplished fact in many foreign countries; and he foresees the political dangers latent in such a programme for our own country."

But, how long will a newspaper-reading and demagogue-driven electorate allow itself to be "diverted," when the net is so ostentatiously spread in sight of the bird? Is not Mr. Roosevelt putting a powerful argument in the hands of Mr. Bryan and his Socialist allies? There is the further question, When is public opinion "irresistible"? According to the test supplied by Professor Ripley, Mr. Roosevelt would have been for the Granger legislation, because public opinion in the western States demanded it imperiously. Professor Ripley quotes with approval President Hadley's opinion that, even if the Interstate Commerce Commission were given power to fix railroad rates, the number of changes would be "very small indeed." Yes, but one can hear the roar coming across the prairies; "What was all the excitement about, then? You were simply trying to 'divert' the honest electors, and all you have given them is a rate on shoe-pegs and canary-seed. Get out of the way and let the real servants of the people take hold of the weapon you have forged, and use it to some effect!" The best way is to tackle political questions separately as they arise, and on their own merits. That there are abuses in railroad administration cannot be denied. If more thorough-going statutes are needed by all means let us have them. But let us have the legislation in and of itself, here and now, with sufficient reason shown, and without these dire insinuations about what the great peril will do to us if we do not take the plunge into the small peril.—*New York Evening Post.*

Prevention of Spontaneous Combustion of Coal.

The Moniteur Industrielle says that the common method of attempting to avert spontaneous combustion in piles of bituminous coal by the insertion of ventilating pipes is usually futile because of the small diameter of the pipe used. A better precaution is to drive an iron or steel bar down into the mass and allow it to remain until it has reached the temperature of the coal in which it is imbedded. A touch of the hand will then be sufficient to indicate whether the heat is sufficient to cause ignition or not. Or the bulk of a thermometer could be set in the bar.

The precautions to be taken against the overheating of the coal pile are: Never heap up damp coal; always keep it in steel or concrete bins and never near the boilers. The pile should never be more than 11½ ft. deep and a free circulation of air around and beneath it when possible. If overheating and ignition does take place the pile should be dug away and turned. Throwing on water is of little use, since if it penetrates into the mass it will only aggravate the difficulty. If the coal cannot be turned, and the fire is in the center, it is a good idea to drive large perforated pipes down into the mass and then force a current of water down through them which will quickly extinguish the fire.

Single-Phase Electric Railway in Washington.

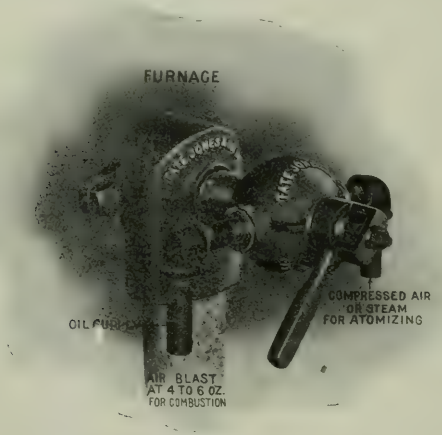
The Westinghouse Electric & Manufacturing Company has obtained the contract for equipping with single-phase electric apparatus the Spokane & Inland Railway, which is building from Spokane, Wash., to Moscow, Idaho, 146 miles. The road is completed for 34 miles out of Spokane, and will be put in operation as soon as possible. The company expects to do a heavy freight business and to carry mail and express as well as passengers. Power will be bought from the Washington Power Company, which will supply three-phase current at 4,000 volts, 7,200 alternations to a frequency-changing station. Here seven 750-k.w. oil-insulated, water-cooled transformers will step down the voltage from 4,000 to 2,000 volts, the potential for which the induction motors of the frequency changing sets are wound. There will be four of these motor-generators or frequency changers of 1,000-k.w. capacity each at normal rating. Each consists of a 1,000-h.p., 3-phase, 2,000-volt, 60-cycle induction motor; a 1,000-k.w. single-phase, 2,200-volt, 25-cycle revolving field alternator, and a 750-h.p., 550-volt direct-current generator which is to float on the storage battery acting alternately as a motor and generator. The three machines will be mounted on a single bed plate with seven bearings. Exciting current for the alternators will be supplied by three sets, each consisting of a 75-h.p., 3-phase, 2,000-volt induction motor and a 50-kw. d.c. generator. Nine 675-k.w. oil-insulated water-cooled transformers will step up the voltage from 2,200 to 45,000 volts, at which pressure it will be transmitted to the 15 static transformer sub-stations, each containing two 375-k.w., 45,000-6,600 volt oil-insulated, self-cooling transformers. A 23-panel switchboard, electrically-operated, automatic oil circuit breakers, and protective apparatus complete the equipment of the frequency changing station. Low equivalent lightning arresters and choke coils are provided for both primary and sec-

ondary circuits in all sub-stations. The transmission lines will consist of two No. 2 copper wires, and the trolley will be of the standard catenary construction, using a No. 000 wire and carrying current at 6,600 volts.

Each passenger car will be equipped with four 100-h.p. motors, capable of maintaining a schedule speed of 35 to 40 miles an hour. In the freight service four 150-h.p. motors will be used on each car. For the heavy freight service double locomotives weighing approximately 70 to 80 tons will be used, each consisting of two parts and each part a complete 35 to 40-ton locomotive. Two or more of these locomotives may be coupled together and operated from the front cab as a single unit. The motor cars and locomotives will all be operated by the Westinghouse multiple unit control system. The motors will operate under three different conditions—6,600 volts alternating current in the interurban districts, 700 volts alternating current in the smaller towns, and 575 volts direct current in the city of Spokane.

The Kirkwood Combination High and Low Pressure Oil Burner.

The accompanying illustration shows the Kirkwood combination high and low pressure oil burner made by Tate, Jones & Co., Inc., Pittsburg, Pa. Actual tests have shown that oil burned under high pressure, that is from 5 to 20 lbs., is considerably more efficient than when burned under a low pressure of from 4 oz. to 1 lb. While a very small amount of the air is required to atomize the



The Kirkwood Combination High and Low Pressure Oil Burner.

oil, a much larger amount is required for combustion, and where compressed air for both the atomization and combustion have to be supplied to a burner, the expense for large compressors and their operation is quite an item and in many cases has prevented the use of the more efficient high-pressure system. With the Kirkwood combination burner it is claimed that only one-tenth of the usual amount of compressed air is required for atomization. The necessary air for combustion is supplied by a blast fan at 3 oz. to 4 oz. This is inexpensive to purchase and requires very little power to operate and a more complete regulation of the fire can also be obtained.

In this burner both the compressed air and the oil are controlled by one lever, and the burner is adjusted so that the proper proportion of compressed air and oil is always right for atomization. This adjustment cannot be changed, and the burner, therefore, always atomizes perfectly. The supply of air is regulated by a gate on the blast pipe. Dry steam fed to the burners at the same pressure as the oil may be used for atomizing. As only enough steam is used to break up the oil the burner is noiseless and the amount of steam used is small. These burners will operate equally well with the heavy crude Texas and California oils as with the lighter oils. A number of furnaces in The Ramapo Iron Works, Niagara Falls, are equipped with this combination burner, and it is claimed that they have affected a large saving in the oil burned.

Manufacturing and Business.

The American Water Softener Co., Philadelphia, reports orders for water softening and purifying plants from the Florida East Coast Railway, and the Detroit, Toledo & Ironton Railway.

The Climax Stock Guard Co., Chicago, during August and September sold 21 car loads of "Climax" cattle guards to the following: Wisconsin & Michigan, Missouri, Kansas & Texas, Central of Georgia, Long Island, and Chicago & Alton railroads, and Westinghouse, Church, Kerr & Co.

In the description of the new private car "Alexandra" built by Rhodes, Curry & Co., Ltd., for the Canadian Government, which appeared in our issue of October 6, page 331, it was stated that the car was equipped by the Electric & Train Lighting Syndicate with the Pintsch system of train lighting. The car was equipped by this company with Deutsch system of train lighting.

Iron and Steel.

Inquiries are being made for structural steel in lots of from 6,000 to 12,000 tons. The largest of these are from railroads. Additional contracts have recently been placed for rails aggregating 80,000 tons by northwestern roads. The Northern Pacific has given an order to eastern mills, bringing its total up to 60,000 tons; the Chicago & North-Western, 20,000 tons, and another western road, 15,000 tons. September contracts for fabricated steel given to the American Bridge Co. are for 30,000 tons, and contracts are pending for a large tonnage in addition. One inquiry is for 16,000 tons. The Dominion Iron & Steel Co., according to reports from Canada, is negotiating with the Chinese Government to supply a large quantity of rails for the Hankow Railway. The total length of this road will be 800 miles, 30 miles of which had been built by an American syndicate, when the concession was bought back by the government. The Dominion Iron & Steel Co. has been given a contract by the Grand Trunk Pacific for about 150,000 tons of rails to be delivered within five years.

PERSONAL.

—Mr. A. O. Cunningham, who was recently appointed Chief Engineer of the Wabash, was born in 1866 at Rangoon, British Burmah. He began railroad service in 1886 as rodman on the Northern Pacific. From 1890 he was for a year engaged in surveying in North Dakota. He then went to the University of Minnesota, graduating in 1894. After graduation he was draftsman to the Gillette-Herzog Mfg. Co., becoming in the next year Assistant Engineer of that company. From 1896 to 1898 he was General Contracting and Engineering and Southern Agent for the Schultz Bridge & Iron Co., of Pittsburg. In 1898 he went to the Pittsburg Reduction Co., and in 1899 was associated with the Pennsylvania Engineering Co., a firm of consulting engineers. He went to the American Bridge Co. in 1900 as Contracting Manager, at Cleveland, Ohio, and in 1902 became Bridge Engineer of the Wabash, where he has remained until his present appointment.

A. O. Cunningham.

—Mr. George T. Nicholson, hitherto Passenger Traffic Manager of the Atchison, Topeka & Santa Fe, was on October 4th made Third Vice-President in charge of traffic, succeeding to the position vacated by Mr. Paul Morton when he became Secretary of the Navy. Mr. Nicholson is 49 years old, having been born in Belvidere, N. C., in 1856. Practically his entire railroad career has been spent in the service of the Santa Fe, which he entered in 1882 as clerk in the general passenger and ticket office, after graduation from the Kansas State University. He became in turn rate clerk, chief rate clerk, chief clerk and Assistant General Passenger and Ticket Agent. At the end of ten years he had risen to the head of the department, having been made General Passenger Agent in 1892. In 1897 he became General Passenger Agent of the St. Louis & San Francisco, but the following year returned to the Santa Fe as Passenger

G. T. Nicholson.

Traffic Manager, the position he now leaves to take control of all traffic of the Santa Fe system.

—Mr. M. Donaldson, who was recently appointed Superintendent of the Ottawa division of the Grand Trunk, was born in 1851 in Scotland. His first railroad service was in 1881, as Chief Draftsman of the Canada Atlantic, becoming later Master Mechanic and Purchasing Agent, and then Superintendent. In 1898 he was appointed General Superintendent, where he remained until October 1, of this year, when the Grand Trunk took over the operation of the Canada Atlantic as its Ottawa division.

—Mr. E. W. McKenna, who has been elected Second Vice-President of the Chicago, Milwaukee & St. Paul, was born in 1848 and entered railroad service in 1862 as messenger and operator on the Pennsylvania. In 1864 and 1865 he was in the United States military telegraph service. From this time until 1870 he held various positions on the Pittsburg, Cincinnati & St. Louis, being appointed Train Despatcher at the end of that time. In the next year he was appointed Superintendent of the Indianapolis & Vincennes, and in 1880 went to the Jefferson, Madison & Indianapolis, with the same title. In 1886 he went to the Pennsylvania Lines West, performing special service under the immediate direction of the General Manager. The next year he became Chief Clerk to the General Manager of the New York, Lake Erie & Western, and in a few months went to the Chicago, Milwaukee & St. Paul, as Superintendent of the Prairie du Chien and Mineral Point divisions. In 1888 he was made Superintendent of the La Crosse and Wisconsin Valley divisions, in 1890 Assistant General Superintendent, and in 1894 General Superintendent of the Eastern district of the Great Northern. In 1895 he left railroad service to become President of the McKenna Steel Working Co. He returned to the Chicago, Milwaukee & St. Paul in 1904 as Assistant to the President, holding that office until his recent appointment.

E. W. McKenna.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—C. A. Morse has been appointed Acting Chief Engineer with office at Los Angeles, Cal., succeeding R. B. Burns.

H. C. Whitehead, General Auditor at Chicago, has been appointed Consulting Auditor. W. E. Bailey, Assistant Auditor, succeeds Mr. Whitehead. J. E. Baxter, Auditor of the Gulf, Colorado & Santa Fe, succeeds Mr. Bailey. J. W. White, Auditor of Disbursements, has resigned, effective October 15. A. L. Conrad succeeds Mr. White, with office at Topeka, Kan.

Atlantic & Birmingham.—G. C. Smith, Acting Superintendent, has been appointed Superintendent, with office at Brunswick, Ga. A. Bonnyman has been appointed Chief Engineer, with office at Oglethrope, Ga.

Buffalo & Susquehanna.—F. H. Goodyear has been elected President and C. W. Goodyear, Vice-President, both with offices at Baltimore, Md. M. E. Olmsted has been appointed General Counsel, with office at Harrisburg, Pa.

Canada Atlantic.—C. M. Hays, Second Vice-President and General Manager of the Grand Trunk, has been elected President of the Canada Atlantic, succeeding C. J. Booth. E. H. Fitzhugh, Third Vice-President of the Grand Trunk, has been elected Vice-President. Frank Scott, Treasurer of the Grand Trunk, has been elected Secretary and Treasurer, succeeding A. W. Fleck, resigned. H. W. Walker has been appointed General Auditor, succeeding W. S. Smith, resigned.

Canadian Pacific.—J. W. Leonard, Superintendent of Construction on the Toronto-Sudbury branch, has been appointed to the newly created position of Assistant General Manager of lines east of Fort William, Ont., with headquarters at Montreal. He will continue to supervise the construction of the Toronto-Sudbury line.

Carolina & Northwestern.—E. F. Reid has been appointed General Freight and Passenger Agent, and J. R. Hall, Auditor, both with offices at Chester, S. C.

Central Indiana.—John Cullinan has been appointed Master Mechanic, with office at Muncie, Ind., succeeding S. W. Crawford.

Chicago, Burlington & Quincy.—V. O. English, Superintendent of the McCook division, has resigned. C. L. Eaton, Assistant Superintendent of Transportation at Omaha, Neb., succeeds Mr. English. F. D. Weidenhammer succeeds Mr. Eaton.

Chicago, Milwaukee & St. Paul.—H. R. Williams, General Manager, has resigned.

Chicago, Rock Island & Gulf.—G. W. Barr has been appointed Superintendent of Telegraph, with office at Fort Worth, Tex., succeeding A. B. Crowley, assigned to other duties.

Chicago Terminal Transfer.—J. R. McGary has been appointed Car Accountant, with office at Chicago, Ill., succeeding H. L. Meier. The office of Engineer of Tracks and Structures has been abolished.

Chicago, Ziegler & Gulf.—U. S. Long has been appointed Traffic Manager, with office at Chicago, Ill., succeeding H. H. Hiland.

Colorado Midland.—W. J. Schlacks has been appointed Superintendent of Machinery, with office at Colorado City, Colo., succeeding J. R. Groves.

Colorado Springs & Cripple Creek District.—J. B. Flaherty, Assistant Superintendent, has been appointed Superintendent, with office at Cripple Creek, Colo. A. L. Boyd has been appointed Purchasing Agent, with office at Canon City, Colo.

Denver, Enid & Gulf.—F. D. Hunt has been appointed General Superintendent, with office at Enid, Okla. T.

El Paso & Southwestern.—L. U. Morris has been appointed Superintendent of the Western division, with office at El Paso, Tex., succeeding F. L. Hunter, promoted.

Fort Worth & Denver City.—G. Geiger has been appointed Superintendent, with office at Childress, Tex., succeeding G. W. Rourke, resigned.

Georgia, Florida & Alabama.—E. O. Alston, General Freight and Passenger Agent, has resigned. G. H. McWilliams, Traveling Freight Agent, in Tennessee, of the Louisville & Nashville, succeeds Mr. Alston, with office at Bainbridge, Ga.

Grand Trunk.—W. G. Brownlee, Superintendent of the Middle division, has been promoted to take charge of the Operating department, heretofore within the jurisdiction of F. H. McGuigan, Fourth Vice-President. U. E. Gillen, Assistant Superintendent of the Middle division, has been appointed Superintendent of the Middle division, succeeding Mr. Brownlee, with headquarters at Toronto, Ont.

Great Northern.—Archibald Gray, Assistant General Freight and Passenger Agent at Butte, Mont., has been transferred to Sioux City, Iowa, succeeding F. Rogers. H. A. Jackson, General Freight and Passenger Agent of the Spokane Falls & Northern, succeeds Mr. Gray.

Gulf, Colorado & Santa Fe.—D. E. Shuckhart has been appointed Auditor, succeeding J. E. Baxter, promoted. See Atchison, Topeka & Santa Fe.

Indiana Harbor.—C. W. Hotchkiss, President, has been appointed General Manager. W. S. Kinnear, Vice-President, has been appointed Assistant General Manager. W. H. Newman, President of the New York Central & Hudson River, succeeds Mr. Hotchkiss. G. J. Grammer, Vice-President of all New York Central lines west of Buffalo except the New York, Chicago & St. Louis, has been appointed Vice-President, and will be in charge of traffic.

Louisville, Henderson & St. Louis.—L. W. Botts has been elected Treasurer, with office at Louisville, Ky.

Missouri, Kansas & Texas.—W. A. Mitchell has been appointed Master Car Builder, with office at Sedalia, Mo., succeeding H. A. Bowen.

Missouri, Oklahoma & Gulf.—A. R. Peyinghaus, General Freight and Passenger Agent, has resigned. W. O. Maxwell succeeds Mr. Peyinghaus.

Missouri Pacific.—J. F. Simms, Trainmaster at Sedalia, Mo., has been appointed Superintendent of the Central Kansas division with office at Osawatomie, succeeding A. DeBernadi, promoted. John Cannon has been appointed Superintendent of the Southern Kansas division, with office at Coffeyville, Kan. J. G. Lorton has been appointed Superintendent of the Valley division, with headquarters at McGehee, Ark., succeeding K. G. Morley, resigned. P. G. Walton, Trainmaster at Poplar Bluff, Ark., has been appointed Assistant Superintendent of the Arkansas division, with office at Wynne, Ark.

Mobile, Jackson & Kansas City.—J. G. Glazier, Superintendent of the Toledo Railway & Terminal, has been appointed Superintendent of the Mobile, Jackson & Kansas City, with office at Mobile, Ala.

New York Central & Hudson River.—F. E. Herriman, General Coal Agent, has been appointed to the newly created position of Coal Traffic Manager of this road and of the Rutland. H. W. Henry, Assistant General Coal Agent, succeeds Mr. Herriman.

Northern Pacific.—W. G. Johnson, Auditor of Disbursements, has been appointed Assistant Comptroller. G. J. Mayer succeeds Mr. Johnson. The offices of both are at St. Paul, Minn.

Oregon Short Line.—F. H. Plaisted, District Freight and Passenger Agent at Boise, Idaho, and C. I. Tuttle, General Live Stock Agent at Salt Lake City, have been appointed Assistant Freight Agents at Salt Lake City, Utah, and their former offices have been abolished.

Pennsylvania.—Samuel Rea, Fourth Vice-President, has been elected Third Vice-President, with the same duties as at present, succeeding S. M. Prevost, deceased. J. B. Thayer, Fifth Vice-President, has been elected Fourth Vice-President in charge of the traffic duties formerly performed by Mr. Prevost. Henry Tatnall, Sixth Vice-President, has been elected Fifth Vice-President, retaining the duties of Treasurer, and the office of Sixth Vice-President has been abolished. C. E. Pugh, Second Vice-President, has been elected director of the Baltimore & Ohio, the Norfolk & Western, the Chesapeake & Ohio and the Long Island, succeeding Mr. Prevost.

Philadelphia & Reading.—W. G. Edmunson has been appointed Engineer of Tests, with office at Reading, Pa.

Reid Newfoundland Company.—W. E. Hamilton has been appointed General Passenger Agent, with office at St. Johns, Newfoundland, succeeding H. A. Morine.

Reidsville & Southeastern.—G. D. Mackay, Secretary and Treasurer of the Darien & Western, has been elected President of the Reidsville & Southeastern also. H. D. Emerson, Vice-President and General Manager of the Darien & Western, has been elected to the same position on this road also. R. Denmark has been elected Secretary.

Rio Grande, Sierra Madre & Pacific.—D. J. Timlin, Master Mechanic, has resigned, and his office has been abolished. The jurisdiction of H. M. Levinson, Superintendent, has been extended over the Mechanical department.

Southern Pacific.—T. A. Graham has been appointed Assistant General Freight and Passenger Agent, with office at Los Angeles, Cal.

Spokane Falls & Northern.—H. A. Jackson, General Freight and Passenger Agent, has resigned. See Great Northern.

Suffolk & Carolina.—C. L. Hutchins, General Manager, has resigned. F. B. Dewey succeeds Mr. Hutchins.

Tennessee.—The office of Superintendent has been abolished.

Terminal Railroad Association of St. Louis.—A. Robertson, General Manager, has resigned, effective November 1. See Western Maryland.

Toledo Railway & Terminal.—J. G. Glazier, Superintendent, has resigned. See Mobile, Jackson & Kansas City.

Toledo, St. Louis & Western.—A. Shane has been appointed Superintendent of Bridges and Buildings. D. Nowlan has been appointed Superintendent of Roadway and Track.

Wabash.—F. A. Delano, First Vice-President, has been elected President.

Western Maryland.—A. Robertson, General Manager of the Terminal R. R. Association of St. Louis, has been appointed General Manager of the Western Maryland and of the West Virginia Central, with office at Baltimore, Md., effective November 1.

Wheeling & Lake Erie.—B. A. Worthington, First Vice-President of this road and of the Wabash-Pittsburg Terminal and the West Side Belt, has been also appointed General Manager.

Wisconsin & Michigan.—M. F. Schulze has been elected Auditor and L. E. Hart, Secretary, succeeding O. A. Koss, Secretary and Auditor, resigned.

LOCOMOTIVE BUILDING.

The Chicago & North-Western, it is reported, is figuring on locomotives.

The Central of New Jersey is asking bids on 20 consolidation locomotives.

The Indiana Harbor has ordered 10 mogul locomotives from the American Locomotive Co.

The St. Louis, Brownsville & Mexico, it is reported, has ordered nine locomotives from the Baldwin Works.

The Northern Pacific, as reported in our issue of September 29, has ordered 80 locomotives from the American Locomotive Co.

The Republic Iron & Steel Company has ordered two locomotives from the American Locomotive Co. for use at its Youngstown, Ohio, plant.

The Canadian Pacific, it is reported, has just placed an order with the American Locomotive Co. for 35 ten-wheel Canadian Pacific class "700" passenger locomotives.

The Michigan Central has ordered 15 consolidation locomotives from the American Locomotive Co. These are to be made at the shops of the Locomotive & Machine Co. of Montreal.

The Kansas City, Fort Scott & Memphis, it is reported, will shortly be in the market for 10 switching locomotives, five ten-wheel passenger locomotives and 15 ten-wheel freight locomotives.

The Southern, as reported in our issue of September 22, has ordered 90 locomotives. Of these, 25 have been ordered from the Baldwin Works and the remaining 65 from the American Locomotive Co.

The Pennsylvania Lines West of Pittsburg have ordered 10 class H-6a consolidation freight locomotives (adapted to use the Walschaert valve gear), five H-6b locomotives and 15 B-29 shifting locomotives from the American Locomotive Co. The H-6a and the H-6b locomotives will be made at the Pittsburg Works, and the B-29 locomotives will be made at the Schenectady Works of the American Locomotive Company.

The Kansas City Southern, as reported in our issue of August 18, has ordered eight switching and 12 freight locomotives from the American Locomotive Co. The consolidation engines will weigh 205,000 lbs., with 185,000 lbs. on drivers; driving wheels, 55 in. in diameter; cylinders, 22 in. x 30 in.; straight boiler, with a working steam pressure of 200 lbs.; firebox, 120 in. x 41 in.; 300 tubes, 14 ft. 6 in. long x 2 in. in diameter; capacity of tender, 6,000 gallons of water and 10 tons of coal. The switching engines will weigh 130,000 lbs.; diameter of drivers, 51 in.; cylinders, 19 in. x 26 in.; straight boiler, with a working steam pressure of 180 lbs.; firebox, 108 in. x 41⅞ in.; 280 tubes, 11 ft. 6 in. long x 2 in. in diameter; capacity of tender, 4,000 gallons of water and eight tons of coal. The special equipment includes: Otis steel firebox, Midvale tires; Franklin K. & M. boiler covering, Railway Steel Spring Co.'s springs, Consolidated Locomotive Safety Valve Co.'s safety valves, Ohio injectors, Climax couplers, Damascus bronze journal bearings, Chicago triple-feed lubricators, Ashcroft steam gages, Baltimore sanding device, Otis steel axles, cast-steel wheel centers and Tyler tubes.

CAR BUILDING.

The Peoria & Eastern is in the market for 100 box cars.

The Chicago, Milwaukee & St. Paul is figuring on passenger cars.

The Texas Southern, it is reported, will shortly buy about 10 box cars.

The Philadelphia & Reading, it is reported, is figuring on 100 flat cars.

The Union Tank Line, it is reported, is buying material for 100 tank cars.

The Chicago & North-Western is reported as being in the market for 18 passenger cars.

The Southern Iron Car Line, it is reported, has ordered 100 cars from the Georgia Car Co.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 20 cabooses from the Pullman Co.

The Pabst Brewing Co., Milwaukee, it is reported, is in the market for 100 refrigerator cars.

The Ozan Lumber Company has ordered 20 logging cars from the American Car & Foundry Co.

The Grand Trunk Pacific, it is reported, has ordered 2,000 freight cars from the Canada Car Co.

The Erie, it is reported, has placed an order with Barney & Smith for an experimental steel passenger coach.

The Autofagasta Railroad Company, of Chili, has ordered 17 passenger cars from the Wason Manufacturing Co.

The Baltimore & Ohio denies having ordered 500 coal cars from the American Car & Foundry Co., as reported in our issue of Oct. 6.

The Japanese Government: It is reported that the Western Steel Car & Foundry Co. is figuring on 500 box cars for the Japanese Government.

The Evansville & Mt. Vernon Traction Company, as reported in our issue of September 22, has placed an order for a number of cars with the St. Louis Car Co.

The Argentine Republic has just placed an order with the Wason Manufacturing Co. for 10 passenger and six baggage cars. These are to be used on the government railroad.

The St. Louis, Brownsville & Mexico, in addition to its orders reported in our issue of October 6, has ordered 12 tank cars of 8,500 gallons capacity from the Bettendorf Axle Co.

The Chicago, Burlington & Quincy has ordered 1,000 box cars of 80,000 lbs. capacity from the Pullman Co., and it is reported that it has also ordered two café cars from the same company.

The Kansas City, Fort Scott & Memphis, it is reported, will shortly be in the market for the following car equipment: Five hundred gondola cars, 500 twin hopper cars, 40 dump cars, 100 steel drop bottom cars, 10 combination mail and baggage cars, and six postal cars.

The Central of New Jersey, as reported in our issue of September 29, has ordered 1,000 box cars, 1,000 coal cars and 1,000 gondola cars from the American Car & Foundry Co. It has also ordered 1,000 steel hopper gondola cars of 100,000 lbs. capacity from the Cambria Steel Co.

The Chicago, Rock Island & Pacific has ordered 750 40-ft. cars of 80,000 lbs. capacity and 250 40-ft. furniture cars of 50,000 lbs. capacity from the American Car & Foundry Co. The special equipment includes: Simplex bolsters, Buffalo brake-beams, Miner draft rigging and McCord journal boxes.

The Pittsburg & Lake Erie, as reported in our issue of Oct. 6, has ordered 200 composite gondola cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for March, 1906, delivery. The special equipment includes: Carnegie axles, Simplex bolsters, Westinghouse air-brakes, Camel brasses, R. E. Janney couplers and Gould journal boxes.

The Chicago, Lake Shore & Eastern, as reported in our issue of Oct. 6, has ordered 800 gondola cars and 200 flat cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co. The special equipment for both includes: Simplex bolsters, Westinghouse air-brakes, Miner draft rigging, McCord journal boxes and Railway Steel Spring Co.'s springs.

The Central New England, as reported in our issue of Sept. 22, has ordered 10 cabooses from the Wason Manufacturing Co. These cabooses will weigh 25,100 lbs., and measure 23 ft. 1 in. long, 9 ft. 3 in. wide, and 13 ft. 8 in. high, over all. The special equipment includes: Sterlingworth brake-beams, Diamond "S" brake-shoes, Tower couplers and Butler draft rigging.

The Central of Georgia, as reported in our issue of Sept. 22, has ordered 50 dump cars of 80,000 lbs. capacity from the Rodger Ballast Car Co., for October delivery. These cars will weigh about 35,600 lbs., and measure 34 ft. long and 10 ft. 3 in. wide, over all. The special equipment includes: Common Sense bolsters, Sterlingworth brake-beams, Westinghouse air-brakes, Tower couplers, Miner tandem draft rigging and standard arch-bar trucks.

The St. Louis, Brownsville & Mexico, as reported in our issue of Oct. 6, has ordered eight day coaches, three combination cars and three 60-ft. baggage cars from the Barney & Smith Car Co.; and 100 36-ft. stock cars, 50 36-ft. box cars and 40 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co., for Dec. 15th delivery. The special equipment for the stock and box cars includes: Westinghouse air-brakes for the stock cars and Tower couplers for the stock and box cars.

The Mexican Central, as reported in our issue of September 29, has ordered 10 box cars of 60,000 lbs. capacity from the Mexican Car & Foundry Co. These cars will weigh 31,000 lbs., and measure 37 ft. 6⅜ in. long, 9 ft. 2⅝ in. wide and 13 ft. 3 in. high over all. The special equipment includes: American Steel Foundries' bolsters, National-Hollow brake-beams, Westinghouse air-brakes and draft rigging, Tower couplers, Wagoner door fastenings, Soule dust guards, McCord journal boxes, Sherwin-Williams paint, Mexican Central corrugated iron roofs and trucks and Pittsburg Spring & Steel Co.'s springs.

The Seaboard Air Line, as reported in our issue of Sept. 22, has ordered 15 wide vestibule passenger cars from the American Car & Foundry Co. These cars will weigh 98,000 lbs., and measure 61 ft. long, over end sills; 9 ft. 8 in. wide and 14 ft. 3 in. high, over all. The special equipment includes: National-Hollow brake-beams, Westinghouse air-brakes, Janney couplers, Forsyth curtain fixtures and material, Adams & Westlake door fastenings, Seaboard Air Line doors, draft rigging, trucks and wheels, Safety heating system, Pintsch light, Murphy's or Flood Conklin's paint, Chas. Scott Spring Co.'s springs and Pullman standard vestibules.

The Kansas City Southern, as reported in our issue of September 8 and 22, has ordered five chair cars, two passenger and mail cars, 100 stock cars of 60,000 lbs. capacity, and 1,000 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. The box cars will measure 36 ft. 6 in. long x 8 ft. 5⅝ in. wide x 8 ft. high, and will be fitted with Scullin & Gallagher steel bolsters. The special equipment for the stock cars will include: Scullin & Gallagher bolsters and Damascus brake-beams. The chair cars will be fitted with steel bolsters, Westinghouse brakes, Janney couplers, Hewitt Manufacturing Co.'s journal bearings, Safety Car Heating & Lighting Co.'s lighting system, Baker heaters and Pullman vestibules. The passenger and mail cars will be 60 ft. long and will be fitted with practically the same special equipment.

The Pennsylvania Lines East of Pittsburg have ordered the following freight car equipment: One thousand three hundred class Xla box cars and 4,060 class Gsd gondola cars from the Pressed Steel Car Co.; 2,300 class Gsd gondola cars from the American Car & Foundry Co.; 1,500 class Gsd gondola cars from the Standard Steel Car Co., and 300 class Xla box cars from the Middletown Car Works; a total of 9,460 cars. The lines west of Pittsburg have ordered 2,000 class Gsd gondola cars from the Pressed Steel Car Co.; 300 class Fm flat cars, 1,100 class Kf stock cars, 1,800 class Xla box cars and 1,000 class Gla gondola cars from the American Car & Foundry Co., and 500 class Xla box cars from the Western Steel Car & Foundry Co., a total of 6,700 cars, making a total of 16,160 cars in all ordered by the lines both east and west of Pittsburg. A brief mention of the above was made in our issue of September 29.

The Union Pacific System has ordered from the American Car & Foundry Co. 101 passenger cars as follows: Fifteen coaches for the Union Pacific, five coaches and two baggage cars for the Oregon Short Line, five coaches and four baggage cars for the Oregon Railroad & Navigation Co., and 10 baggage and 60 chair cars for the Southern Pacific. Deliveries will be made at the rate of 30 cars per month. Commencing Feb. 1, 1906, 15 cars will be delivered from the St. Charles and 15 from the Jeffersonville Works. The coaches will have a seating capacity of 70 persons, and will measure 67 ft. 8¾ in. long, 10 ft. ⅜ in. wide and 14 ft. 1 9/16 in. high over all. The special equipment includes: American Car & Foundry Co.'s axles, Diamond special brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Hewitt brasses, Janney couplers, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Adams & Westlake door fixtures, Miner draft rigging, Union Pacific dust guards, Consolidated Car Heating & Lighting Co.'s heating system, Pintsch light, Standard Steel Co.'s platforms, Railway Steel Spring Co.'s springs, Union Pacific standard trucks, Pullman vestibules and Standard Steel Co.'s wheels. The chair cars have the same dimensions and special equipment, except that they have a seating capacity of 58 persons and measure 76 ft. 11¾ in. long over all. The dimensions and special equipment for the baggage cars are the same as for the coaches. In addition to the above, the Union Pacific System has ordered from the Pullman Co. 20 passenger cars as follows: Five observation and smoking cars and six baggage cars for the Union Pacific, one dining and two observation and smoking cars for the Oregon Railroad & Navigation Co., and six dining cars for the Southern Pacific. Four of the baggage cars will be for the San Pedro, Los Angeles & Salt Lake and will be equipped with dynamos.

BRIDGE BUILDING.

Bedford, Ky.—Bids are wanted October 16 by J. H. McMahon for building a steel bridge 70 ft. long over Cane creek, in Trimble County. W. C. Morgan is County Clerk.

Little Rock, Ark.—An ordinance is before the City Council providing for the construction of a viaduct at Argenta over the Little Rock & Fort Smith and the St. Louis, Iron Mountain & Southern tracks on Main street. The cost of the work will be about $27,500.

Marion, Ohio.—Bids are wanted October 24 by L. N. Hipsher, County Auditor, for building a bridge with a steel superstructure over the Scioto river at the site known as Newman Bridge, to consist of one span 188 ft. long to carry a single track, with a roadway of 16 ft.

Mitchell, Ont.—A steel bridge 120 ft. long will be built on the twelfth concession of Grey.

Norfolk, Va.—The War Department has granted the application of the Norfolk Viaduct Corporation for permission to build a

cantilever electric car bridge over the Elizabeth river between this place and Berkley to be 175 ft. above low water and 600 ft. long. The cost of the work will be about $350,000.

North Vancouver, B. C.—A new bridge with a 180 ft. span is to be built at Seymour Creek.

Ottawa, Ont.—The county council has decided to build a steel bridge over the Rideau river.

Philadelphia, Pa.—Both branches of the Philadelphia City Council have passed ordinances to authorize a loan of $6,000,000, $4,000,000 of which will be used to abolish grade crossings; but the ordinance will not become effective until approved at the polls.

Peterboro, Ont.—The city council is having plans made for an overhead steel bridge across the Otonabee river at Hunter street.

Pine Bluff, Ark.—Plans are being made to build a free bridge over the Arkansas river, which is to be a combined railroad and highway bridge.

Racine, Wis.—The plans submitted by Engineer John Geist, as ordered by the city, call for a swing bridge to be built on the line with Main street. The approaches are to be of cement and the cost of the work will be $67,000. The City Council may soon authorize the asking of bids for this work.

San Jose, Cal.—Bids are wanted October 16 by Henry A. Pfister, Clerk of the Board of Supervisors, for building a bridge over the Guadalupe creek on Willow street in Santa Clara County.

Shelbyville, Ind.—A contract has been given to L. H. Fish, of this place, to build a new bridge and repair three others over Robinson creek.

Shreveport, La.—The City Council of Shreveport has begun preliminary work towards the construction of a free traffic bridge over the Red river, and will make the surveys in accordance with the direction of the War Department under the act recently passed by Congress.

Spokane, Wash.—Bids are wanted October 19 by F. P. Weymouth, President of the Board of Public Works, for building a bridge over the Spokane river at Mission avenue, to consist of one 150-ft. span and one 200-ft. span or of four 92-ft. spans. Bids will be accepted for either a steel superstructure with tubular piers or for a reinforced concrete structure with concrete superstructure.

Toronto, Ont.—Steel bridges will be built over the tracks of the Grand Trunk at Bathurst street and the Canadian Pacific in the Island Park, at a cost of about $75,000.

Ventura, Cal.—Arrangements have been made by the County Commissioners to raise $50,000 to be used towards building two bridges, one over Sespe creek near Fillmore and the other over the Ventura river at Casitas Pass.

Other Structures.

Brampton, Ont.—The Grand Trunk, it is said, will build a new passenger station to cost about $40,000.

Glassport, Pa.—The Pittsburg & Lake Erie is planning to build repair and machine shops at this place to cost about $100,000.

Owensboro, Ky.—The Louisville & Nashville has given a contract to Walter Brashear, of Henderson, for putting up a brick union passenger station to cost $35,000. It will be used jointly by the Louisville & Nashville, the Illinois Central and the Louisville, Henderson & St. Louis.

Pittsburg, Pa.—A contract has been given by the Pennsylvania to W. F. Trimble & Sons Co., of Allegheny, for building an inbound freight house on the Duquesne Way elevated line in Pittsburg. The plans call for a brick building 48 ft. wide and 900 ft. long, one-half of which is to be four stories high and the remainder one story. The cost of the work will be about $450,000, and 3,000 tons of structural steel will be required for the frame work.

Varcoe, Man.—The Canadian Pacific is to build a new station here.

Winnipeg, Man.—The Canadian Northern will shortly call for bids for the construction of a number of stations along its new extensions.

It is reported the Canadian Pacific has bought ground as a site for a new station.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Augusta & Florida.—This company, which is building a railroad from Midville, Ga., north through Burke and Richmond Counties, via Keysville to Augusta, a distance of 60 miles, having been unable to secure trackage rights over the Southern from Keysville to Augusta, proposes at once to extend its road from that point north to Augusta, 20 miles. (See Construction Record.)

Cairo & Thebes.—Incorporation has been granted a company under this name in Illinois, with a capital of $10,000, to build a railroad from Cairo, at the southern end of Alexander County, Ill., northwest to Thebes, about 25 miles. The incorporators include: E. A. Smith, W. J. Johnson, D. Hartman, G. J. Becker and J. H. Galligan, all of Cairo.

Canadian Pacific.—This company is planning to build a branch from a point near Wolseley, on the main line, to Reston, on the Souris branch, 122 miles.

Cananea, Yaqui River & Pacific.—This company, which operates 40 miles of road from Naco, Ariz., southwest to Cananea, Mex., is to extend its road south from its southern terminus and also northeast towards the boundary line to a connection with the Southern Pacific.

Chesapeake & Ohio.—This company, it is said, is planning to build a branch line at Main Shelby creek, in Kentucky, for a distance of about 20 miles into a rich coal and timber section. Surveys for this work have been made and rights of way are being secured.

Chicago & Alton.—Work is under way on the construction of 50.66 miles of second main track from Sherman, Ill., northwest to Bloomington. This will, when completed, give the Chicago & Alton a double track from Chicago to Iles, 187.2 miles, counting the Coal City branch as part of the double track. In this connection, the grades between Carlinville and Bloomington are being reduced to 0.3 per cent. northbound, thereby securing this low grade all the way from the Illinois coal fields to Chicago.

Chicago, Burlington & Quincy.—This company, according to newspaper reports, will begin work on a new line in the Big Horn Basin in Wyoming. The proposed route is from Fannie, in the northern part of Big Horn County, east along Polecat creek to the Big Horn river, thence south along the river to Warland, which will be the southern terminus, a distance of about 100 miles. The new line will open up more than 250,000 acres of irrigated land. It is thought that the line will eventually be connected with the line from Bridgeport, Neb., to Guernsey, Wyo., and made a part of the main line.

Chicago, Desplaines & Fox River.—Articles of incorporation have been filed in Illinois by a company under this name with a capital of $1,000,000, to build a railroad from Chicago north and northwest through the counties of Cook and Lake to McHenry County, Ill., a distance of about 50 miles. The incorporators include: George W. Bryson, William S. Reed, Ernest T. Ross, Walter C. Gunn and William K. Kenly, all of Chicago; office in Chicago.

Chicago, Weathersford & Brazos Valley.—A contract has been given by this company to the McCarthy-Miller Construction Co., of Lufkin, Tex., to build this proposed road from Weathersford, Tex., via Springtown and Pooleville to Bridgeport, a distance of 35 miles. The road may eventually be extended farther south to Granbury or Glen Rose. The road is supposed to be an independent project, but will make connections with the Rock Island. The city of Weathersford has contributed $65,000 towards the construction of the line. The names of the incorporators are not given.

Cleveland, Berea & Southern (Electric).—This company, which has been granted a charter in Ohio, has secured all its rights of way and will soon begin construction. The proposed line is about 30 miles long. The contractors will begin in South Brooklyn and work toward a point southwest of Berea, entering that place over the Cleveland & Southwestern. From this place, a branch will be built south to Medina. C. H. Hubbell, of Cleveland, is interested.

Cleveland, Cincinnati, Chicago & St. Louis.—The first track elevation resolution, under the law passed by the last session of the Legislature, has been adopted by the Board of Public Works of Indianapolis, Ind., and has been agreed to by representatives of the Cleveland, Cincinnati, Chicago & St. Louis and the Vandalia roads. Provision has been made for the elevation of tracks and the depression of the streets at Kentucky avenue and Missouri and West street crossings, and for the erection of a new bridge over White river for the Vandalia. The latter company will elevate the tracks for a considerable distance west of White river and the Indianapolis & Vincennes trains will reach the elevation by a new route. The work will cost about $300,000, the railroads paying about 75 per cent. and the city the balance. Work will be commenced this month and is to be completed by December, 1906.

Des Moines, Iowa Falls & Northern.—This company, which operates 75 miles of road from Iowa Falls to Des Moines, has let a contract to R. A. Elzy, of Marshalltown, for building the first eight miles of its proposed extension from its northern terminus (Iowa Falls) to Hampton, in Franklin County. The road is to be eventually extended to Mason City, an additional 20 miles. (September 8, p. 79.)

Fort Worth & Mineral Wells (Electric).—A charter has been granted a company under this name in Texas, with a capital of $250,000, to build an interurban electric road from Fort Worth, Tex., west to Mineral Wells, about 60 miles. The offices of the company will be at Fort Worth, and the directors include: Cicero Smith, D. M. Howard, H. N. Frost, E. J. Waldrow and A. Stevenson, all of Mineral Wells.

Gainesville Midland.—A charter amendment has been granted to this company in Georgia giving it permission to extend its line from Jefferson, in Jackson County, southeast to Athens, in Clark County, a distance of 18 miles, and to change the gage of the road from narrow to standard. Work is to be commenced shortly. (Aug. 25, p. 62.)

Grand Trunk Pacific.—A contract that is worth between $4,000,000 and $5,000,000 has been given by this company to Foley Brothers, Larson & Co., of Winnipeg, for building the line between Fort William and Lake Superior Junction, about 210 miles. This is the second contract let by the G. T. P. The first was given to Macdonald & MacMillan, of Winnipeg, to build the line from Portage la Prairie to Touchwood Hills. The awarding of this contract means that about 500 miles of the road will be under actual construction by the latter part of this month. The work must be completed in time to move the grain crop of 1907. This company will immediately call for bids for the construction of an additional 500 miles of track, making 1,000 miles to be under way before December.

Great Northern.—According to newspaper reports, this company's connection with the Burlington now under construction between Sioux City and Omaha will be operated by the Burlington as a portion of that system and through trains will be run from Omaha to St. Paul and Minneapolis over the C., B. & Q. and Great Northern. The new line will be about 112 miles between Omaha and Sioux City, while that of the Chicago & North-Western is only 105 miles long.

See Vancouver, Victoria & Eastern below.

Hayneville & Montgomery.—Incorporation has been granted in Alabama to a company of this name, with a capital of $50,000, to build a railroad from Hayneville, Ala., to Tyson, on the Louisville & Nashville, and thence to Montgomery; also to build a line from Hayneville to Big Swamp, in Lowndes County. The incorporators include: G. E. McGehee, Charles Schuessler and W. G. Davis, all of Lafayette, Ala.

Illinois Central.—It is said that work is to be at once begun on the Jackson & Southeastern, which is a part of the Birmingham branch of this road. Construction is to be begun at Frogmore, Tenn., which is the Illinois Central lower yards, and to be continued toward Perry Switch, on the Mobile & Ohio.

Indiana Belt (Electric).—A charter has been granted a company under this name in Indiana, with a capital of $10,000, to build a railroad from Indianapolis to Greenfield, through Maxwell, Eden, Pendleton, Noblesville, Lebanon, Danville, Martinsville, Franklin and Shelbyville. The officers are: Charles A. Barnes, President; Everet Hatfield, First Vice-President; Irving Tyner, Second Vice-President; P. Bidgood, General Manager; Thomas Beecher, Secretary and Treasurer. F. Bidgood, of Logansport, is Chief Electrical Engineer

Kansas City, Mexico & Orient.—An officer of this company is reported as saying that 76 miles of the road north of Sweetwater, Tex., will be put in operation this month; also that the line east of Chihuahua in Mexico will be in operation for a distance of a little over 100 miles. It is expected to have the road from Kansas City to Sweetwater operated by the first of next year, and 1,000 miles in operation by April, 1906.

Louisville & Nashville.—See Louisville Southern below.

Louisville Southern (Louisville & Nashville).—According to local reports, an eastern syndicate, in which John D. Rockefeller is interested, has bought 10,000 acres of coal lands along the proposed extension of this road in upper Harlan County, Ky. It is the intention of the syndicate to build an extension of the Louisville & Nashville from a point on the Cumberland Valley division, to the coal property in Cumberland Valley, a distance of 35 miles.

Manitoba & Midland.—An office has been opened at Portage la Prairie and surveys are being made for a line from Emerson, on the international boundary north to Portage la Prairie. The promoters hope to eventually build the line to Hudson Bay.

Mexican International.—This road, which will be extended from Durango, Mex., to Guadalajara, a distance of about 400 miles, has been finally located from Durango to Chalchihuites, 150 miles, and construction work on this first division will be soon begun. Surveys for the balance of the road are now being made. C. G. Carroll is the engineer in charge of the work.

Morelia & Tacambaro.—An officer writes that contracts will be let for construction work within 30 days on this proposed road from Irapuato, on the Mexican Central, south through the State of Michoacan to Tacambaro, thence west to Ario, a distance of 225 miles. The road has been granted a number of valuable concessions by the Mexican Government; also from the State of Michoacan. C. D. Knapp, of New York, is Vice-President and General Manager. (September 29, p. 103.)

Newark & Hackensack River (Electric).—Incorporation has been granted a company under this name in New Jersey with a capital of $1,000,000 and headquarters at 763 Broad street, Newark, to build an electric railroad from Park Place, Newark, to the Hackensack river. The incorporators include: T. N. McCarter, Rumson, N. J.; C. A. Sterling, East Orange; A. H. Charlton, Elizabeth; J. J. Burleigh, Merchantville; A. R. Kuser, Bernardsville; T. C. Barr, Orange, and M. T. Cox, East Orange. The Jersey City & Hackensack River Railway Company, also incorporated with a capital of $1,000,000 by the same parties, is to continue the line of the above company from that point to the intersection of Erie and Fourteenth streets, Jersey City, where it is to connect with the proposed line of the Interstate Tunnel Railway Company, which in turn is to construct the tunnel to the middle of the North River connecting with the affiliated company incorporated in New York State. The approximate length of the two lines will be seven and a quarter miles.

New York Central & Hudson River.—Work is in progress in four-tracking the line at various points between Mott Haven Junction and Croton, on the Hudson division, 29 miles. At the junction of the main line of the N. Y. C. & H. R. (old Spuyten Duyvil & Port Morris) with the New York & Harlem at Mott Haven Junction, there is a large amount of rock cutting on both sides of the present double track. North of Spuyten Duyvil along the shore of the Hudson, the shore line is being extended out into the river by filling in at available points, and two additional tracks are being laid west of the present three main tracks. As yet no buildings have been moved or crossings changed, and therefore no long stretches of track have been laid, but all parts of the line are being made ready for the four tracking. This work includes a new cut-off from a point just south of King's Bridge station, west to a point a few hundred yards east of Spuyten Duyvil, which will save nearly a mile in distance and a long and sharp curve. The rock cutting on this section is nearly completed and the work now to be done consists of grading, ballasting and bridging two short arms of the Harlem river, over which the new line will pass. Over each of these a concrete culvert is already well under way.

New York, New Haven & Hartford.—At a recent meeting of the Board of Aldermen of New Haven, Conn., the new proposition of this company to widen its cut through the city, which work has been under consideration for several years, was agreed to. The cut to be widened is 8,000 ft. long. Over this cut there will be 12 steel bridges to replace existing wooden structures. The cost of the work will be about $5,000,000.

Norman's Southeastern.—Incorporation has been asked for by a company under this name in Missouri with a capital of $120,000 to build a railroad 12 miles long in Stoddard County. The incorporators include: W. W. Norman, S. A. Ruch and C. A. Vernon, of Huntsville.

North Coast.—Articles of incorporation have been filed by this company in Washington (authorized capital $1,000,000) to build an electric or steam road into the Yakima Valley. The incorporation is said to be with the object of building a new railroad from the Sound to the Yakima Valley, and may be a project of the Northern Pacific to secure a route through Naches Pass. The incorporators include: F. B. Dudley, of Niagara Falls, N. Y.; R. E. Strahorn, of Spokane; J. A. Kerr and John H. McGraw, of Seattle, and O. A. Fechter and J. J. Rudkin, of North Yakima.

Northern New Mexico & Gulf.—Incoroporation has been granted a company under this name in New Mexico, with a capital of $300,000, with headquarters at El Rito, in Arriba County, to build a railroad from the Santa Fe Central at Santa Fe northwest toward Arizona. The proposed road will cross the Tesque Pueblo grant, follow the Rio Grande north from San Ildefonso and Santa Cruz by way of Santa Clara, and thence across the Rio Grande to Espanola. It will then follow the Chama river west and the Gallinas river into Sandoval County, and thence across the Canyon Largo into San Juan County via Fruitland, to the New Mexico-Arizona boundary. There will be a branch line to Farmington, Aztec and Durango, Colo. The incorporators include: William H. Coe, of New York; E. B. Miller, of El Rito; F. E. Coe, of Denver; G. H. Howard, of Santa Fe, and G. V. Howard, of Boulder, Colo.

Pennsylvania.—According to newspaper reports, surveys are being made by this company for a new freight line from Trenton, N. J., northeast to Waverly, near Newark, thus paralleling the present four-track main line for 45 miles. It is said that the surveyors crossed the Raritan river about a mile below New Brunswick.

Construction work, it is said, has been commenced by this

company on the Monongahela division from its present terminus at West Brownsville southwest to Rice's Landing, in Green County, Pa., a distance of 12 miles. The new line will develop a rich coal region which has hitherto been without transportation facilities. It is expected to complete it next spring, when a line will be built from the southern terminus north through Washington County to a connection with the Ellsworth branch, making a loop.

Work has been started on this company's new line from Beatty, Pa., to Greensburg, eight miles. The contractors are H. S. Kerbaugh on the eastern end, and Drake & Stratton on the western end. The present line, which is to be superseded, passes through a long tunnel at Donohue. The new line will be one-half mile shorter than the present one and will have a better alinement and lighter grades. About one mile of the existing line will be used, but the other seven miles will be on a new right of way and will have four tracks. The improvement is to cost approximately $2,000,000. The contractors expect to have the road ready for use early in 1907.

Pere Marquette (Erie).—This company has given a contract to Chick Bros., of Windsor, Ont., to build 15 siding tracks, each 3,000 ft. long, at St. Thomas, Ont.

Raleigh & Pamlico Sound.—An officer writes that construction work will be pushed on this proposed road which is to run from Raleigh, N. C., east via Wilson, Snowhill and Greenville to Washington, a distance of 114 miles. The company has recently been placed under new management, which is planning to extend the road from Washington to New Bern, N. C. Track has been laid for about 9½ miles and on an additional five miles grading has been completed. The officers of the company are: Charles O. Haines, President and General Manager; Adam Treadwell, Secretary and Treasurer, and John W. Stewart, Chief Engineer. The offices of the company are at Raleigh, N. C. (See Construction Record.)

Texas, New Mexico & Pacific.—A charter has been filed by a company under this name in Texas, with a capital of $1,000,000, to built a railroad from McKinney, Tex., west to a point in Cochran County, approximately 375 miles. The general offices of the road will be at McKinney. The incorporators include: L. K. Davis and W. Maple, of Chicago; J. Chain, J. L. White, J. L. Doggett, M. J. Healy and others, of McKinney.

Union Pacific.—This company, it is said, has located the line of its new cut-off to be built between Omaha and Elkhorn, on which work is to be commenced at once. The grade on the new line will be less than 1 per cent., but much grading will be necessary on the west end, where the main line will join the cut-off. The distance from South Omaha to Elkhorn by the old route is 28 miles and by the new line only 18 miles. It is proposed to run all through trains over this cut-off.

Vancouver, Victoria & Eastern (Great Northern).—President J. J. Hill, of the Great Northern, is reported as saying that construction work on the western section of this road will be rushed. A start will be made this winter at Cloverdale, where the new road will join the New Westminster Southern, now a part of the Great Northern. The contractors, dividing the work into large sections, will work east over the Hope mountains to connect with the other section of the Vancouver, Victoria & Eastern, now being built from the boundary into the Similkameen district. It will be an all-Canadian line, with a terminal at Vancouver.

Vandalia.—See C., C., C. & St. L.

Virginia Peninsula.—An officer writes that construction work will be begun within 30 days on this proposed road, which is to be operated by gasolene motors. The line is from Newport News, Va., through Bethel, Poquoson, Grafton, Yorktown, Gloucester and a number of smaller places, with a main line 20 miles long and branches of 10 miles. Contracts will be let shortly for the construction work. A contract has been given to the Penn Steel Co. for the rails. Work will be light, as there are no grades over 1 per cent. and no curves. W. A. Post is President; J. L. Patton, Vice-President, and J. L. Marye, Jr., Engineer, Norfolk, Va. (See Virginia Roads, September 29, p. 104.)

Washington Roads.—The Hamilton-Lyman Lumber Co., owning large tracts of timber lands in Skagit Valley, will at once begin the construction of a railroad from Hamilton on the Great Northern west to Sterling, a distance of 15 miles.

Western Pacific.—Announcement has been made by this company that work on its proposed road will soon be started between Oakland and Oroville. The Utah Construction Co., which has the contract for a large proportion of this road, is subletting some of the work north of Oroville, and grading on the section west of Salt Lake will be commenced shortly. The work includes a tunnel 7,400 ft. long at Spring Garden, Cal.; also one 6,000 ft. long at Beckwith Pass, Cal. The company has completed the location of its entire line between Oakland, Cal., and Salt Lake City, and is now securing rights of way.

Windsor, Essex & Lake Shore.—A charter has been granted this company in Michigan (capital $1,000,000) to build a railroad from Windsor to Chatham, passing through Tilbury and Maidstone, 120 miles. The officers are: William J. Wilson, President, of Port Huron; John W. Goodson, Secretary, of Detroit; W. C. Crawford, Treasurer, of Tilbury, Ont., and Philip Haselton, General Manager, of Detroit.

RAILROAD CORPORATION NEWS.

Canadian Northern.—The Mackenzie & Mann interests have bought the Nipigon Railway, a company which proposed to build from Nipigon Bay, on Lake Superior, to Nipigon Lake, 40 miles. This was acquired because its projected route paralleled the Mackenzie & Mann line to be built from Sudbury, Ont., to Port Arthur.

Chesapeake & Nashville.—This road and its equipment has been sold to William A. Northup, of Louisville, Ky., for $300,000 cash. It runs from Gallatin, Ky., to Scottsville, and, including an 11-mile branch, is 35 miles long.

Dominion Atlantic.—This company has purchased the Midland Railway, which is 60 miles long and runs across Hants County in Nova Scotia, connecting with the Dominion Atlantic at Windsor and with the Intercolonial at Truro.

Erie.—The Erie has offered to stockholders of record on October 21 the right to subscribe for $12,000,000 4 per cent. convertible, series B bonds, of 1953, at par and interest. These bonds are convertible into common stock at 60 between October, 1907, and October, 1917. Each stockholder may subscribe for bonds to the extent of 6.75 per cent. of his stock. The bonds are part of an authorized issue of $50,000,000, of which $10,000,000 has already been issued. The proceeds will be used to pay for the stock of the Cincinnati, Hamilton & Dayton. There were 1,603 shares of C. H. & D. stock bought from J. P. Morgan & Co. at 135, and 74,000 shares at an average of 160. This gives the Erie ownership of 75,603 out of the total 80,000 shares of Cincinnati, Hamilton & Dayton stock.

Galveston, Harrisburg & San Antonio.—This company has acquired the Galveston, Houston & Northern and assumed its operation. It will be known as the Galveston division.

Great Northern.—The long rumored "melon" to be distributed by the Great Northern has been brought to pass by a circular issued to the stockholders offering them the privilege of subscribing at par to new stock to the extent of one-fifth (20 per cent.) of their holdings on November 8, when the stock books will close. As Great Northern preferred—there is no common stock—is selling at about 325, this privilege is a valuable one, the rights having been valued on the curb market on notice of the issue at 37. On this basis the privilege amounts to a 37 per cent. stock dividend. The new issue will amount to $25,000,000, which makes the total amount of stock outstanding $149,375,600.

Nashville, Chattanooga & St. Louis.—The interest rate on all bonds which may hereafter be certified and issued under the provisions of the debenture of April 2, 1888, made with the United States Trust Co. of New York, trustee, has been reduced from 5 to 4 per cent.

New York Central & Hudson River.—Gross earnings for the nine months ending September 30 were $62,577,355, an increase of $5,089,123 over the figures for the corresponding period in 1904.

New York, New Haven & Hartford.—This company has issued an additional $5,000,000 of coupon notes, maturing October 1, 1906. This will make $12,000,000 of coupon notes outstanding, the other issues maturing at various dates in 1906 and 1907.

Richmond-Washington Company.—This company, which is a holding company in the interest of six railroads for the Richmond, Fredericksburg & Potomac and the Washington Southern, has issued an additional $2,000,000 of collateral trust 4 per cent. bonds of 1943, making $8,500,000 outstanding of the total $11,000,000 authorized.

St. Louis Southwestern.—The stockholders have authorized the guaranteeing of an issue of not exceeding $500,000 first mortgage 5 per cent. 50-year bonds of the Shreveport Bridge & Terminal, and also an agreement with that company for the use of its bridge and other property for 50 years.

Terminal Railroad Association of St. Louis.—President Roosevelt has directed the Attorney-General to proceed with the prosecution of the suit to enjoin this company from continuing its control of the two bridges and the Wiggins Ferry lines across the Mississippi river, at St. Louis. This suit has been pending two years and is brought under the anti-trust law, the government declaring the operation of the different lines by a single company as unlawful monopoly.

GENERAL NEWS SECTION

NOTES.

The Chicago, Rock Island & Pacific has discontinued all of its "interurban" passenger trains in Iowa.

To increase its supply of small sizes of coal the Reading has put five anthracite washeries in operation. The demand for small sizes is unusually great.

The Pennsylvania is being prosecuted in the United States Court in Ohio for running a freight car between Columbus and Pittsburg not equipped with automatic couplers.

It is announced in Montreal that the Canadian Pacific has made reductions on all freight rates to the Pacific coast, the new basis being 49 cents (first class) per 100 lbs. less than the tariff hitherto in force.

Chicago papers say that the Atchison, Topeka & Santa Fe proposes to spend $400,000 a year for the next five years in promoting the settlement of the states and territories on the southwestern part of its lines.

Mr. E. H. Harriman is having an examination made of the routes over which it is proposed to build railroads in the Philippine Islands. Mr. Robert Hawxhurst, Jr., formerly Chief Engineer of the Kohola & Hilo (Hawaii), is in charge of the work.

A despatch from Kansas City indicates that the railroads of Missouri have been successful in postponing the enforcement of the maximum freight rate law. The Attorney General has withdrawn his demurrer and this action is expected to lead to indefinite delay in the enforcement of the law.

The Lake Shore & Michigan Southern has put new padlocks (with keys different from the old ones) on all switches throughout the company's lines. It is said that the officers believe that the misplacement of the switch at Mentor recently, which caused a disastrous derailment, is chargeable to some person, not an employee, who had a switch key. Records have been made of the names of all persons to whom the new keys have been issued.

A number of railroads in Vermont are protesting against an order made by the Railroad Commission of that state requiring the use of certain signals at crossings where the railroad is crossed by an electric railway. The signal is a disk, fixed some distance from the crossing, to be set against approaching trains by the conductor of the electric car. The railroads claim that the disks prescribed are not large enough and that the signals, as ordered to be arranged, are more dangerous than not to have any signals at all.

Members of the New York Produce Exchange who have for some time been complaining of an unusual scarcity of cars at Buffalo for the shipment of export grain to Boston and New York, announce that the railroads have promised to concentrate all available cars at Buffalo and to "allow the general movement of merchandise to suffer." The congestion of grain at Buffalo, grain brought there by lake vessels, is so great that the railroads are now making contracts with shippers for the carriage of their grain only subject to delay, and also subject to additional storage charges at Buffalo.

The southbound trains of the Interborough Rapid Transit Company on the Ninth avenue elevated line, New York City, now pass the Fifty-third street junction without stopping. It is said that this disregard of the order issued by the state Railroad Commission, after the recent disastrous derailment at that point, is justified by the road on the ground that the stops cause congestion of traffic and so delay the passengers. This action appears to have been taken with the knowledge of the commission, and apparently with its consent.

Conductor W. B. Caldwell, who was indicted by the Grand Jury of Jefferson County, Tennessee, on a charge of involuntary manslaughter, or criminal negligence resulting in the terrible butting collision of passenger trains at New Market, Tenn., Sept. 24, 1904, killing over 60 persons, was tried last week, and the result was a mistrial, the jury failing to agree. It is said that the case will be again tried at the next term of the court. The principal witness for the prosecution was a law agent of the Southern Railway, who testified that the conductor had told him a few minutes after the wreck that it was caused by his forgetting orders to meet a train a few miles back.

A Real Airship.

An invention which will solve the problem of transportation in rural communities, where, by reason of physical obstacles, steam and electric lines cannot well be used, is now being perfected by B. W. Harris, of Waveland, Ind. In brief, the invention includes an overhead system of cables not only furnishing support but also carrying the current of electricity for power. The car thus operated can be used for freight or passengers. The experimental car that Mr. Harris has constructed at Mattoon, where he is now working, will hold five people. The cables supporting the car are in turn supported by poles. Uneven breaks in the ground, little hills and valleys, have no effect on the level plain of the cable, as the poles are cut to a length that keeps the cables level. The long aerial car is of aluminum, coming to a sharp point at both ends to do away with as much resistance as possible. At each side there is a small door, by which the operator enters. The propelling power—electricity—is collected by the glass wheels upon which the car glides from the cables which form the track. The four wheels, which are about 14 inches in diameter, are deeply grooved, thus making it impossible for the car to leave the cables. The operator can control the car at all times from within, having levers and switches by which he can reverse, start or stop the car instantly.—*Indianapolis News.*

General Electric Company's Awards at Portland.

The Jury of Awards of the Lewis and Clark Exposition at Portland, Ore., has awarded gold medals to the General Electric Company for the following features of its exhibit in the electrical department: For the best exhibit in the electrical department, Curtis steam turbine, meters and instruments, time-limit relays and oil switches, switchboards, meter controlling panels, circuit breakers and lightning arresters; direct and alternating current motors, direct and alternating current generators, static transformers, automatic voltage regulators, magnetite arc lamp, alternating and direct current enclosed arc lamps, mercury arc lamps, magnetic starting device for mercury arc lamps, mercury arc rectifier, railway motors and controllers, mining locomotives, searchlight and method of control, progress and development in the electrical art, metalized carbon filament incandescent lamps. The gold medals were the highest awards. Not only was the exhibit of the General Electric Company the largest and most complete of any of the electrical manufacturers on the grounds but the Exposition was lighted throughout with Edison incandescent lamps made by this company. The new "meridian" lamps, also made by the General Electric Company, were extensively used.

Lectures on Traffic at N. Y. University.

The School of Commerce of New York University is to have three courses in "railway traffic," to be conducted on Monday evenings during the current year by W. H. Lough, Jr. The announcement says that these courses are of a thoroughly practical character, designed to be directly beneficial to men employed in traffic offices. . . . "They are the beginning of an attempt on the part of the School of Commerce to put the study of railroad methods on a scientific basis, and to prepare young men for responsible positions in the railroad service more thoroughly and more quickly than can now be done." Classes in railroad organization, railroad law and railroad accounts are proposed also. Eventually the school expects to offer to railroad men a well rounded series of courses in their profession. Professor J. F. Johnson, Dean of the School, says: "We cannot provide brains, and a good deal of the detailed training must be picked up in day-to-day work, but we can give our young men an intelligent outlook over the railroad field. . . ."

Good Roads Propaganda in Iowa.

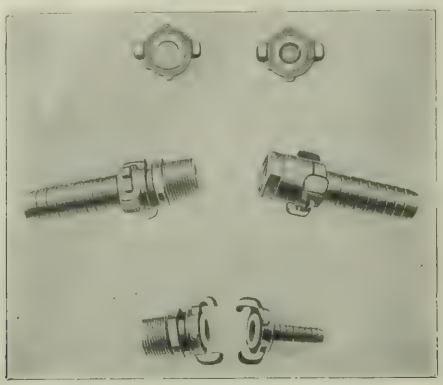
It is announced that a party of speakers and expert road builders are to be carried in special trains over the lines of the Chicago, Burlington & Quincy during the last ten days of October and over the Chicago Great Western in the first part of November. The purpose of the trip is to arouse interest in good roads and spread information concerning the best methods in road-building.

The Chicago Hose Coupler.

This universal coupler was designed for a standard, to avoid extra expense for specially constructed couplers to suit various sizes of hose used with pneumatic tools. It has no male or female part at the coupling end, but instead each half has both male and female features, so that each half is exactly the same and will couple regardless of the size and style of the shank, making it a universal coupler in every sense of the word. Quarter-inch hose

will couple with three-quarter-inch hose, one-inch pipe, or anything having one of the Chicago couplers attached to it.

The shanks are manufactured for pipe male thread, pipe female thread, and hose in standard commercial sizes one-quarter inch up



The Chicago Hose Coupler.

to one inch, which enables all couplings to be made without resorting to reducers or special shanks to meet the conditions presenting themselves where pneumatic tools are in use.

These couplers are manufactured by the Chicago Pneumatic Tool Company, who have manufacturing facilities for 500 sets per day.

Manufacturing and Business.

The Electro-Dynamic Company, of New York and Bayonne, N. J., has moved its St. Louis office to Seventh and Hickory streets.

B. V. H. Johnson, General Agent of the Safety Car Heating & Lighting Co., at St. Louis, has been transferred to the Philadelphia office, and Charles B. Adams has been appointed as General Agent at St. Louis.

Mr. George William Catt, President of the Atlantic, Gulf & Pacific Co., died in New York City on October 8, at the age of 45. He took a C. E. degree from the Iowa State College in 1882, and then went into the offices of the King Bridge Co., of Cleveland, being Bridge and Contracting Engineer in the Mississippi valley several years. In 1885, he went to the Pacific coast in charge of that company's business in that region, and the next year became Chief Engineer of the San Francisco Bridge Co. In 1889, he was placed in charge of the Seattle office of that company, and in the next two years did much of the bridge work on the Great Northern and other railroads which were built at that time in the state of Washington. In 1891, Mr. Catt went to Boston and obtained a contract for some hydraulic dredging in Boston harbor. He developed this business on the Atlantic coast and in the next year organized the New York Dredging Co. In 1899, the business of this company was merged into the new corporation, the Atlantic, Gulf & Pacific Co., Mr. Catt being the President and Chief Engineer until his death. He was also Consulting Engineer and Vice-President of the Puget Sound Bridge & Dredging Co., of Seattle, and Consulting Engineer of the San Francisco Bridge Co. and the British Columbia General Contract Co. We quote the following appreciation of Mr. Catt by Mr. Henry S. Wood, Secretary and Treasurer of the Atlantic, Gulf & Pacific Co.: "Notwithstanding the most successful business career of Mr. Catt, his greatest contribution to society has been the demonstration of an upright and firm but generous character. Of exemplary personal habits, he demanded of his assistants and recommended by his example to his associates a life free from reproach, efficient in service and loyal to the interests over which he exercised such able control. Whether in college fraternity or the leading engineering societies of the United States, his associates will remember him with pleasure, and his taking off with the deepest regret. The engineer's profession of America is poorer by his loss."

G. W. Catt.

The O. M. Edwards Company, Syracuse, New York, announce that it has recently appointed W. G. Willcoxson as its Chicago representative, and that Mr. E. F. Chaffee, formerly Passenger Car Foreman, at the West Albany shops of the N. Y. C. & H. R. R. R., has been appointed as its Eastern representative, with headquarters in New York City.

T. K. Wells has been appointed Superintendent of Transportation of the Manila Electric Railway and Lighting Company, of Manila P. I. Mr. Wells has had a wide experience in railroad work having been with the Wabash Railroad and the St. Louis, Iron Mountain & Southern Railroad for 14 years and with the Syracuse Rapid Transit Company for eight years.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, has recently received a large order for hollow staybolt bars from the American Railroad Company, San Juan, Porto Rico, and also a large additional order for shipment to Japan. Mr. F. C. Lippert has taken a position with this company as traveling salesman in the western territory with headquarters at St. Louis, Mo.

It is announced that the Pratt & Whitney Company have purchased a plant in Dundas, Ontario, for the manufacture of its full line of small tools—such as taps, reamers, milling cutters, punches, dies, twist drills, etc. The building is a modern structure, and the power plant is already in place. The location of the factory is near that of the John Bertram & Sons' Company, which, as has been announced, was recently purchased by the Niles-Bement-Pond Company.

The American Blower Company reports all departments of its shops at Detroit to be extremely busy. Among other large orders under way is one for the complete heating apparatus for the new Allegheny shops of the Pennsylvania Lines West of Pittsburg. Orders from the wood-working field include a fifth dry kiln for the W. F. Stewart Co., Flint, Mich. and kilns for the English Mfg. Co., Morrill, Wis.; I. B. Morrison, Hallville, Tex., and the Buffalo (N. Y.) Lounge Co.

The Abner Doble Company, San Francisco, has recently received an order from the California Gas & Electric Corporation for a 9,000-h. p. Doble tangential water wheel for its De Sabla power plant. This machine will be similar to the 8,000-h. p. Doble wheel installed in the De Sabla plant last year and the three 8,000-h. p. Doble wheels recently completed and now successfully operating in the new electra station of the same company. The wheel will operate under a head of 1,530 ft., at 400 r. p. m., and will be driven by a single jet of water, thus making it the most powerful water wheel ever constructed for operation under a single jet of water.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Association of Railroad Surgeons.

This association, a consolidation of the International Association and the American Academy, held its first regular meeting at Chicago, October 11. The President for the ensuing year is Dr. R. W. Corwin, Pueblo, Colo., Chief Surgeon of the Colorado Fuel & Iron Co.; Secretary, Dr. H. B. Jennings (C., R. I. & P.), Council Bluffs, Iowa.

Transportation and Car Accounting Officers.

Secretary G. P. Conard announces that the November meeting of the Association of Transportation and Car Accounting Officers will be held at the Jefferson Hotel, St. Louis, Mo. (not New Orleans), on Tuesday, November 21. There will be reports from the Committees on Conducting Transportation; on Car Service; on Office Methods; on Per Diem, and on Handling Railroad Service Mail.

PERSONAL.

—Mr. W. G. Edmundson, who has been appointed Engineer of Tests of the Philadelphia & Reading, is a graduate of Cornell University. He worked in the shops of the Brooks Locomotive Works and of the Pittsburg & Lake Erie Railroad at Pittsburg for about two years. In 1902, he went to the Pennsylvania Railroad as draftsman, becoming later an inspector of buildings in the shops and power plants.

—Mr. Hal. S. Ray, who was recently appointed Assistant General Passenger Agent of the Rock Island System, was born in Connecticut in 1869. He was educated at the Philadelphia Central High School and entered railroad service as a clerk in the district pas-

senger office of the Chicago, Rock Island & Pacific at Philadelphia in 1890. All of his work has been done for this company. He has served successively as Assistant City Passenger and Ticket Agent at Des Moines, Iowa; City Passenger and Ticket Agent at Wichita, Kan.; District Passenger Agent at Wichita; Traveling Passenger Agent at Pittsburg, Pa.; District Passenger Agent at Philadelphia; General Agent of the Passenger Department at Denver, and General Eastern Passenger Agent in New York for both the Rock Island and the Frisco Systems, from which position he was recently promoted.

—The election of Mr. F. A. Delano to the Presidency of the Wabash Railroad was announced in the *Railroad Gazette* last week. His career is too well-known to our readers to need extended mention, but the accompanying portrait may be new to some of them. Mr. Delano began his railroad service on the Chicago, Burlington & Quincy in 1885. He was steadily promoted and in 1901 was elected Vice-President and General Manager of the Lines East of the Missouri River. In 1904 he resigned and was out of railroad service until April of this year, when he went to the Wabash as Vice-President. He is also President of the other Wabash properties, the Wheeling & Lake Erie, the Wabash-Pittsburg Terminal and the West Side Belt.

F. A. Delano.

—Mr. G. B. Obey, who was recently appointed Superintendent of the Monongahela Railroad, entered railroad service a little over 20 years ago as telegraph operator on the Baltimore & Ohio. Later he went to the Pittsburg & Lake Erie and served there successively as despatcher, chief despatcher, and since 1901, Superintendent of the Monongahela & Youghiogheny division, from which office he was transferred to his new position.

—The accompanying photograph of Mr. A. B. Stickney, President of the Chicago Great Western, is of interest at this time on account of the interest aroused in Mr. Stickney's testimony before the Federal Court at Chicago. Mr. Stickney said: "In fixing the rate on dressed meat we do not have very much to say. The packer generally makes the rate. He comes to you and always makes you feel that he is your friend. Then he asks you how much you charge for certain shipments of dressed meats. The published tariff may be 23 cents a hundred, but he will not pay you that. You say to him, 'I'll carry your meat for 18 cents.' He says, 'Oh, no, you won't. I won't pay that.' Then you say, 'Well, what will you pay for it?' He then replies, 'I can get it hauled for 16 cents.' So you haul it for 16 cents a hundred. He generally tells you that if you want the business you must haul the meat for the price he names."

A. B. Stickney.

ELECTIONS AND APPOINTMENTS.

Arkansas Southern.—A. R. Porterfield, Auditor, has resigned, and the office has been abolished. The authority of the officials of the Accounting department of the Chicago, Rock Island & Pacific has been extended over that department of the Arkansas Southern.

Atchison, Topeka & Santa Fe.—W. J. Black, General Passenger Agent of the A., T. & S. F., has been appointed Passenger Traffic Manager of the whole system, succeeding George T. Nicholson, promoted. James M. Connell, General Agent of the Passenger department, at Chicago, succeeds Mr. Black. E. J. Shakeshaft, Chief Clerk in the general passenger office at Topeka, has been appointed Assistant General Passenger Agent.

Atchison, Topeka & Santa Fe (Coast Lines).—J. J. Byrne, General Passenger Agent, has been appointed Assistant Passenger Traffic Manager, with office at Los Angeles, Cal.

Buffalo & Susquehanna.—The offices of F. H. Goodyear, President, and C. W. Goodyear, Vice-President, are at Buffalo, N. Y., not at Baltimore, Md., as reported.

Chicago, Milwaukee & St. Paul.—Until further notice, the duties of General Manager will be performed by W. J. Underwood, Assistant General Manager.

Chicago, Rock Island & Pacific.—W. H. Burns, Auditor of Freight Traffic, has been appointed to the newly created office of Assistant to the General Auditor. C. G. Weaver, Assistant Auditor of Freight Traffic, succeeds Mr. Burns. L. K. Luff succeeds Mr. Weaver.

Colorado & Southern.—A. D. Parker, General Auditor, has been elected Vice-President, in charge of the Accounting department.

Detroit River Tunnel.—J. C. Mock, Signal Engineer of the Michigan Central, has been appointed Electrical Engineer of the D. R. T.

Detroit, Toledo & Ironton.—J. C. Homer, Superintendent of Motive Power, has resigned. W. J. Haynen, hitherto Division Master Mechanic at De Soto, Mo., succeeds Mr. Homer.

Erie.—W. H. Hamilton has been elected a director, succeeding Robert Bacon. Russell Harding, heretofore First Vice-President of the Cincinnati, Hamilton & Dayton, the Pere Marquette and the Chicago, Cincinnati & Louisville, has been elected Vice-President of the entire Erie system, in charge of operation. His headquarters will be at New York.

G. A. Heller, Superintendent of the Delaware division, has resigned. W. C. Hayes, hitherto Superintendent of the Employment Bureau, at Jersey City, succeeds Mr. Heller, with office at Susquehanna, Pa.

Grand Trunk Pacific.—A. B. Smith has been appointed Manager of the Telegraph Department, with office at Montreal, effective November 1.

Gulf, Colorado & Santa Fe.—J. H. Keefe has been appointed Assistant to the Second Vice-President and General Manager.

Iowa Central.—Marquis Barr, Claim Agent at Oskaloosa, Iowa, has been appointed General Claim Agent of the Iowa Central and the Minneapolis & St. Louis, with office at Minneapolis.

Little Rock & Southern.—The newly elected officers of this road, which is being constructed by the Rock Island, are as follows: E. B. Pierce, President and Treasurer; W. S. Tinsman, Vice-President; T. S. Buzbee, Secretary, and G. H. Crosby, Assistant Secretary and Treasurer.

Louisville & Nashville.—C. H. Cannon has been appointed Signal Engineer, with headquarters at Louisville.

Mexican Central.—J. G. Smith has been appointed Master Mechanic of the Coahuila & Pacific division, with office at Saltillo, Coahuila.

Michigan Central.—E. A. Everett has been appointed acting Signal Engineer; office at Detroit. See Detroit River Tunnel.

Missouri, Kansas & Texas.—George Morton, General Passenger and Ticket Agent, has resigned. W. S. St. George, General Eastern Agent, succeeds Mr. Morton.

Minneapolis & St. Louis.—See Iowa Central.

New York, Chicago & St. Louis.—C. B. Gorham, Superintendent of the Eastern division, has resigned. W. L. Blair, Superintendent of Telegraph, succeeds Mr. Gorham. R. W. Mitchener, Trainmaster at Conneaut, Ohio, succeeds Mr. Blair.

New York, New Haven & Hartford.—C. M. Ingersoll, Chief Engineer, has been appointed Commissioner in charge of the new department of real estate, right of way and taxes. He will be assisted by a Real Estate Agent, Engineer, Rent Agent, and other assistants whom he may appoint from time to time with the approval of the President. He reports direct to the President.

Edward Gagel, Principal Assistant Engineer, succeeds Mr. Ingersoll as Chief Engineer, with headquarters at New Haven.

South & Western.—John A. Muse, General Freight and Passenger Agent, has been appointed Assistant Auditor. Lewis Walke has been appointed General Freight and Passenger Agent, succeeding Mr. Muse, with office at Bristol, Va.

Spokane Falls & Northern.—E. S. Blair, General Agent of the Great Northern, at San Francisco, has been appointed General Freight and Passenger Agent of the S. F. & N., with office at Spokane, Wash., succeeding H. A. Jackson, resigned.

Tidewater.—R. C. Johnson has been appointed Division Engineer, in charge of signals, with office at Norfolk, Va.

Union Pacific.—P. A. Valentine has been elected a director in place of James H. Hyde.

Wabash.—C. B. Adams, Superintendent of Transportation, has resigned. D. I. Forsyth, Assistant Superintendent of Transportation, has been appointed Acting Superintendent of Transportation.

Wisconsin Central.—Newman Erb and George M. Cumming have been elected directors, succeeding J. S. Dale and F. R. Hart.

LOCOMOTIVE BUILDING.

The Chesapeake & Ohio is reported as figuring on about 35 locomotives.

The Durham & Southern has ordered two locomotives from the Baldwin Works.

The Chicago, Burlington & Quincy, it is reported, has ordered 50 locomotives from the Baldwin Works.

The Western Maryland has ordered a 150-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Boston & Maine has ordered 10 locomotives from the American Locomotive Co. These will be made at the Manchester Works.

The Durham & Southern has ordered two 18-in. x 26-in. 10-wheel locomotives from the Baldwin Works for November delivery.

The Chesapeake & Ohio has ordered one Shay locomotive from the Lima Locomotive & Machine Co. The total weight of this engine will be 150 tons.

The Canadian Pacific, it is reported, has just placed an order with the American Locomotive Co. for 35 ten-wheel Canadian Pacific class "700" passenger locomotives.

The St. Louis, Brownsville & Mexico, as reported in our issue of October 13, has ordered nine locomotives from the Baldwin Works, including four 10-wheel freight engines, two switching engines and three eight-wheel passenger engines.

The Baltimore & Ohio has ordered 245 locomotives from the American Locomotive Co. This order includes both freight and passenger engines. The freight engines are of the 2-8-0 type and the passenger engines are of the 4-6-2 type.

The Chicago & North-Western has ordered 70 locomotives from the American Locomotive Co., as follows: Twenty-five 18 in. x 24 in. 6-wheel switching engines, 10 Atlantic type passenger engines, and 35 21-in. x 26-in. 10-wheel freight engines. All of the above are duplicates of previous orders.

The Chicago, Burlington & Quincy has ordered 50 simple Prairie type locomotives from the Baldwin Co. The locomotives weigh 205,000 lbs., with 150,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 69 in.; radial stay boiler; working steam pressure, 210 lbs.; heating surface, 3,584 sq. ft.; 301 tubes, 2¼ in. in diameter and 19 ft. long; firebox, 108 in. x 72 in.; grate area, 54 sq. ft.; tender capacity, 8,000 gallons of water and 16 tons of coal.

The Central of New Jersey has ordered 10 simple consolidation type locomotives from the American Locomotive Co. These engines will weigh 210,000 lbs., with 186,000 lbs. on drivers; cylinders, 20 in. x 32 in.; diameter of drivers, 61 in.; wagon top boiler, with a working steam pressure of 200 lbs.; total heating surface, 3,259 sq. ft.; 409 tubes, 2 in. in diameter x 14 ft. 3⅜ in. long; firebox, 123 in. long x 97 in. wide; grate area, 81.56 sq. ft.; tank capacity, 7,000 gallons of water and 16 tons of coal.

The Panama has ordered 24 2-6-4 type and 120 2-6-0 type locomotives from the American Locomotive Co. These engines will be made at the Schenectady Works and are for use on the Panama Canal construction work. The 2-6-4 locomotives weigh 183,500 lbs., with 124,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 54 in.; straight boiler, with a working steam pressure of 180 lbs.; total heating surface, 1,372.7 sq. ft.; 222 charcoal iron tubes, 2 in. in diameter x 12 ft. long; narrow firebox, 90⅞ in. long x 41¾ in. wide; grate area, 26.2 sq. ft. The engines are fitted with side and rear tanks having a water capacity of 3,700 gallons and a coal capacity of five tons.

The Chesapeake & Ohio has ordered 35 simple consolidation locomotives from the American Locomotive Co. These locomotives weigh 186,500 lbs., with 166,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 56 in.; extended wagon top boiler; working steam pressure, 200 lbs.; heating surface, 3,230 sq. ft.; 370 National steel tubes, 2 in. in diameter and 14 ft. 7 in. long; firebox, 90 in. x 75 in.; grate area, 47 sq. ft.; tender capacity, 6,000 gallons of water and 10 tons of coal. The special equipment includes: Westinghouse air-brakes, Carnegie axles, Gollmar bell ringers, Monarch brake-beams, Perfecto brake-shoes, Tower and Climax couplers, Hancock injectors, Jerome piston and valve rod packings, Leach sanding devices, Nathan sight feed lubricators, and Latrobe driving and truck wheel tires.

The Midland Valley, as reported in our issue of September 8, has ordered four 4-6-0 class and one 2-8-0 class locomotive from the Baldwin Works. The 2-8-0 class engine will weigh 136,000 lbs., with 120,000 lbs. on drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 50 in.; wagon top boiler, with 180 lbs. working steam pressure. The 4-6-0 class engines will weigh 120,000 lbs., with 90,000 lbs. on drivers; cylinders, 18 in. x 24 in.; diameter of driving whels, 55 in.; wagon top boiler, with a working steam pressure of 180 lbs. The tenders of both classes of engines will be of the "U" type and will have a coal capacity of 10 tons and a water capacity of 5,000 gallons. The special equipment includes: Carnegie steel firebox, Standard tires, Franklin boiler covering, Richardson valves, Hancock injectors, Tower couplers, Pyle-National headlights, Westinghouse brakes, Nathan lubricators, Houston sanding device, and Crosby safety valves, steam gages and whistles.

The Atchison, Topeka & Santa Fe, as reported in our issue of September 29, is making 10 six-wheel simple oil-burning switching engines in its Topeka shops. These engines will weigh 144,000 lbs., and will have cylinders 20 in. x 26 in.; diameter of driving wheels, 51 in.; wagon top boiler, with a working steam pressure of 180 lbs.; firebox, 102⅛ in. x 41¼ in.; 281 tubes, 2 in. in diameter x 11 ft. 10¾ in. long; heating surface, tubes, 1,750 sq. ft.; firebox, 177.9 sq. ft.; total, 1,928 sq. ft.; grate area, 29.3 sq. ft. The tender will be of the "U" type and will have a water capacity of 3,900 gallons and a fuel capacity of 2,000 gallons. The special equipment includes: Lukens steel for both boiler and firebox, standard tires, Railway Steel Spring Co.'s springs, magnesia boiler covering, piston valves, Ohio injectors, Tower couplers, Hewitt journal bearings, Adams & Westlake headlights, Westinghouse brakes, Kewanee brake-beams, Crane safety valves, Chicago lubricators, United States metallic packing, Crosby steam gages and whistles, Gollmar bell-ringers, Leach sanding device, Johnston blow-off valves, Congdon brake-shoes and Standard Steel Works driving wheel centers.

The Northern Pacific, as reported in our issue of Oct. 13, has ordered 30 simple Mikado type engines; 20 simple Pacific type engines; 20 simple Prairie type engines and 10 simple six-wheel switching locomotives from the American Locomotive Co. for 1906 delivery. The Mikado type engines will weigh 260,000 lbs. with 205,000 lbs. on drivers; cylinders, 24 in. x 30 in.; diameter of drivers, 63 in.; wagon top boiler; working steam pressure, 200 lbs.; heating surface, 4,250 sq. ft.; 375 tubes, 2 in. in diameter and 19 ft. 6 in. long; firebox, 97 in. x 66 in.; tender capacity, 10,000 gallons of water and 12 tons of coal. The Pacific type engines weigh 219,000 lbs. with 143,000 lbs. on drivers; cylinders, 22 in. x 26 in.; diameter of drivers, 69 in.; wagon top boiler; working steam pressure, 200 lbs.; heating surface, 3,550 sq. ft.; 347 tubes, 2 in. in diameter and 18 ft. 6 in. long; firebox, 97 in. x 66 in.; tender capacity, 7,000 gallons of water and 12 tons of coal. The Prairie type engines weigh 195,000 lbs. with 150,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 63 in.; wagon top boiler; working steam pressure, 200 lbs.; heating surface about 3,200 sq. ft.; 350 tubes, 2 in. in diameter and 17 ft. long; firebox, 96 in. x 63 in.; grate area, 42 sq. ft.; tender capacity, 6,000 gallons of water and 12 tons of coal. The switching engines weigh 150,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; wagon top boiler; working steam pressure, 180 lbs.; heating surface, 1,700 sq. ft.; 264 tubes, 2 in. in diameter by 11 ft. 2 in. long; firebox, 102 in. x 42 in.; grate area, 29 sq. ft.; tender capacity, 24,000 gallons of water and six tons of coal.

CAR BUILDING.

The Texas Southern is in the market for freight cars.

The Union Pacific, it is reported, will build additional motor cars.

The Atlantic Coast Line is figuring on additional freight equipment.

The Maine Central, it is reported, is figuring on passenger equipment.

The Great Northern is in the market for 300 ore cars of 100,000 lbs. capacity.

The Lehigh Valley, it is reported, is figuring on about 2,500 box and coal cars.

The Isthmian Canal Commission has ordered 800 flat cars from the American Car Co.

The Chesapeake & Ohio has ordered 22 cabooses from the American Car & Foundry Co.

The Seaboard Air Line has ordered 500 additional box cars from the Western Steel Car Co.

The St. Louis Southwestern, it is reported, will shortly be in the market for freight cars.

The Chicago, St. Paul, Minneapolis & Omaha has ordered 40 passenger cars from the Pullman Co.

The Philadelphia & Reading, it is reported, has ordered 80 passenger cars from Harlan & Hollingsworth.

The Philadelphia & Westchester (Electric), it is reported, is in the market for some steel passenger cars.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 1,000 box cars from the American Car & Foundry Co.

The New York, Ontario & Western, it is reported, has ordered 10 passenger cars from Harlan & Hollingsworth.

The Harriman Lines have ordered 60 chair cars, 16 baggage cars and 25 cabooses from the American Car & Foundry Company.

The Central of New Jersey has ordered 25 passenger cars and six combination passenger and baggage cars from Harlan & Hollingsworth.

The Northern Pacific is in the market for 500 gondola cars in addition to the 5,000 box cars mentioned in our issue of September 29.

The New York, New Haven & Hartford, it is reported, has ordered a number of interurban electric cars from the Wason Manufacturing Co.

The Durham & Southern has ordered two passenger cars and one combination mail, baggage and express car from the American Car & Foundry Co.

The Chesapeake & Ohio, it is reported, has ordered 500 hopper cars from the Standard Steel Car Co. and 500 gondola cars from the American Car Co.

The Central Vermont is figuring on 500 flat cars of 60,000 lbs. capacity, 100 flat cars of 80,000 lbs. capacity, and 100 gondola cars of 80,000 lbs. capacity.

The Buffalo & Susquehanna has ordered 500 gondola cars of 100,000 lbs. capacity from Barney & Smith, and is reported as being in the market for upwards of 200 coal cars.

The South Side Elevated, Chicago, has ordered 50 car bodies from the American Car & Foundry Co. These are in addition to those reported in our issue of September 22.

The Chicago, Milwaukee & St. Paul has ordered 25 passenger cars, 15 of which are to be made by Barney & Smith and the remaining 10 have been ordered from the Pullman Co.

The Brooklyn Rapid Transit Company is asking bids on 150 semi-convertible surface cars. The trucks for these cars have been ordered from the Baldwin Locomotive Works and the order for the wheels has been given to the Schoen Steel Wheel Co.

The Pennsylvania is reported about to let contracts on a large number of steel passenger cars. It is said that they will be somewhat larger than the 120 steel cars which were recently delivered to the Long Island Railroad by the American Car & Foundry Co.

The Tramway Rural a Vapor of Buenos Ayres, Argentine Republic, has ordered 85 cars from the J. G. Brill Co. Ten of these cars will be used for high-speed service and will be mounted on extra heavy trucks. The Brill Co. recently furnished 150 cars to the same company.

The Norfolk & Western is building at its Roanoke shops 300 hopper bottom gondola cars of 100,000 lbs. capacity. These cars weigh 38,000 lbs. and measure 34 ft. 6 in. long, 9 ft. 2 in. wide, and 10 ft. ½ in. high, over all. The special equipment includes: Christie brake-shoes, Westinghouse air-brakes, Butler draft rigging and Barber trucks. It will probably build 1,500 additional cars of the same type next year.

The Toledo, Peoria & Western has ordered 100 box cars of 80,000 lbs. capacity from the Pullman Co., for February, 1906, delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment includes: Pullman axles and brasses, American Steel Foundry's bolsters, National-Hollow brake-beams, Westinghouse air-brakes, Tower couplers, Dayton draft rigging, Pennsylvania standard journal boxes, springs and trucks and Murphy roofs.

The Cleveland, Cincinnati, Chicago & St. Louis, as reported in our issue of Oct. 13, has ordered 20 cabooses from the Pullman Co. and 20 cabooses from the American Car & Foundry Co. These are for December delivery. They will weigh 24,500 lbs. each and will measure 23 ft. 6 in. long by 9 ft. 1¾ in. wide by 14 ft. 6¾ in. high over all. The special equipment includes National-Hollow brake-beams; C., C., C. & St. L. standard brasses, door fasteners and paint, and McAlpine draft rigging.

The Duluth & Iron Range has ordered 500 steel hopper bottom ore cars of 100,000 lbs. capacity from the Pressed Steel Car Co., instead of 750, as reported in our issue of October 6. These cars are for March, 1906, delivery, and will weigh about 32,000 lbs., measure 22 ft. long and 9 ft. 6 in. high, inside measurements. The special equipment includes: Simplex bolsters, Pressed Steel Car Co.'s brake-beams, Streeter steel back brake-shoes, Westinghouse air-brakes and draft rigging, Franklin dust guards, McCord journal boxes and Pittsburg Spring & Steel Co.'s springs.

The Cleveland Electric, as reported in our issue of October 6, has ordered 50 convertible passenger cars from the J. G. Brill Co. These cars will be 35 ft. 6 in. long, inside; 8 ft. 2¼ in. wide over posts, and 12 ft. high from rail to top of roof. The special equipment includes: Cleveland Electric Railway Co.'s axles and brake-shoes, Brill brake-beams and trucks, National Electric Co.'s air-brakes, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Dayton Manufacturing Co.'s door fastenings, Sherwin-Williams Co.'s paint, Monitor roofs, and Standard Car Wheel Co.'s wheels.

The Central of New Jersey, as reported in our issue of October 13, has ordered 1,000 low-side wood gondola cars from the American Car & Foundry Co., 1,000 steel underframe box cars from the Standard Steel Car Co., and 1,000 steel hopper coal cars from the Cambria Steel Co. The gondolas will have a capacity of 80,000 lbs. and will measure 34 ft. 4 in. long x 2 ft. 6 in. wide x 8 ft. 6 in. high inside; over-all dimensions will be 36 ft. long x 9 ft. 11 in. wide. The box cars will have a capacity of 60,000 lbs. and will weigh about 38,600 lbs. and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. 1¼ in. high inside; the over-all dimensions will be 37 ft. 3½ in. long x 9 ft. 8 in. wide x 13 ft. 4½ in. high. The hopper coal cars will have a capacity of 80,000 lbs. and will weigh about 36,700 lbs. and measure 30 ft. long x 9 ft. 5⅝ in. wide inside; the over-all dimensions will be 31 ft. 6 in. long x 10 ft. wide x 10 ft. 2 in. high. The special equipment for all of the above cars will include: Steel underframes, Westinghouse brakes, M. C. B. brasses, Tower couplers and Barber arch bar oscillating trucks. The box cars will be fitted with Kewanee brake-beams and the coal cars will be fitted with Diamond adjustable brake-beams.

BRIDGE BUILDING.

Akron, Ohio.—Bids are wanted October 28 by the County Commissioners for building an iron bridge 60 ft. long with 16-ft. roadway and a 4-ft. sidewalk on stone or concrete foundations. M. D. Buckman is County Auditor.

Brownsville, Tex.—The St. Louis, Brownsville & Mexico will soon locate a site for the proposed bridge to be built either from this place or some other point on the American side over the Rio Grande river to a point in Mexico.

Chattanooga, Tenn.—The Chattanooga Company, Ltd., and others are agitating the question of building a railroad bridge over the Tennessee river.

Denver, Colo.—Bids are wanted November 8 at the office of the Engineer, U. S. Reclamation Service, Chamber of Commerce Building, Denver, for building concrete culverts, bridge abutments and 10 combination highway bridges and furnishing 570,000 tons of steel. The work is to be done on the line of the Interstate canal from Whalen to Torrington, Wyo. Plans are on file at the office of the Chief Engineer of the Reclamation Service at Washington, D. C.; also with John E. Field, Engineer, Denver, Colo.

Duluth, Minn.—The Lake avenue viaduct, it is said, will be repaired at a cost of $13,000. T. F. McGilvray is City Engineer.

Fredericton, N. B.—A steel bridge on stone piers will be built to replace the Mt. Whatley bridge connecting Nova Scotia and New Brunswick. Plans are also being made for a bridge to have a draw span to replace the Palmer Pond bridge in the parish of Dorchester.

Surveys are being made to locate the site for a bridge to be built over the St. John river at Hawkshaw.

Greenfield, Ind.—Bids are wanted October 23 by William I. Garriott, County Auditor, for building a steel bridge 70 ft. long, known as the Harlan bridge, over Sugar creek; also for a steel bridge 75 ft. long, to be known as the Moorehead bridge over the Brandywine in Center township, and a steel bridge 100 ft. long over Sugar creek in Green township.

Lancaster, Pa.—Bids are wanted October 30 by the Commissioners of Lancaster County for the superstructure of a highway bridge over Big Beaver creek, near Refton. M. G. Schaeffer is Comptroller.

Memphis, Tenn.—Bids are wanted November 6 by Shelby County, Tenn., Levy Commission for building two 50-ft. steel highway bridges on concrete piers, one 20-ft. steel highway bridge, 1,065

ft. of steel highway trestle, and raising 227 ft. of steel truss highway bridge. Charles A. Barton is engineer for the commission.

New Market, Ala.—Bids are wanted November 6 by Madison County Commissioners, at Huntsville, for building a steel bridge on the New Hope road.

Ottawa, Ont.—The contract has been given to the Steel Concrete Construction Co., of Montreal, for building the concrete bridge about 400 ft. long, to cost $20,000, over the Rideau river, two miles from Ottawa, in the county of Carleton. Charles MacNab is County Clerk.

Port Huron, Mich.—Bids are wanted November 3 by the City Comptroller for building the unfinished portion of the canal from Lake Huron to Black river. The work includes 270,000 yds. of excavation, building a railroad bridge to carry two tracks, one highway bridge, a water gate and 350 ft. of protection pier. R. D. O'Keefe is Superintendent of Public Works.

Sanatoga, Pa.—The County Commissioners are selecting the site for the 400-ft. bridge to be built over the Schuylkill river, between this place and Frick's Locks.

Seymour, Texas.—The Wichita Valley Railroad, which is building an extension from Seymour to Stamford, will build a bridge over the Brazos river to cost $72,000.

South Bend, Ind.—Bids are wanted November 6 by the County Commissioners for building the concrete substructure and removing the Jefferson street bridge to Springbrook Park over the St. Joseph river, at a cost of about $26,000. W. J. Harbon is County Auditor.

Wichita, Kan.—Bids are wanted October 23 by C. N. Cartwright, County Clerk, for building a steel bridge.

Other Structures.

Adel, Ga.—The Georgia Southern & Florida Railroad has let the contract for building a new brick passenger station here.

Davenport, Iowa.—The various roads entering this city have agreed to jointly build a union passenger station.

Lancaster, Pa.—Bids are being asked by the Philadelphia & Reading for a new brick freight house, 31 x 171 ft., with a covered platform 110 x 10 ft.

Madison, Wis.—The Chicago & North-Western is planning to put up a new freight house here, at a cost of $70,000; also a new passenger station to cost $125,000.

Minneapolis, Minn.—According to reports, the Minneapolis, St. Paul & Sault Ste. Marie is planning to build a freight house here.

Montreal, Que.—A contract has been given by the Montreal Street Railway Company to the Canadian White Company, Ltd., for building large car sheds.

The Canadian Pacific, according to newspaper reports, will put up additions to its Angus shops at a cost of $52,350; also a building for its employees, 116 x 70 ft., to cost $32,000.

Ottawa, Ont.—The Grand Trunk Pacific is having plans prepared for a large passenger house which will be erected on the site of the present central station. It will extend over the canal by means of a large arch.

Ridgewood, N. J.—Announcement has been made that the Erie is planning to put up a new passenger station here.

Shoreham, Minn.—The Minneapolis, St. Paul & Sault Ste. Marie it is said will build additions to its shops here, to cost about $100,000.

West Nashville, Tenn.—The Nashville, Chattanooga & St. Louis will build a 100-ft. extension to its erecting shop; also a similar extension to its tender shop at a cost of $30,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Western.—Articles of incorporation have been filed by this company to build a railroad from a point near Birmingham west to the Alabama-Mississippi state line. Entrance into the new union station at Birmingham can be made over the Southern's tracks. The officers of the new company are all Illinois Central officials.

Atlanta & Carolina.—Bids will soon be asked by this company for building its proposed road from Atlanta, Ga., east to Conyers, about 25 miles. The cost of the proposed work will be about $850,000. M. Mason is Chief Engineer, and M. T. Edgerton, Secretary, Atlanta.

Brownwood, Waco & Northern.—An officer writes that the prospects of building this proposed road are good. The route runs from Rising Star in Eastland County, Tex., south via May, to Brownwood, 30 miles, thence east through Hamilton, Cliffton and Valley Mills, to Waco, 125 miles. Contracts for grading will be let in about three months. The proposed road will pass through a level country. The officers have not yet been elected. (October 6, p. 111.)

Chicago, Rock Island & Pacific.—Surveyors of this company are in the field running three lines from Iowa City west to Des Moines, with the object of obtaining a more direct route for the main line. The surveyors have completed one line between these points, several miles south of the present road. Two other routes lying between the present line and the one just surveyed will be laid out.

Crooked Creek.—This road, formerly the Webster City & Southwestern, has been sold to a syndicate represented by a Mr. Seaman, of Milwaukee. The road is now in operation from Webster City, Iowa, southwest to Lehigh, 18 miles, and to the coal mines along the Des Moines river south of Lehigh. The new owners have arranged for the early construction of two extensions; one southwest from Lehigh to Gowrie, 15 miles, where connection will be made with the Northwestern, the Rock Island, Newton & Northwestern and the Minneapolis & St. Louis roads, and the other from Brushy, northwest to Fort Dodge, about 12 miles, to connect with the Illinois Central, the Chicago, Great Western, and other roads. The company has options on valuable land in Fort Dodge adjoining the properties of the Great Western.

Cumberland Railroad.—This company, which has nearly completed a 10-mile road into the Bush Creek coal fields of Knox County, Ky., is making surveys to build an extension of 17 miles into Jellico, Tenn. (See Construction Record.)

Detroit-Bay City Traction.—This company has filed a trust mortgage for $3,000,000 to cover a bond issue of that amount to build an electric line between Detroit and Bay City, Mich., 112 miles. The contract for the construction of the road has been let to the Ross Construction Co., of Chicago, and a subsidiary company, the Wayne Construction Co., of Detroit, has been organized to carry on the work in Michigan. The contract calls for the completion of the road by Oct. 1, 1906. Construction work will begin at Bay City, run east to Akron and then south to Caro. It is planned to complete 32 miles this year. The officers of the company are: President, E. H. Whitcomb, Davenport, Ia.; Secretary, L. A. Rockwell, Detroit; Treasurer, C. H. Christian, Detroit.

Great Northern.—Work is being hurried on the extension from St. John, N. Dak., to Brandon, Man., and it is expected that trains will be running over the new branch this fall.

Houston & Texas Central.—This company has given a contract to W. S. Hipp, of Houston, for grading the whole of its new line from Mexia, Tex., south to Navasota. This line is to be built to overcome the heavy grades on the present line. Between these two points on the present line the distance is 110 miles.

Hudson Street Railroad.—Articles of incorporation have been filed by this company in New Jersey, with a capital of $3,000,000, to build and operate a street railroad in Jersey City, from Washington and Plymouth streets through various streets, 31 routes in all. The incorporators include: Pliny Fiske, of Rye, N. Y.; W. G. Oakman, of Roslyn; W. C. Fiske and A. Freedman, of New York City; David Young, of Newark, N. J., and William G. McAdoo, of Yonkers, N. Y. The company is understood to be affiliated with the "Hudson Companies," controlling tunnels from Jersey City to New York.

Illinois Central.—See Alabama Western above, and Yazoo & Mississippi Valley below.

James Bay.—The ratepayers of Parry Sound, Ont., have voted $25,000 bonus to this road on condition that the company establish a division point there with shops.

Jamestown, Diaz & Cherry Valley.—This company has been granted a charter in Arkansas, with a capital of $1,000,000, to build a railroad from Jamestown east through Diaz, in Jackson County, and thence to Cherry Valley, in Cross County, a distance of 65 miles.

Kanawha & West Virginia.—Contracts are reported let to Rinehart, Wyatt & Co., of Charleston, for building the proposed extension of this road from Bluecreek to Charleston, W. Va., a distance of 13½ miles. (September 8, p. 79.)

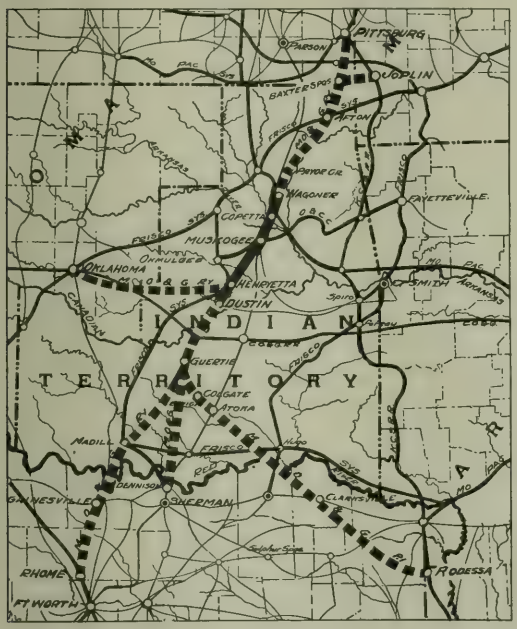
Kansas City, Mexico & Orient.—President Stilwell of this road is quoted as saying that grading between Eldorado and Emporia, Kan., a distance of 63 miles, is practically completed. The line between Wichita and Canton, Okla. T., a distance of 146 miles, is now in operation. Track has been laid from Sweetwater north to McCaulley, Tex., 25 miles, and this work will soon be finished to Rule, an additional 35 miles. From Sweetwater south to San Angelo, 27 miles, construction work is under way, 20 miles being completed. Track has been laid from Chihuahua, Mex., east for a distance of 74 miles, and this portion of the road was to have been put in operation the first of this month. From Minaca west

he road is nearly finished for a distance of about 40 miles, leaving gap of about 150 miles through the Sierra Madre mountains to connection with the line already built northeast for 73 miles from Topolobampo, on the Pacific coast. (September 15, p. 87.)

Keweenaw Central.—Arrangements, it is said, have been made or the funds to build the proposed extension of this road for a istance of 32 miles. A contract has been let to Frank Buschell, f Lake Linden, for building 12 miles, and work is to be started at nce. (June 2, p. 183.)

Lake Shore & Michigan Southern.—Announcement has been nade that preliminary plans are under way to relocate the line hrough Port Clinton, Ohio, to eliminate the curves. Much of the ight of way has been secured. The work includes the building f a four-track bridge over the Portage river a mile west of the resent structure.

Missouri, Oklahoma & Gulf.—This road, which operates a line 2 miles long from Wagoner, Ind. T., south to Henryetta, has ecently completed an additional 13 miles from that point south to Dustin. An officer writes that a contract has been let for the rading and bridge work to J. W. Hoffman & Co., of Kansas City, Mo., for an extension of the road from Wagoner, its present northrn terminus, north to Afton, 70 miles. The work will not be difficult. The maximum curvature will be 4 degrees. The work includes the building of four steel bridges and 2,000 ft. of trestles. The road is projected to extend north to Pittsburg, Kan., with a branch east to Joplin, Mo., on the northern end, a branch from



Missouri, Oklahoma & Gulf.

Henryetta west to Oklahoma City, Ind. T., and a branch from Dustin south to Guertie, where it will be divided into three sections, the western one to extend to Rhome, Texas, where connection will be made with the Fort Worth & Denver City; the central branch to Denison, Texas, and the eastern branch to Rodessa, La. (September 29, p. 103.)

Lake Superior & Southern.—An officer writes that this proposed road will run from Huron Bay, on Lake Superior, on the northern peninsula of Michigan, southwest via Lake Michigamme. Forty miles have been graded and bridges and culverts built. Track laying is to begin early next spring. Contracts will be let during the next six months for additional grading, track laying and bridge work. M. C. Phillips, of Oshkosh, Wis., is President, and George A. Young, of the same place, Construction Engineer. (October 6, p. 111.)

Las Vegas & Tonopah.—This company, which was recently incorporated in Utah with a capital of $4,000,000, will build a railroad from Las Vegas, on the San Pedro, Los Angeles & Salt Lake, through Lincoln, Nye and Esmeralda Counties to Tonopah, Nev., with connections to the mining camps at Bullfrog, Beatty, Rhyolite and Goldfield. The incorporators include: William A. Clark, of Butte, Mont.; W. H. Comstock, of Los Angeles; R. C. Kerens, of St. Louis, Mo.; C. O. Whittemore, of Salt Lake City, and others. Construction work is to be started at once.

Louisiana East & West.—An officer writes that this road, which has its northern terminus at Bunkie, La. (on the Texas & Pacific) and runs south through Eola, on the Southern Pacific, to Ville Platte, is probably to be extended to Rayne. As soon as the first 25 miles of this proposed extension is built, bonds to the amount of $250,000 will be sold to the Hibernia Bank & Trust Co., of New Orleans. Quarantine restrictions prevent the letting of contracts at present. The grading will consist entirely of earth work, as the line will run through a comparatively level country. C. J. Carpenter, Bunkie, La., is Superintendent. (September 29, p. 103.)

Minneapolis, St. Paul & Sault Ste. Marie.—An officer is quoted as saying that this road is planning to make extensive improvements in its terminals at Minneapolis. This company is now building 22 miles of side tracks and extensions.

Morgantown & Dunkard Valley (Electric).—Incorporation has been granted this company in West Virginia, with a capital of $300,000, to build a railroad from Morgantown, in Monongalia County, W. Va., west to Wadestown, 30 miles. The road may eventually be extended 12 miles south from this point to Mannington, passing through a rich agricultural section. W. W. Smith and George G. Johnson, of Morgantown, are interested.

Napa & Lakeport (Electric).—An officer writes that the route of this proposed electric railroad is from Napa, California, north through Napa, Conn, Chiles and Pope valleys via Middletown and Kelseyville, in Lake County, to Lakeport, about 75 miles. The contract for grading and track laying will be let in about six months when the final survey and location of the line has been completed. There will be 12 miles of heavy work. There will be one tunnel of 2,200 ft., one of 1,200 ft. and two of 500 ft. each. C. H. Miller is Chief Engineer, 209 Union Trust Building, San Francisco.

Nashville & Hopkinsville Interurban.—Bids may soon be asked by this company for building its proposed railroad from Nashville, Tenn., north to Hopkinsville, Ky., 78 miles. The company is considering the use of gasolene motor cars for passenger and freight service. F. L. DeMarco, Sheffield, Ala., is interested, and P. H. Hall, of Chicago, is Chief Engineer.

New York & Stamford (Electric).—This company, operating a line from New Rochelle, N. Y., northeast to Port Chester, 14 miles, which is controlled by the New York, New Haven & Hartford, has filed a certificate at White Plains seeking authority to build a line from Port Chester, west to White Plains, five miles. It is proposed to build the new line on private right of way.

Oklahoma & Northwestern.—Surveys have been completed by this company and grading work will be commenced at once by A. B. Sutton, the contractor in charge of construction work. The proposed route is from Elk City, Okla. T., on the Choctaw, Oklahoma & Gulf (Rock Island), north through Roger Mills, Day and Woodward Counties, to a point in Beaver County, about 100 miles, with a branch on the south to the south fork of the Red river near Sayre, about 15 miles. E. E. Niess is President and A. G. St. John, Chief Engineer, both of Chicago.

Ohio River & Gulf.—Surveys are being made for this proposed road, and five miles have been permanently located. The route is from Johnson Stand, Tenn., on the Tennessee Central, north to Jamestown, 34 miles, through a territory containing valuable timber, coal and oil fields. It is proposed eventually to extend the road north to the Ohio river near Louisville. The work includes the building of one bridge. Bids for building the road will be asked next month. William Cooper, of Maryland, Tenn., is President, and J. E. Jones, of Monterey, Tenn., Secretary and Treasurer. Major R. J. Moscrep, of Maryland, Tenn., is the engineer in charge of the work.

Oklahoma Central.—An officer writes that this road, which was formerly the Canadian Valley & Western, has commenced grading work on its proposed road from Lehigh to Chickasha, Ind. T. A contract has been given to the Canadian Valley Construction Co., of Lehigh. The line is practically level, with four degrees of maximum curvature. The work includes the building of seven girder bridges. R. L. McWillie, of Lehigh, Ind. T., is Chief Engineer.

Pittsburg & Cross Creek.—A contract is said to have been given by this company to the Gianini Construction Co., of Pittsburg, for building its proposed connection from the Wabash-Pittsburg Terminal to Burgettstown, in Washington County, Pa. (August 25, p. 63.)

Saint Maurice Valley.—A contract has been given by this company to Ross & McRae for building its proposed road from Three Rivers, Que., northwest via Shawinigan Falls, on the Great North-

ern of Canada, to Grand Mere, 22 miles. J. A. Aldred is Vice-President.

South & Western.—A contract is reported let by this company to the Carolina Co., of Bristol, Tenn., for building its proposed road from the coal fields of southwest Virginia through Virginia, Tennessee and North Carolina to a connection in South Carolina with the Southern, the Seaboard Air Line and the Atlantic Coast Line, a total length of 300 miles of main line. (October 6, p. 112.)

Southern.—W. J. Oliver, of Knoxville, Tenn., who has the contract for double track work on this road east of Knoxville, has sublet part of the work as follows: To McCreary & Co. for the first 10 miles; to Donaghy & Co. for the second 10 miles, and to J. E. Borches Co. for two miles. The work will soon be commenced. (September 29, p. 104.)

This company has given a contract to the Callahan Construction Co., of Knoxville, Tenn., for building six tracks from Shark's Gap to Lonsdale, Tenn., a distance of about six miles.

Union Pacific.—See Yellowstone Park below.

Union Traction Company of Iowa (Electric).—This company has been organized in Iowa, with a capital of $100,000, and office at Marshalltown. The company is to build an electric railroad from Marshalltown north to Grundy Center, thence northeast to Waterloo, Iowa, and another line from Marshalltown south to Newton, Iowa, where connection is to be made with the Interurban Railway Company of Des Moines, which will extend its Des Moines-Colfax line from Colfax to Newton. The total length will be 78 miles. The officers are: D. T. Denmead, of Marshalltown, President; J. E. Sedgewick, of Waterloo, Vice-President; L. C. Norris, of Marshalltown, Secretary, and George E. Lichty, of Waterloo, Treasurer.

Yazoo & Mississippi Valley (Ill. Cent.).—This company has filed a statement changing the route of its proposed Silver Creek extension. The new line has been located. It runs from a point on the Yazoo & Mississippi Valley at Silver Creek, in Yazoo County, Miss., southwest, following Silver creek and crossing Big Sunflower river at Holly Bluff, just west of Campbellsvile, and it will reach the main line at Valley Park, Kelso or some other station in that section. (May 19, p. 167.)

Yellowstone Park (Union Pacific).—An officer writes that grading work is under way on this proposed road, which has been located from St. Anthony, Idaho, southeast to Marysvale, 18 miles. The Utah Construction Co. has the grading contract for this portion of the work. W. H. Bancroft is President, and William Ashton, Chief Engineer, both of Salt Lake City, Utah. (September 29, p. 104.)

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—The proceeds of the sale of the $32,420,000 50-year 4 per cent. convertible bonds of 1955, which are a part of the $50,000,000 authorized, will be used for the completion of lines in the course of construction, for double tracking and reduction of grades, and for additional equipment. Of the amount realized on these bonds, the company has already authorized an expenditure of $9,300,000 for additional equipment and $9,500,000 for the completion of lines now in the course of construction.' (January 27, p. 32.)

Boston & Maine.—The stockholders have voted to issue $10,000,000 4 per cent. 20-year refunding bonds to refund at maturity $7,774,500 bonds maturing September 1, 1906, and $2,000,000 maturing October 1, 1906. They also voted to issue $152,000 4 per cent. 20-year bonds for the purchase of the franchise, property, etc., of the Danvers Railroad, and $306,000 4 per cent. 20-year bonds to reimburse the B. & M. for the payment of $300,000 which it made in taking over the funded debt of the Newburyport Railroad, which runs from Bradford, Mass., to Danvers, 27 miles, and is leased by the B. & M. The Danvers Railroad runs from Wakefield Junction, Mass., to Danvers, 10 miles, and is also leased by the Boston & Maine, which owns its $125,000 bonds.

Central of Georgia.—The New York Stock Exchange has listed $1,052,000 first-preference income 5 per cent. coupon bonds of 1945, $2,952,000 second preference and $1,944,000 third preference.

Central Pacific.—The New York Stock Exchange has listed an additional $2,941,000 first refunding mortgage 4 per cent. guaranteed bonds of 1949, making the total amount listed $79,292,000.

Cleveland, Cincinnati, Chicago & St. Louis.—An additional $4,727,900 of common stock has been listed on the New York Stock Exchange, making the total amount listed $35,597,600.

Consolidated (N. Y., N. H. & H. electric lines).—The managers of this company are arranging to do an express (parcel) business, and have organized The Trolley Express Co., with $100,000 capital. The entire capital stock will be owned by the Consolidated.

Duluth, South Shore & Atlantic.—The operations for the year ended June 30 resulted in a deficit of $206,552, this being a decrease of $76,899 as compared with 1904. The gross earnings were $2,706,936, an increase of $182,324, and expenses, $1,852,705, an increase of $103,249. Gross earnings from freight increased $245,842, while passenger earnings decreased $60,235. The increase in operating expenses was in maintenance of way and in maintenance of equipment; the cost of conducting transportation decreased.

Great Northern.—The proceeds of the sale of the $25,000,000 new capital stock sold to the stockholders at par will be used to repay the $7,500,000 short-term notes issued recently, and also to pay for extensions of lines in the northwest. (October 13, p. 120.)

Gulf & Ship Island.—The annual report of this company for the year ending June 30 shows a deficit of $47,804. This unfavorable showing is due to the interruption of traffic caused by the storms in the early part of 1905. The gross earnings were $1,877,397, an increase of $48,582; but expenses increased $168,007, which made the net earnings $480,155, a decrease of $120,425. The net income was $179,450, a decrease of $153,863. It is equivalent to 3 per cent. on the $6,000,000 capital stock; and since a dividend of 4 per cent. was paid this left a deficit. During the year the capital stock was increased $500,000, and the funded debt $165,000. The average number of miles operated during the year was 275.

Hampshire & Worcester (Electric).—This road, which runs from West Brookfield, Mass., northwest to Ware, 12 miles, and has been in the hands of a receiver, has been sold to the American Loan & Trust Co., of Boston, for $5,000 over and above encumbrances. (September 8, p. 80.)

Lehigh Valley.—This company has bought the property of Coxe Bros. & Co., Inc., the largest independent coal operators in the anthracite fields. This includes the Delaware, Susquehanna & Schuylkill Railroad, which is 49 miles long and runs from Drifton to Gowen, Pa., 31 miles, with 18 miles of branches and 133 miles of trackage rights, over the Lehigh Valley, from Penn Haven Junction to tidewater at Perth Amboy. The Delaware, Susquehanna & Schuylkill has no bonds and $1,500,000 common stock, the last dividend on which was one of 9 per cent., and on which a dividend of 70 per cent. (50 per cent. stock) was paid in 1893. The purchase will be financed by an issue of $19,000,000 short-term collateral trust bonds, to be secured by pledge of the stock of Coxe Bros. & Co. and the Delaware, Susquehanna & Schuylkill. The annual tonnage which will be added to the Lehigh Valley's coal production will be in the neighborhood of 2,000,000 tons, or about 3 per cent. of the total annual anthracite production.

Louisville & Nashville.—The New York Stock Exchange has listed an additional $3,000,000 of the unified 50-year 4 per cent. bonds of 1940, making the total amount listed $37,562,000.

Pacific Coast.—The annual report for the year ended June 30 of this company, which operates a number of short lines near Puget Sound, shows a surplus of $482,996, an increase of $129,882. The net income was $1,109,246, amounting to nearly 9 per cent. on the $12,525,000 of capital stock. Of this amount, $626,250 in dividends were paid on the first and second preferred and common stock. The gross earnings were $6,199,276, an increase, over last year, of $296,303.

Toledo Railways & Light (Electric).—This company has declared another dividend of 1 per cent., making 2 per cent. for the year 1905, a 1 per cent. dividend having been paid last May. The earnings for the current year are at the rate of about 3½ per cent. yearly on the $11,000,000 capital stock.

Wabash.—At the annual meeting on October 11, Joseph Ramsey, Jr., voted on $3,804,200 of stock and $3,184.000 of debenture bonds. George Gould voted on $46,146,700 of stock and $22,851,000 of debenture bonds. As Mr. Ramsey voted cumulatively, that is, concentrated all his votes on one member of the board of directors instead of voting on all 13 directors, he was able to cast 526,386 votes toward the election of one director; but Mr. Gould, voting non-cumulatively, was able to cast 689,977 votes for each director.

Western Pacific.—The first payment of the semi-annual interest on the $50,000,000 first-mortgage 5 per cent. bonds of 1935 has been paid. The money for this payment was taken from the amount raised by the sale of the bonds themselves, and this will be done hereafter until the road is in operation. After that, the Denver & Rio Grande and the Rio Grande Western guarantee the payment of interest.

GENERAL NEWS SECTION

NOTES.

It is announced that after November 5 the time tables of the Michigan Central east of Detroit will show Eastern time instead of Central time, as now.

When an officer of the Pennsylvania road goes to Pittsburg in his private car a telephone in the car is connected with the railroad and city exchanges immediately on arrival.

The Globe Express Company, which does business on the Denver & Rio Grande and other railroads in Colorado, is to take the express contract of the Western Pacific. Among the directors of the Globe Express Company are George J. Gould, E. T. Jeffery and C. H. Schlacks.

At White Plains, N. Y., October 18, Albert Woods and his wife were sentenced to imprisonment, one for at least three years and the other for at least two years, for perjury, in making a fraudulent claim against the New York City Railway for personal damages. Woods was conductor of a car and Mrs. Woods claimed to have been injured because of the sudden starting of the car. They pretended not to know each other. Two New York lawyers have been arrested for aiding the Woodses in their frauds.

The Canadian Pacific announces a change in the handling of its sleeping, parlor and dining cars. Henceforth this service, west of Fort William, is to be operated as a separate department, and William Bell, District Superintendent, will report to William Whyte, Second Vice-President, at Winnipeg, instead of to the sleeping-car superintendent at Montreal. There will be superintendents at four points between Winnipeg and Vancouver, and each will keep a stock of supplies. Dining cars and buffet cars will also be put in service on several of the branch lines of the western district. The change is to secure closer inspection and improved service. All operating departments of the western lines are now under the direct management of Mr. Whyte, who reports only to the president.

Hearing on the Air Brake Law.

Secretary Edward A. Moseley, of the Interstate Commerce Commission, announces that the hearing on the question of increasing the minimum percentage of power brakes in trains, to be held in accordance with a former notice of the commission, is to take place at the office of the commission in Washington on Thursday, Nov. 2, at 10 a.m., at which all persons interested may appear either in person or by counsel. In accordance with the former notice, the commission has gathered data from the railroads throughout the country showing the number of freight cars owned and the number air-braked, together with statements as to the actual percentage of air-brakes used in the freight trains of the respective companies during a period of six months. The minimum percentage of air-brakes in use, now required by the law, is 50; under the Act of March 2, 1903, the commission may order an increase in this minimum percentage requirement.

Railroad Strike in Russia.

A strike of railroad employees on the four principal railroads centering in Moscow, Russia, which began last week, has become extensive and the railroad men in St. Petersburg are preparing to strike, if they have not already done so. Traffic to and from Moscow is said to be almost at a standstill. Press despatches say that the strike is largely political, the socialist leaders desiring to show their strength.

Sierra Leone Government Railroad.

This road, the construction of which was begun in 1896, has been completed from Freetown, on the west coast of Africa, to Baiima, 222 miles, and was recently handed over to the Government, the Colony of Sierra Leone being under British administration. The road was made narrow gage, 2 ft. 6 in., to reduce the expense of construction, the traffic being expected to be light for some years to come. The traffic is, however, increasing rapidly, as the country tapped contains large quantities of rubber, palm oil and other vegetable products. The maximum curvature on the main line is 8 deg. 40 min. and the maximum grade 2 per cent., but there is a five mile branch on which the grade runs up to 4.3 per cent. The first 32 miles out of Freetown are laid with 28-lb. rails and 30-lb. rails are used on the rest of the line. The ties are of steel, weighing 35 and 40½ lbs., according to the weight of the rails, and the ballast is gravel and broken stone throughout. Owing to the good quality of this ballast, little difficulty has been found in maintaining the track in spite of the heavy rainfall, which averages about 175 inches annually. Temporary bridges were built of native wood and replaced in about two years by steel and concrete structures. Arch culverts and abutments for open culverts are also of concrete. The Séwa and Moa bridges are the most important. They are supported on concrete piers and the girders are of the half-through or partial deck type. This type has the advantage of retaining the cross bracing and giving good headway for a given depth of girder, while it is not so costly as the through type, owing to the shorter distance between girder centers. Prairie (2-6-2) and six-wheel coupled locomotives are in use and have so far proved satisfactory.—*The Engineer.*

Dust Guard Slots in Journal Boxes.

The discussion at the September meeting of the Railway Car Foremen's Club of Chicago, on the question whether journal boxes having the dust guard slot opening at the bottom are preferable to boxes which have the dust guard slot opening at the top, brought out the fact that if the dust guard slot of a journal box is closed at the bottom, the dust guard is liable to be broken against the bottom of the slot when a box is jacked up to remove a brass. The dust guard slot if closed at the bottom accumulates dirt, which would free itself if the slot was open at the bottom. The wooden wedge for closing the dust guard slot is liable to dry out and become lost, and if this happens, more dirt will go into the dust guard slot if open on the top than if open at the bottom. The liability of wasting oil from the back of the box is not increased if the dust guard slot is opened at the bottom, as the inside wall of the dust guard slot prevents the oil from flowing into the dust guard well from the box. If too much oil is placed in a box so that it runs out at the rear end, even if the dust guard slot is closed at the bottom, the oil will soon run over the outside wall of the dust guard well because the dust guard occupies the space in the dust guard well immediately under the axle. The question of eliminating the inside dust guard wall was subjected to M. C. B. letter ballot this year, but was rejected. Of course, if this inside dust guard wall had been eliminated it would be necessary to have the dust guard slot of journal boxes open at the top in all cases.

Milan Exposition of 1906.

To celebrate the completion of the Simplon tunnel an International Exposition under royal patronage is to be held in Milan, Italy, from May to November, 1906, and it is said that it will be the largest European Exposition ever held outside of Paris. Practically all of the European countries will participate officially, as well as several Asiatic nations.

In the transportation section, retrospective exhibits will show the historical development of the various methods of travel. The dominant feature will be Motion. All products, as far as possible, must be shown in connection with the processes. For the automobile display an entire pavilion will be set apart. This part of the show will terminate in mid-summer so that machines exhibited may be sold for early delivery. Italy is now prosperous and a large attendance at the Exposition is confidently expected. Genoa, the port of entry, is less than 100 miles distant. The cost, therefore, of transporting exhibits from the United States will be comparatively cheap. For terms of space or further information, application should be made to J. H. Gore, George Washington University, Washington, D. C.

The Executive Committee of the Exposition offers a prize of 5,000 francs for a car-coupler to fulfil certain requirements; one of them, which has least engaged attention in this country, is the ability to use it with cars provided with two buffers at each end, such as have been universal in Europe until recently. Competitors must announce their intention to compete by Dec. 31 next.

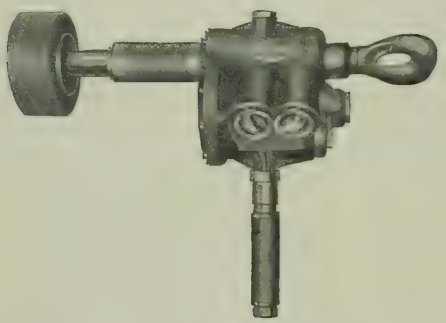
The We-Fu-Go Water Softening and Purifying System.

In order to provide suitable water for its 4 power-house boilers at its Jenison (Mich.) power house, the Grand Rapids, Holland & Chicago Railroad Company had installed a We-Fu-Go water softening and purifying system made by Wm. B. Scaife & Sons Co., Pittsburg, Pa. A creek about 250 ft. from the power house has been the source of supply for the last three years, and under the old system it was necessary to clean the boilers every two weeks, but since the installation of the new system one cleaning a month is all that is necessary to keep the boilers in good condition. Even this would be unnecessary were it not for the chemical action on the scale which is dropping off in large quantities. At one cleaning from 400 to 600 lbs. of scale has been removed, and at this rate, according to the engineer in charge, it will not be necessary to clean the boilers at all during the season of heavy traffic next summer. Two tanks made of cypress wood, 14 ft. high, having a diameter of 16 ft. at the bottom

and 14 ft. 8 in. at the top, with a capacity of 17,000 gallons each are placed on a platform about 6 ft. high. A small tank of 65 gallons capacity is placed on the top of another platform about 18 ft. or 20 ft. above the first. A chemical solution of lime and soda ash is allowed to run from the small tank into one of the larger ones while it is being filled from the bottom with water. The quantities of lime and soda ash required vary with any change in the water, a very simple means of testing the water is provided with the plant which enables the engineer to easily determine the quantities of each required. It requires an hour and 10 minutes to fill one of the large tanks with the present pump, which is not pressed to its full capacity. During the time of filling a paddle revolves in each tank to disseminate the chemicals. A 2½-h.p. motor located on the first platform furnishes the power necessary to operate a 2-ft. paddle in the small tank and a 12-ft. paddle in the larger. The large paddle makes about eight revolutions a minute. While the pure water in one tank is being utilized the other is being filled. During the season of heavy traffic about 60,000 gallons of water is used by the boilers, and it is estimated that since the water has been treated by this system about tons of coal a day have been saved. The cost of installing the above plant was about $2,500.

The Thor Pneumatic Grinding Machine.

The Independent Pneumatic Tool Co., Chicago and New York, has just placed on the market a new air machine, designated as the "Thor" pneumatic grinder No. 7, designed for grinding, polishing and buffing purposes. The machine is of the reciprocating piston type, having four pistons, direct acting on the crank, and is equipped with the "Thor" Corliss valve motion. The grinding spindle proper is held in a housing extended from the end of the motor in line with the crank shaft, and runs at approximately 3,000 r.p.m. It is not a part of the crank shaft, however, but is connected with it. The grinding spindle runs on bearings that are



The "Thor" Pneumatic Grinding Machine.

a combination of ball and plain bearings. There is a large bronze bearing next to the motor, and adjacent to this is fitted a four-point ball-bearing which acts as a thrust bearing both ways, and also as a support for the shaft. At the outer end is a metallic packing that also acts as a bearing, and at the same time prevents the lubricating oil from running out of the machine. A grip handle placed in line with the grinding spindle, and the outside of the housing of the grinding spindle, serve as handles. Mandrels of any suitable length or shape may be attached to the grinding spindle for driving emery wheels, soft polishing wheels or discs. The machine weighs about 20 lbs. and consumes approximately 20 cu. ft. of free air per minute. Several large plants have made exhaustive tests of these machines and claim that they have given entire satisfaction.

Accident Bulletin No. 16.

Accident Bulletin No. 16, just issued by the Interstate Commerce Commission for the months of April, May and June, shows passengers and 221 employees killed, and 1,253 passengers and 511 employees injured in train accidents. Other accidents bring the total number of casualties to passengers and employees up to 14,669 (886 killed and 13,783 injured). For the year ending June 30, 1905, there is an increase of 117 in the number of passengers killed and an increase of 11 in the total killed of both passengers and employees. In coupling accidents, the total number of deaths for the year, 243, is 35 less than for the year preceding, and the number of injuries, 3,110, is 331 less; while the number of men employed is estimated to have been 9 per cent. greater than the year before.

Manufacturing and Business.

The Mount Vernon Car Manufacturing Co., Mount Vernon, Ill., has enlarged its car wheel foundry capacity so that 400 wheels can be made daily.

The Pennsylvania Railroad Company has placed an order with the Westinghouse Machine Company for six 132 in. x 26 in. grate and four 100 in. x 20 in. grate Roney mechanical stokers for its Altoona shops.

The Kennicott Water Softener Co., Chicago, is building 18 steel storage tanks of the Harriman pattern, capacity 65,000 gals. each, for the Union Pacific.

The Hurley Track-laying Machine Company, Syracuse, N. Y., has recently placed a track-laying machine with the Streeter & Lusk Contracting firm on the Chicago & North-Western work between Manitowoc and Gillett, Wis.

The Dayton Pneumatic Tool Co., Dayton, Ohio, has received orders for 30 No. 3 "Green" chipping hammers from the Jones & Laughlin Steel Co., Pittsburg, Pa., and 38 "Green" hammers of miscellaneous sizes for shipment to Japan.

The National Machinery Company, Tiffin, Ohio, maker of bolt, nut and wire nail machinery, states that it has received a number of orders from various railroad companies for its threading and tapping machines, as well as for its upsetting and heading machines, in which it has made some radical improvements in design.

A "jarless" pneumatic hammer is being placed on the market by the Helwig Mfg. Co., St. Paul, Minn., maker of pneumatic tools and other labor-saving devices. It is claimed that owing to the lack of vibration in this hammer there is no strain on the user and for that reason it increases the working capacity of every operator. The 9-in. stroke hammer, which weighs but 14 lbs., rivets up to 1¼ in.

The Sherwin-Williams Paint Co. has opened a branch house in Cincinnati, Ohio, at 416-422 Pioneer street, making 13 branch houses in addition to its five large plants. A circular announcing the fact shows views of important plants and branch houses of the company, and gives other information relative to the scope of the business done, methods, product, etc., and detailed information about the new Cincinnati branch.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Ticket Agents' Association.

At the meeting of this association in Portland, Me., October 16, W. Bunton, Peterboro, Ont. (Grand Trunk), was elected President.

General Passenger Agents.

At the annual meeting of the American Association of General Passenger & Ticket Agents, held at the City of Mexico, October 17, A. J. Smith, of the Lake Shore & Michigan Southern, was elected President and C. L. Stone, of the Louisville & Nashville, Vice-President; and C. M. Burt (Central of New Jersey), of New York City, was re-elected Secretary. The next meeting is to be held at Atlantic City, N. J.

Society of Naval Architects and Marine Engineers.

The thirteenth annual meeting of this society will be held at 12 West 31st street, New York, November 16 and 17, to be followed by a banquet, November 17, to which members and their guests are invited. The papers to be read are as follows:

"Problems in Ferryboat Propulsion," by Col. Edwin A. Stevens, Vice-President.
"Ventilating Fans and Pipes," by Naval Constructor D. W. Taylor, U.S.N.
"Action of Screw Propellers." By Prof. Wm. F. Durand.
"Tests of Model Propellers," by A. V. Curtis and L. F. Hewins.
"The Cruisers," by Commander William Hovgaard, Royal Danish Navy.
"Comparison of Recent Battleships," by Naval Constructor H. G. Gilmor, U. S. N.
"'The Ultima,' a Globular Naval Battery," by Anson Phelps Stokes.
"A Tale from Japan," by George W. Dickie.
"Longitudinal Bending Moments of Certain Lake Steamers," by W. I. Babcock.
"Steam Boiler Troubles," by Horace See.
"Water-tight Bulkheads for Battleships and Cruisers," by Harold F. Norton.
"Marine Turbine Propulsion," by Charles G. Curtis.
"Marine Steam Turbine Developments," by E. M. Speakman.
"How a Ninety-footer Behaves in an Ocean Race," by Paul Eve Stevenson.
"High-Speed Launches," By Clinton H. Crane.
"Speed Trials of the Gasolene Launch 'Ludo.'" by George Crouse Cook.
"Scantling Regulation in Yachting," by W. P. Stephens.

PERSONAL.

—Mr. H. S. Storrs, General Superintendent of the Lake Shore & Michigan Southern, died of paralysis at Cleveland, Ohio, on October 25.

—Mr. J. H. McWilliams, who has been appointed General Freight and Passenger Agent of the Georgia, Florida & Alabama, began his railroad service in the Traffic department of the Chicago, Milwaukee & St. Paul at Council Bluffs, Iowa, in 1891. In 1897 he went to the Atlanta, Knoxville & Northern as traveling freight and passenger agent. In 1900 he was made General Passenger Agent of the same road and General Freight and Passenger Agent in 1902. When the road was absorbed by the Louisville & Nashville on Jan. 1, 1905, he was made traveling freight agent in Tennessee of the latter road, leaving this position to accept his recent appointment.

—Mr. J. F. Simms, who was recently appointed Superintendent of the Central Kansas division of the Missouri Pacific, was born in Mississippi in 1866. After being employed in various places in the South as agent and operator he became in 1889 night operator of the St. Louis, Iron Mountain & Southern. He was made train despatcher in 1890 and the next year was transferred to the Missouri Pacific with the same title. In 1895 he was made chief despatcher and in 1901 Division Superintendent at Concordia, Kan. Two years later he was transferred to the Eastern division. On Jan. 10, 1905, all Division Superintendents' titles were changed to trainmaster, and he was therefore trainmaster at Sedalia, Mo., at the time of his present appointment.

—Mr. F. E. Herriman, who was recently appointed to the new position of Coal Traffic Manager of the New York Central, began railroad service in 1874 as clerk to the superintendent of the Cincinnati, Sandusky & Cleveland, and served consecutively as secretary to the general manager, assistant to the president, and purchasing agent of that road and coal and lumber agent of the Chesapeake, Ohio & Southwestern, at Louisville, Ky. In 1885 he was made General Freight and Passenger Agent of the Beech Creek, where he remained for 14 years. He then came to the New York Central as division coal agent of the Beech Creek district, and in 1901 was made General Coal Agent of this road and of the West Shore, where he remained until Oct. 1, 1905. He was also General Coal Agent of the Boston & Albany and other New York Central lines. Since the acquisition by the New York Central of the great Beech Creek coal properties, and the railroad extensions into that bituminous coal region, Mr. Herriman has had charge of the commercial development. The problem was not the simple one of mining coal and selling it. In his relations with the other coal carriers, as well as with the users of coal, his work was probably as difficult and delicate as any that comes to a traffic officer. His was the duty of "butting in" with a new supply and a new line, and of course his instructions were to get a fair share of the business and at the same time to avoid war. He succeeded by reason of his thorough knowledge of all the intricacies of the coal business, aided much by his irrepressible humor.

F. E. Herriman.

—Mr. Alexander Robertson, who will become General Manager of the Western Maryland and the West Virginia Central on October 31, was born at Albany, N. Y., in 1860. His first railroad service was in 1885 as brakeman on the Fitchburg. He served consecutively as conductor, general yardmaster, station master and trainmaster until 1897, when he went to the Wabash as general yardmaster. He was later made trainmaster and then Superintendent of the Middle division. In 1903 he was appointed Manager of the Western Maryland and the West Virginia Central & Pittsburg, where he remained until 1904, when he became General Manager of the Terminal Railroad Association of St. Louis, where he is at present.

A. Robertson.

—Mr. C. E. Rickey, who was recently appointed Superintendent of the Cincinnati division of the Cincinnati, New Orleans & Texas Pacific, entered railroad service in the Engineering department of this road in 1883. The next year he went to the Maintenance of Way department of the Alabama Great Southern, where he remained until 1891, when he was appointed chief clerk to the superintendent of that road. Seven years later he was made Assistant Superintendent, and in 1902 became chief clerk to the General Manager of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern. In July of this year he was made Superintendent of Car Service of both companies, which position he leaves to accept his recent appointment.

—Mr. John Cannon, Jr., who has been appointed Superintendent of the Southern Kansas division of the Missouri Pacific, is 33 years old. He began railroad service on the Illinois Central at the age of 14. In 1886 he was employed in the Superintendent's office and remained there in various positions until 1892, when he was made chief clerk to the Assistant Superintendent of the Chicago division. In 1894 he was appointed chief clerk to the Superintendent of the Amboy and St. Louis divisions, and in 1901 chief clerk to the General Superintendent of Transportation. He was appointed assistant trainmaster of the St. Louis division in 1903, and in 1904 was made chief clerk to the General Manager. In January, 1905, he became trainmaster of the Springfield and Chicago divisions, which position he left to go to the Missouri Pacific.

—Mr. Alex. Bonnyman, who is Chief Engineer of the Atlantic & Birmingham and the Atlantic & Birmingham Construction Company, which is building an extension of this road from Montgomery, Ga., to Birmingham, Ala., began railroad work in 1888 as Assistant to the Engineer of Maintenance of Way on the Eastern division of the Newport News & Mississippi Valley Company's lines, now the Chesapeake & Ohio. He later served as rodman and instrument man on the Kentucky Union, now the Lexington & Eastern, and as Resident Engineer, and in the transportation department of the South Bound Railroad, now the Seaboard Air Line. In 1894 he went to the Central of Georgia as Assistant Engineer, and from 1895 to 1898 was roadmaster and engineer of the Chattanooga, Rome & Southern division of this road. In 1899 he was appointed Superintendent of the Atlantic & Birmingham, in charge also of construction, from which position he has been promoted to be Chief Engineer.

—Mr. Edward R. McNeill, Division Engineer of the Grand Trunk Pacific, at Winnipeg, Manitoba, died of typhoid fever on October 7th. Mr. McNeill was born in Iowa in 1866 and attended the University of Iowa from 1884 to 1887. He then began railroad service in the Engineering department of the Rock Island. In 1889 he went to the Northern Pacific as instrument man, and in 1890 was put in charge of the masonry line of the Wicks tunnel, with the title of Assistant Engineer. He resigned in 1894 and engaged in private practice for five years. He returned to railroad work as engineer in charge of construction on the Montana Central. In 1901 he went to the Great Northern as resident engineer on the Middle district, resigning in September, 1903, to become District Engineer of the Grand Trunk Pacific at Edmonton, Alberta. In July of this year he was promoted to his last office, in which he was in charge of 500 miles of location and construction.

ELECTIONS AND APPOINTMENTS.

Chicago & North-Western.—Frank Walters, Superintendent of the Sioux City division, has been appointed Assistant General Superintendent at Norfolk, Neb. E. G. Scheveneli, Superintendent of the Iowa & Minnesota division, succeeds Mr. Walters.

Cincinnati, Hamilton & Dayton.—Charles Steele, Samuel Spencer, George F. Baker, F. D. Underwood and R. R. Rhodes have been elected directors. F. D. Underwood, President of the Erie, has been elected also President of the Cincinnati, Hamilton & Dayton, the Pere Marquette and the Chicago, Cincinnati & Louisville. Russell Harding has been elected Vice-President of these roads, and the Secretary and Treasurer of the Erie have been elected Assistant Secretary and Assistant Treasurer, respectively, of them.

Delaware & Hudson.—A. J. Stone, General Superintendent, has resigned, effective November 1. See Erie.

Erie.—A. J. Stone, General Superintendent of the Delaware & Hudson, has been appointed Assistant to the General Manager of the Erie, with office at New York, effective November 1. George Van Keuren, General Superintendent of the Erie division, at Jersey City, has resigned, effective November 1. R. H. Bowron, General Manager of the Cincinnati, Hamilton & Dayton, succeeds Mr. Van Keuren.

See Cincinnati, Hamilton & Dayton.

Las Vegas & Tonopah—J. Q. Goss has been appointed General Auditor, and Arthur Maguire, Chief Engineer, of this new company, which is a subsidiary of the San Pedro, Los Angeles & Salt Lake.

Pacific.—H. R. Williams, formerly General Manager of the Chicago, Milwaukee & St. Paul, has been elected President of this new railroad in the state of Washington, and A. H. Barkley, Secretary. W. L. Darling, formerly Chief Engineer of the Chicago, Rock Island & Pacific, has been appointed Chief Engineer of the Pacific.

Philadelphia & Reading.—R. J. Stackhouse, Superintendent of the

Wilmington & Columbia division, has been appointed Superintendent of the new Harrisburg division, which is composed of the Lehigh Valley branch, the Philadelphia, Harrisburg & Pittsburg branch, and the Gettysburg & Harrisburg Railway. F. S. Stevens, Superintendent of the Lebanon and Reading divisions, succeeds Mr. Stackhouse. W. H. Keffer, Assistant Superintendent of the Reading division, succeeds Mr. Stevens as Superintendent of the Reading division.

Rio Grande Western.—E. H. Harriman has retired from the board of directors and is succeeded by A. H. Calef.

F. E. Baxter, Division Engineer at Salt Lake City, has resigned, effective November 1.

Wabash.—George Gould has resigned as Chairman of the board, and E. T. Jeffery, President of the Denver & Rio Grande, succeeds him. E. B. Pryor, Assistant to the President, has been elected to the new office of Fourth Vice-President in charge of the Treasury and Accounting departments. A. C. Bird, Vice-President in charge of traffic, has resigned.

W. D. Holliday, Assistant General Freight Agent of this road and of the Wabash-Pittsburg Terminal and the West Side Belt, has resigned.

Wheeling & Lake Erie.—H. T. Douglas, Jr., Consulting Engineer of this road and of the Wabash-Pittsburg Terminal and the West Side Belt, has been appointed Chief Engineer of these three roads, with office at Pittsburg, Pa., succeeding George T. Barnsley, assigned to other duties.

The office of H. J. Booth, General Freight Agent of this road and of the Wabash-Pittsburg Terminal and the West Side Belt, has been moved from Cleveland, Ohio, to Pittsburg, Pa. The office of E. B. Coolidge, Assistant General Freight Agent of the Wheeling & Lake Erie, remains at Cleveland, Ohio.

See Wabash.

Wisconsin Central.—Howard Morris, General Counsel at Milwaukee, Wis., has been elected Vice-President. He will continue to act as General Counsel. George M. Cumming, recently elected a director, has been appointed to the executive committee.

LOCOMOTIVE BUILDING.

The Southern Pacific, it is reported, has ordered 140 locomotives.

The Republic Iron & Steel Co., Chicago, is in the market for two additional locomotives.

The Chesapeake & Ohio, as reported in our issue of October 20, has ordered 35 locomotives from the Richmond Works of the American Locomotive Co.

The Lake Superior & Ishpeming has ordered one locomotive from the American Locomotive Co. and one locomotive from the Lima Locomotive & Machine Co.

The Esser Coal & Coke Company, Esserville, Va., is in the market for a 36-in. gage locomotive having a hauling capacity of at least 25 tons up a 3 per cent. grade.

The Spokane & Inland is reported to have ordered three electric locomotives from the Westinghouse Electric & Manufacturing Co. These locomotives are to weigh 140,000 lbs.

The Illinois Steel Company has ordered three 36-in. gage industrial locomotives from the H. K. Porter Co. The cylinders of these locomotives will measure 16 in. x 20 in.

The Duluth, Missabe & Northern, as reported in our issue of September 22, has ordered six combination freight engines from the American Locomotive Co., and two 10-wheel passenger locomotives from the Baldwin Works.

The Boston & Maine, instead of ordering 10 locomotives, as reported in our issue of October 20, has ordered only two additional locomotives. These, with the 36 locomotives which were ordered in August, make a total of 38 locomotives ordered from the American Locomotive Co.

The Grand Trunk, as reported in our issue of October 6, has ordered 25 locomotives from the Montreal Works of the American Locomotive Co. for May, 1906, delivery. Fifteen of these are of the consolidation freight type with cylinders of the Richmond system of compounding, and the remaining 10 are of the 10-wheel type, with simple cylinders.

The Duluth & Iron Range, as reported in our issue of September 22, has ordered five simple freight locomotives from the Baldwin Works. The freight locomotives weigh 194,000 lbs., with 171,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of driving wheels, 54 in.; straight boiler, with a working steam pressure of 200 lbs.; 321 tubes, 2¼ in. in diameter x 16 ft. long; total heating surface, 3,162 ft.; grate area, 49.5 sq. ft. The tender is provided with a "U" water bottom and has a capacity of 7,000 gallons of water and 12 tons of coal. The special equipment includes: Standard tires, Pittsburg Spring & Steel Co.'s springs, Franklin boiler covering, American balance valves, Simplex injectors, Tower couplers, Schroeder headlights, Westinghouse brakes, National-Hollow brake-beams, Ashton safety valves, Nathan lubricators, United States metallic packing, Ashcroft steam gages, Curren whistles, Leach sanding device and Streeter steel back brake-shoes.

The Canadian Pacific, as reported in our issue of October 20, has ordered 35 locomotives from the Montreal shops of the American Locomotive Co. It has also ordered 15 locomotives from the Canadian Locomotive Co., and 10 locomotives which are to be made at its Angus shops makes a total of 60 engines in all which have been ordered. All of the above are single engines fitted with superheaters, and are of the (4-6-0) type for both passenger and freight service. Deliveries are for December, 1905, and January and February of 1906. These engines are to weigh 190,000 lbs., with 142,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 63 in.; boiler, extended wagon top with radial stayed firebox; working steam pressure, 200 lbs.; total heating surface, 2,413 sq. ft. There are 240 tubes 2 in. in outside diameter x 14 ft. 2 in. long, and 22 superheater tubes of 5 in. in diameter x 14 ft. 2 in. long; firebox, 102 in. x 70 in.; grate area, 50 sq. ft.; tender capacity, 5,000 imperial gallons; coal capacity, 10 tons. The special equipment includes: Westinghouse air-brakes, C. P. R. axles, "Little Giant" bell ringers, magnesia section block boiler lagging, Simplex brake-beams, C. P. R. brake-shoes, Washburn pilot and Tower tender couplers, Pyle-National headlights, Hancock injectors, Magnus and Ajax journal bearings, United States metallic piston and valve rod packing, World Brand safety valve, Leach sanding device, Richardson sight-feed lubricators, C. P. R. springs, Star steam gages, Krupp standard and Midvale driving wheel tires, cast-steel truck wheels and wrought-iron disc tender wheels.

The St. Louis, Brownsville & Mexico, as reported in our issue of October 20, has ordered four 10-wheel (4-6-0) locomotives, four simple 8-wheel (4-4-0) and one simple 6-wheel (0-6-0) switching locomotive from the Baldwin Locomotive Works, all for December 15 delivery. The 10-wheel locomotives will weigh 127,040 lbs., with 95,840 lbs. on the drivers; cylinders, 19 in. x 24 in.; diameter of drivers, 62 in.; wagon top boiler, with a working steam pressure of 180 lbs.; 230 iron tubes, 2 in. in diameter and 13 ft. ½ in. long; Otis firebox, 71⅝ in. x 34¼ in.; tank capacity, 4,500 gallons, and oil capacity, 2,500 gallons. The 8-wheel locomotives will weigh 196,000 lbs., with 58,480 lbs. on the drivers; cylinders, 17 in. x 24 in.; diameter of drivers, 62 in.; wagon top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,886 sq. ft.; 187 tubes, 10 ft. 11 in. long; Otis firebox, 69⅜ in. x 34¼ in.; tank capacity, 4,500 gallons, and oil capacity, 2,300 gallons. The switching locomotives will weigh 100,500 lbs.; cylinders, 18 in. x 24 in.; diameter of drivers, 50 in.; straight boiler, with a working steam pressure of 180 lbs.; heating surface, 1,496.3 sq. ft.; 202 iron tubes, 2 in. in diameter and 13 ft. 2 in. long; Otis firebox, 63 in. x 34 in.; tank capacity, 3,500 gallons, and oil capacity, 1,800 gallons. The special equipment for all includes: Tower couplers, Pyle-National electric headlights for 10-wheel and 8-wheel locomotives, Monitor injectors, Ajax journal bearings for 10-wheel and 8-wheel locomotives, Richardson valve rod packings, Baldwin standard safety valves, Leach sanding devices, Detroit sight-feed lubricators, Safety steam heat equipment for 8-wheel locomotives and Midvale driving and truck wheel tires for 10-wheel and 8-wheel locomotives.

CAR BUILDING.

The Western Maryland, it is reported, is in the market for passenger cars.

The Ulster & Delaware has ordered 10 passenger cars from the Pullman Co.

The Coal & Coke has ordered three passenger cars from the Pullman Co.

The Alabama Great Southern, it is reported, is in the market for 250 flat cars.

The Manistee & Grand Rapids, it is reported, is figuring on new freight equipment.

The Chesapeake & Ohio has ordered 500 gondolas from the American Car & Foundry Co.

The Philadelphia & Reading has ordered 1,000 box cars from the American Car & Foundry Co.

The Louisville & Atlantic has ordered 60 freight cars from the American Car & Foundry Co.

The Southern has ordered 114 plain box cars and 198 ventilated box cars from the Lenoir Car Works.

The Interstate has ordered five steel hopper cars of 80,000 lbs. capacity from the Pressed Steel Car Co.

The Atlantic Coast Line, it is reported, will shortly order upwards of 1,500 60,000 lbs. capacity box cars.

The Minneapolis & St. Louis has ordered 900 box cars and 100 stock cars from the American Car & Foundry Co.

The Great Northern has ordered 300 steel ore cars of 100,000 lbs. capacity from the American Car & Foundry Co.

The Delaware & Hudson has ordered 2,000 gondola cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Delaware, Lackawanna & Western, it is reported, will shortly be in the market for a large number of freight cars.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 50 refrigerator cars from the American Car & Foundry Co.

The Isthmian Canal Commission has ordered 800 flat cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Southern Pacific, it is reported, has ordered 600 steel flat cars, 120 passenger and baggage cars and eight observation cars.

The Cold Blast Transportation Company has, it is reported, ordered 200 refrigerator cars from the American Car & Foundry Co.

The New Orleans Great Northern has ordered three 70-ft. coaches, three mail and express cars and one buffet car from Barney & Smith.

The Chicago, Rock Island & Pacific, as reported in our issue of October 6, has ordered 250 furniture cars from the American Car & Foundry Co.

The New York Central Lines are about to order 20,000 freight cars and will shortly place orders for from 6,000 to 7,000 cars in addition to the above.

The Intercolonial has ordered four parlor cars, five combination tourist sleepers and 75 box cars of 60,000 lbs. capacity from the Crossen Manufacturing Co.

The Lake Superior & Ishpeming has ordered 100 steel ore cars of 100,000 lbs. capacity from the Pressed Steel Car Co. These cars are for April, 1906, delivery.

The Atlantic Coast Line has ordered 1,200 box cars and 300 flat cars from the Baltimore Steel Car & Foundry Co., and 15 passenger cars from Barney & Smith.

The Temiskaming & Northern Ontario has ordered three passenger cars, three working cars and one logging and mail car from the Crossen Car Manufacturing Co.

The New York, New Haven & Hartford has ordered 500 flat cars and 500 hopper cars from the Standard Steel Car Co. and 300 cars from the American Car & Foundry Co.

The Louisville & Nashville will build 750 additional box cars at its own shops, and is reported as being in the market for additional passenger equipment, including two dining cars.

The Pittsburg, Binghamton & Eastern is figuring on new equipment, including coal, flat, box and milk cars. The Chief Engineer of the company is J. W. Burke, 45 Broadway, New York.

The Chicago, Milwaukee & St. Paul, as reported in our issue of October 13, has ordered five standard sleeping cars, four tourist sleeping cars, two dining cars and one café car from the Pullman Co.

The Duluth, Missabe & Northern has ordered 200 flat cars and 50 box cars, all of 80,000 lbs. capacity, from the Western Steel Car & Foundry Co., and 25 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Erie, it is reported, has just placed a large order for all-steel self-clearing gondola cars with the Standard Steel Car Co. These, it is reported, are in addition to those noted in our issue of September 22 as being ordered from the Pressed Steel Car Co.

The Des Moines, Iowa Falls & Northern has ordered 30 gondola cars of 80,000 lbs. capacity from the American Car & Foundry Co., for November delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 3 ft. 9 in. high, all inside measurements. The special equipment includes: Westinghouse air-brakes and Chicago couplers.

The Chesapeake & Ohio has ordered 22 cabooses from the American Car & Foundry Co. The inside dimensions of the cars are 17 ft. 1 in. long x 7 ft. 10 in. wide x 6 ft. 8¼ in. high; over-all dimensions are 23 ft. 8 in. long x 9 ft. ¼ in. wide x 13 ft. 10⅜ in. high. The bodies and underframes are of wood. The special equipment includes: Monarch brake-beams, Christie brake-shoes, Climax couplers and Miner tandem draft gear.

The Baltimore & Ohio, as reported in our issue of October 6, has ordered 10 horse express cars from the Pullman Co., for November 15 delivery. These cars will weigh 45,000 lbs., and measure 70 ft. 11¾ in. long, 10 ft. 1¼ in. wide and 14 ft. 6 in. high, over all. The special equipment includes: Baltimore & Ohio standard brake-beams, brake-shoes, brasses, door fastenings, dust guards, paint, springs and trucks, Westinghouse air-brakes, Miner tandem draft rigging, McCord journal boxes and Pintsch light.

The New York, Ontario & Western, as reported in our issue of October 20, has ordered 10 passenger cars from Harlan & Hollingsworth for April, 1906, delivery. These cars are fitted with wide vestibules and weigh about 100,000 lbs. They are 64 ft. long inside and have a seating capacity of 75 passengers. The bodies and underframes are of wood. The special equipment includes steel axles; Commonwealth double body bolsters, National hollow brake-beams, American brake-shoes, Westinghouse brakes, Gould couplers, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Gould friction draft rigging, Symington journal boxes, the Safety Car Heating & Lighting Co.'s Frost system of lighting, Gould wide vestibules, and Railway Steel Spring Co.'s wheels.

The Tramway Rural & Vapor, of Buenos Ayres, Argentine Republic, as reported in our issue of October 20, has ordered 85 Brill patented grooveless-post semi-convertible cars from the J. G. Brill Co. Seventy-five of these cars are for city service and are mounted on the Brill type of single truck, No. 21-E. These cars measure 21 ft. 4 in. over the bodies and 30 ft. 4 in. over the vestibules; width over sills, 7 ft. 10½ in., and over posts at belt, 8 ft. 2 in. The remaining 10 cars are mounted on Brill No. 27-E-1 high-speed trucks, and are for use on a division extending for several miles out of the city. The length of these cars is 31 ft. over the bodies and 41 ft. over the vestibules; width over sills, 8 ft. ½ in., and over posts at belt, 8 ft. 2½ in. The shorter cars have a seating capacity of 32 and the longer cars seat 44 passengers. The seats are of Brill make and have step-over backs. All of the cars have the interior finished in mahogany and the vestibules are stationary and provided with folding-doors with Brill patented controlling device.

The Pennsylvania has just ordered 10,000 class Gsd all-steel drop bottom gondolas, 5,000 class Gla all-steel self-clearing hopper gondolas, and 5,000 class XL box cars, making in all 20,000 freight cars. The order was distributed as follows: Pressed Steel Car Co., 12,000 cars, including 2,500 class Gla all-steel self-clearing hopper gondola cars for the lines west of Pittsburg, 5,500 class Gsd all-steel drop bottom gondola cars and 4,000 XL box cars for the lines east of Pittsburg, 1,000 of the latter are to be made at the works of the Western Steel Car & Foundry Co.; American Car & Foundry Co., 3,100 cars, including 2,500 class Gla all-steel self-clearing gondola cars for the lines west of Pittsburg, and 600 class XL box cars; Standard Steel Car Co., 2,000 class Gsd all-steel drop bottom gondola cars; Cambria Steel Co., 2,500 class Gsd all-steel drop bottom gondola cars, and Middletown Car Co., 400 class XL box cars. These cars will all be of 100,000 lbs. capacity, and the box cars will have steel underframes and American Railway Association standard inside dimensions. Deliveries will begin in March, 1906. This is probably the largest single car order ever placed by any one road. The above order is in addition to the large order for 16,160 cars placed by the Pennsylvania which was reported in our issue of October 13.

The Central of Georgia, as reported in our issue of September 15, has ordered 450 box cars of 60,000 lbs. capacity from the South Atlantic Car & Manufacturing Company, 500 steel hopper coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co., and 400 wooden flat cars of 60,000 lbs. capacity from the Pullman Co. The box cars will measure 36 ft., and the special equipment includes: Westinghouse brakes, Simplex brake-beams, Tower couplers, Butler tandem drawbar attachments, Railway Steel Spring Co.'s springs, Symington journal boxes and dust guards, Murphy's improved Winslow roofs, Jones' door fixtures, Lappin or Herron brakes, and Sherwin-Williams paint. The coal cars will measure 31 ft. 10 in. long, and the special equipment includes: Arch-bar trucks, Simplex truck bolsters, Westinghouse brakes, Simplex brake-beams, Tower couplers, Miner tandem drawbar attachment, Railway Steel Spring Co.'s springs, McCord journal boxes, Ajax journal bearings, Susemihl side bearings and Dunham door fastenings. The wooden flat cars will measure 40 ft. long and the special equipment includes: Andrews cast-steel trucks, Simplex bolsters and brake-beams, Westinghouse brakes, Janney couplers, twin spring drawbar attachment, Railway Steel Spring Co.'s springs, Gould journal boxes, Camel journal bearings and Hartman side bearings.

BRIDGE BUILDING.

BEAUFORT, N. C.—The Beaufort & Western Railway Co., recently organized, will build a bridge between this place and Morehead City. F. L. Merritt is President; R. F. Foster, Vice-President, and M. Manly, Secretary and Treasurer.

DES MOINES, IOWA.—The City Council has passed a resolution authorizing the City Engineer to prepare plans for a reinforced concrete bridge to be built over the Des Moines river on Locust street.

The proposed bridge will be similar to the new one now under construction on North Sixth street.

Edmonton, N. W. T.—The Canadian Northern is building a temporary timber bridge over the North Saskatchewan, with approaches 5,400 ft. long on the permanent concrete piers, which will be replaced early next year by a permanent steel structure.

Guelph, Ont.—The Township Council will build a new steel bridge to replace the Caraher's bridge.

Guthrie, Ky.—Bids are wanted by F. M. Duffy for building an iron bridge 50 ft. long, in Taylor County.

Mattawa, Ont.—The Ontario Government will build a steel bridge here to cost about $9,000.

Milwaukee, Wis.—Application has been made by the Park Board for an appropriation of $15,000 to build a bridge over the North-Western tracks, which have been depressed at Riverside Park. The railroad company has completed the retaining walls which will serve as abutments.

Minneapolis, Minn.—The Great Northern is planning to build a steel bridge over its tracks at Superior avenue to replace the present wooden structure.

Portage La Prairie, Man.—The Canadian Northern has plans ready for building a steel swing span bridge 150 ft. long over the Assiniboine river four miles east of this place.

Portland, Ore.—According to reports, the Northern Pacific has decided to build a bridge 160 ft. above high water over the Willamette river south of the Portland drydock.

Shawinigan Falls, Que.—The Saint Maurice Valley Railroad, which is building a road through this place, will build a bridge 300 ft. long over the Saint Maurice gorge.

Stratford, Ont.—Plans have been filed by the Canadian Pacific for its proposed bridge to be built on its branch from Goderich.

Sussex, N. B.—The People's Railway Co., it is said, is planning to put up a large steel bridge at this place.

Victoria, B. C.—T. W. Paterson, M. P. and President of the Board of Trade, is promoting the building of a steel bridge from Vancouver Island to the mainland.

Woodville, Miss.—At a recent meeting of the Board of Supervisors, a bond issue of $9,800 was authorized for building a steel bridge over Buffalo bayou at Murray's ferry, in Wilkinson County.

Other Structures.

Bamberg, S. C.—The Southern Railroad station and platforms, together with a number of freight cars and stores, were destroyed by fire October 13; loss, about $50,000.

Indianapolis, Ind.—Plans have been completed to at once build additions to the union station, at a cost of $75,000.

Grand Rapids, Mich.—The Grand Trunk, it is said, will shortly ask for bids for putting up a new passenger station two stories high, 80 x 80 ft., to cost $50,000.

Oakmont, Pa.—The Pennsylvania will soon ask bids for putting up a brick passenger station 200 ft. long, to cost about $25,000.

Pawnee City, Neb.—Bids are wanted November 14 by George L. Lore, County Clerk, for putting up all the bridges that may be needed in Pawnee County for one year.

Sheboygan, Wis.—The West Side Belt Line has been given a franchise which insures the building of a new passenger station to cost $72,000 and a new freight house to cost $80,000.

Sioux City, Iowa.—The Great Northern, it is said, has recently bought 82 acres of land on which it will put up new shops.

Wetaskiwin, Alberta.—The Canadian Pacific, it is said, will put up a new station here to cost $25,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Anderson & Saline River.—This company, which was incorporated some time ago in Arkansas, has increased its capital from $20,000 to $56,000. It is to build a railroad from Clio, in Cleveland County, Ark., southwest for a distance of 18 miles. The incorporators include G. W. Richie, of Pine Bluff, Ark., and others. (See Construction Record.)

Atlantic City & Shore.—Articles of incorporation have been filed by a company under this name in New Jersey to build a railroad in Atlantic County. The incorporators include: J. F. Cotter, of Philadelphia; G. H. B. Martin, George C. Duval, J. H. Switzer and others, of Camden, N. J.

Beaumont & Great Northern.—An officer writes confirming the report that grading has been commenced by Lamb & Hansen, contractors, of Trinity, Tex., on this proposed road from Trinity southeast to Livingston, about 30 miles. The work is easy, the maximum grades being only 1 per cent., with a curvature of 3 degrees, and only two steel bridges will be required. Track laying is to begin early next month. William Carlisle, of Atchison, Kan., is President, and C. A. Noblett, Chief Engineer, Trinity, Tex. (Sept. 29, p. 102.)

Buffalo & Susquehanna.—The extension of the main line of this road from Dubois, Pa., south to Sykes, a distance of 6.9 miles, has been opened for freight traffic; also an extension of the Wellsville branch from Wellsville, N. Y., north to Belfast, 19.6 miles.

Canadian Northern.—This company is grading its new cut-off west of Winnipeg to connect the Portage la Prairie with the Hudson Bay branch.

Chesapeake & Ohio.—The Big Sandy branch has been extended from Pikeville, Ky., south to Regina, 16 miles.

Chicago & North-Western.—See Wyoming & North-Western below.—See Pierre, Rapid City & North-Western below.

Chicago, Burlington & Quincy.—An officer writes that contracts have been let by the C., B. & Q. to Guthrie & Co., of St. Paul, Minn., for building its proposed extension from Frannie, in the northern part of Big Horn County, Wyo., southeast through Lovell and Basin to Wellington, and thence south to Worland, about 85 miles. The work includes the building of three steel bridges and the excavation of about 22,000 cu. yds. to the mile, 16 per cent. of which will be rock. The maximum grades will be 16 ft. to the mile. (October 13, p. 118.)

Chicago, Indianapolis & Evansville.—A company has been formed in Indiana by L. Wallace, O. B. Jamieson, I. N. Ritchie, S. M. Smith and others, of Indianapolis, with a capital of $325,000, which, they say, is for the purpose of building a railroad from Evansville to Indianapolis and Indiana Harbor, Ind.

Chicago, St. Paul, Minneapolis & Omaha.—This company is planning to improve its road from Le Mars, Iowa, north to Alton. The present line, which is 16 miles long, will be straightened and grades reduced.

Coal Belt.—Surveys have been completed by this company, which was incorporated in Utah to build a railroad from Spanish Fork, Utah, through Utah, Wasatch and Carbon Counties to the coal fields, a distance of 89 miles. Construction work will be commenced during the winter. Contracts have not as yet been let. The maximum grade will be 2 per cent. and the maximum curvature, 10 degrees. S. B. Milner is President, and F. P. Jacobs, Chief Engineer, Salt Lake City, Utah.

Colorado, Oklahoma Central & New Orleans.—See Guthrie, Fairview & Western below.

Darien & Western.—This road has opened its extension from Ludowici, Ga., west to Weefannie, five miles, for freight traffic.

Dawson Springs & Madisonville.—Incorporation has been granted a company under this name in Kentucky, with a capital of $100,000, to build a railroad in Hopkins County, Ky., from Dawson northeast to Madisonville, 20 miles. The incorporators include: W. G. Harris, A. Haydon, W. J. Powell and L. Haydon, all of Hopkinsville. The offices of the company will be at Madisonville.

Decatur, Sullivan & Mattoon.—This company has been organized at Sullivan, Ill., with a capital of $600,000, and will ask for incorporation to build an interurban road from Decatur, Ill., to Mattoon, passing through Mount Zion, Dalton City, Bethany, Sullivan and Coles. At Decatur, connection will be made with the present interurban road to Springfield and St. Louis, and with the line now building to Clinton and at Mattoon with the road to Charleston. The board of directors includes: J. M. Clokey and Felix B. Tait, of Decatur; A. R. Scott, of Bethany; G. B. Spitler, of Mount Zion; J. H. Uppendahl, of Dalton City; W. A. Steele and J. B. Titus, of Sullivan; R. B. Starbuck and E. C. Craig, of Mattoon.

Denver, Northwestern & Pacific.—The extension of this road, recently opened, runs from Arrowhead, Colo., west to Sulphur Springs, a distance of 32.5 miles. (Sept. 22, p. 95.)

Dubuque, Iowa & Wisconsin.—This company has been organized in Iowa to build a railroad from Dubuque through Iowa, Illinois and Wisconsin to points not yet decided upon. The directors include: J. M. McFadden, A. W. Tredway, F. J. Piekenbrock, H. H. Blish, J. E. Hedley and others.

Gainesville Midland.—An officer writes that work will shortly be begun on the extension from Jefferson, in Jackson County, Ga.,

southeast to Athens, in Clark County, a distance of 18 miles. Contracts will probably be asked for the work about Nov. 1. (October 13, p. 119.)

Great Northern.—The work carried out by this company and subsidiary lines during the past year and at present under construction includes the building by the Dakota & Great Northern, a line from a junction with the main line at York, N. Dak., to Thorn, 34.35 miles; from a junction with the main line at Towner, N. Dak., to Maxbass, 45.89 miles, both of which were opened for operation August 1; extension of line from Westhope, N. Dak., to Antler, 12.75 miles, opened August 25, and an extension of line from Munich to Sarles, 20.53 miles, opened October 3; the Washington & Great Northern and the Vancouver, Victoria & Eastern, are together to form a line from the international boundary at Midway via Molson and Oroville to Keremeos, B. C., 96 miles. The 49 miles in the United States are being built by the Washington & Great Northern, and the 47 miles in British Columbia by the V., V. & E., which already has 30 miles of line in British Columbia. The latter company has also located an extension from Keremeos to Princeton, 40 miles, on which work will soon be started.

The Minnesota & Great Northern has begun work on an extension of its line from Greenbush to Roseau, Minn., 22 miles, which will be opened for operation during the present year.

The Dakota & Great Northern is now building a line from Ellendale, N. Dak., west to Forbes, 13.4 miles, which will be completed in time to move this year's crops.

Guthrie, Fairview & Western (K. C., M. & O.).—Persons said to be interested in this company, which is building a line from Fairview, Okla. T., southeast via Kingfisher to Guthrie, a distance of about 100 miles, have recently incorporated two companies in Oklahoma Territory; one, under the name of the Colorado, Oklahoma Central & New Orleans, with a capital of $20,000,000, to build a railroad from Denver, Colo., south to Trinidad, thence southeast crossing a corner of New Mexico, through Beaver, Woodward, Day, Dewey and Blaine Counties to Fairview, in Woods County, on the Kansas City, Mexico & Orient, about 520 miles, connecting at the latter point with the Guthrie, Fairview & Western. The other company, under the name of the Guthrie, Shawnee & Shreveport, has been incorporated with a capital of $9,000,000, to build from the eastern terminus of the Guthrie, Fairview & Western at Guthrie, southeast through Logan, Lincoln, Oklahoma and Pottawatomie Counties, in Oklahoma Territory, and the Creek, Seminole, Chickasha and Choctaw nations, in Indian Territory, through the eastern part of Texas to Shreveport, La., approximately 350 miles. All of these new lines, it is said, are being built for the Kansas City, Mexico & Orient, and when completed will give that road a through connection from Denver to Shreveport. The incorporators of the new roads are: W. S. McCaull, of Joliet, Ill.; G. E. Smith, J. G. Trimble, L. Underwood and G. F. Riehl, of Kansas City; G. C. Cowles, of Darrow; Don Carlos Smith and F. L. Williams, of Guthrie. The headquarters of the company will be at Guthrie.

Guthrie, Shawnee & Shreveport.—See Guthrie, Fairview & Western above.

Kansas City, Mexico & Orient.—See Guthrie, Fairview & Western above.

Louisville & Nashville.—This company is reducing the grade on its old line between Corbin and Saxton, Ky., on the Knoxville division, and between Knoxville and Etowah, Tenn., on the Atlantic division. The company is building a new low grade line from Etowah to Cartersville, Ga., where connection will be made with the Western & Atlantic, over whose tracks the company has trackage rights to Marietta. When these works are completed the company will have a good direct line from Cincinnati to Atlanta, a distance of about 485 miles, with reduced grades from Corbin to Atlanta.

Missouri Pacific.—An officer writes regarding the proposed extension of this road from Atchison, Kan., to St. Joseph, Mo., that no authority for this work has yet been given. The company has bought land in the city of St. Joseph for freight terminal facilities, which will be improved as required. The company at present runs trains over the Burlington tracks between Atchison and St. Joseph. (September 29, p. 103.)

Nashville Interurban.—An officer writes that this company is considering the question of using gasolene as motive power. The proposed line is to run from Nashville, Tenn., south through Brentwood to Franklin, about 21 miles. Construction work is to begin early in November; contracts have not as yet been let. The work is very easy, the maximum grades in the city being 5 per cent. and out of the city 2 per cent., with a maximum curvature of 10 deg. outside of the city. There will be one steel or concrete steel bridge over the Harpeth river at Franklin. Major E. B. Stahlman is President, and Charles S. Brown, Chief Engineer, Nashville, Tenn. (September 8, p. 79.)

New York Central & Hudson River.—Surveys are being made by this company in Brewster, N. Y., for proposed double-track work on the Harlem division. The double track at present extends from New York north as far as Goldens Bridge and will be extended to Brewster, 8.3 miles. The most difficult work on this section is between Brewster and Croton Falls, where several large cuts will have to be made and many fills. One bridge will have to be rebuilt. The work will be completed in about a year.

Nevada & California.—This road, formerly the Carson & Colorado, has been extended from Fort Churchill to Hazen, Nev., 28 miles, and has been made standard gage from Hazen to Mina. Between the latter place and Keeler the narrow gage is still used.

See Railroad Corporation News.

Northern Pacific.—The Fargo & Southwestern branch has been extended from Edgeley, N. Dak., on the Dakota division, west to Gackle, 30 miles.

North Yakima Valley.—A contract has been given by this company to Allen & Mathieson for grading part of its proposed road through Naches Pass, in the Yakima Valley. The company expects to have 15 miles of its road finished this year. George Donald, of North Yakima, Wash., is interested.

Pacific Railroad.—Incorporation has been granted a company under this name in Washington with a capital of $3,000,000 to build a railroad from Seattle southwest to Wallula, Wash. The air line distance between these two places is 200 miles. The new company has taken over the tidewater lands recently bought in the name of James T. Woodward, President of the Hanover National Bank, New York, and it is reported that the new road will form the western end of the Chicago, Milwaukee & St. Paul. H. R. Williams, formerly General Manager of the Chicago, Milwaukee & St. Paul, is President, and W. L. Darling, Chief Engineer. (See Elections and Appointments.)

Pawnee Railroad.—An officer writes that this road, which operates a line from Auburn, in Sangamon County, Ill., east nine miles to Pawnee, has given contracts to Johnston & Grommett Bros., of Afton, Ill., for grading and track work, and to the Wisconsin Bridge & Iron Co., of Milwaukee, Wis., for the steel bridges for extending its road from Pawnee southeast, 16 miles, to Taylorville, which is on the Baltimore & Ohio and the Wabash.

Pierre, Rapid City & North-Western (C. & N.-W.).—This company, which was recently incorporated in South Dakota to build a railroad from Pierre, S. Dak., west through Stanley and Lima Counties to Rapid City, S. Dak., 165 miles, has given the contract to Winston Bros. Co., of Minneapolis. (September 29, p. 103.)

Redbluff & Fallriver.—Articles of incorporation have been filed by this company in California, with a capital of $1,000,000, to build a railroad from Redbluff, on the Southern Pacific, northeast via Shingletown to Fallriver mills, about 40 miles. The directors include: D. L. Miles, E. R. Walbridge and H. P. Stice, of Redbluff; P. E. Vilas and A. Thacher, of Shingletown; S. Leavett, of San Francisco; O. P. Montelius, of Oakland, and others.

Shreveport & Northeastern.—This company, recently granted a charter in Louisiana to build a railroad from Shreveport northeast to Memphis, Tenn., a distance of about 275 miles, has, it is said, completed surveys from Shreveport to Homer, and obtained nearly all the rights of way. Grading is now in progress between Minden and Homer, and contracts for track laying will be let early next year. (September 15, p. 88.)

Southern Pacific.—This company has begun work on a branch from Santa Cruz, Cal., to Davenport, on the coast, 22 miles. The new line may eventually be extended along the coast north to San Francisco, paralleling the Ocean Shore electric road, which is now being built over the same route.

See Nevada & California above.

Texas, New Mexico & Pacific.—An officer writes that this company, which was recently granted a charter in Texas, has given the general contract to the Rock Island Construction Co., First National Bank Building, Chicago, and is making surveys for its proposed road. The line is to run from McKinney, in Collin County, Tex., west by northwest through Denton, Decatur, Bridgeport, Graham, Belknap, Haskell, Rayner, Espuela, Emma and Lubbock, in Texas, west to Roswell, N. Mex., about 500 miles. The company will build a number of towns along the proposed route, and grading contracts will be let as soon as the surveys are completed. The work will be easy. There will be six important steel bridges. Jesse Shaine is President, and M. J. Healy, General Manager, McKinney, Tex. (October 13, p. 119.)

Tulsa, Texas & Gulf.—Application has been made by L. Howard Lee, of Oklahoma City, for a charter for this company, with a capital of $10,000,000, to build a railroad from Matagorda Bay, Tex., north to Oklahoma City, Okla. T., and Tulsa, Ind. T., about 600 miles. The directors include: M. H. Smythe, Gainesville, Tex.; H. V. Pentecost, Guthrie; J. W. Helt and M. S. Lee, Oklahoma

City; D. D. Merry, Roswell, N. Mex.; Warren K. Snyder and L. Howard Lee. The promoters say that financial backing for the enterprise has been secured and that construction will soon be started.

Wallula Pacific.—This company, which was recently granted a charter in Washington to build a railroad from Wallula to Vancouver, Wash., it is said, has completed surveys for about 115 miles, and contracts will be let in about four weeks. (August 25, p. 63.)

Waynesburg Southern.—A charter has been granted a company under this name in Pennsylvania, with a capital of $120,000, to build a railroad in Green County, Pa., from Waynesburg south to the state line, a distance of 12 miles. Thomas F. Barrett, of Pittsburg, is President. The directors include: E. McSweeney, of Pittsburg; A. I. Cook and E. Barrett, of Waynesburg, and others.

Western Pacific.—This company has given a contract for building its proposed line from Oakland north to Oroville, in Butte County, Cal., to H. H. Huston, of Tacoma, Wash. (October 13, p. 119.)

Wichita Valley Railroad.—This company, which was recently incorporated in Texas with a capital of $200,000, by Col. Morgan Jones, of Taylor County; N. Harding, George Thompson, and others, of Fort Worth, and of which B. F. Yokum and Edwin Hawley, of New York, and Frank Trumbull, of Denver, are directors, will take over the Wichita Valley Railway. The road extends from Byers to Seymour, Tex., 75 miles. The new company will build an extension from Seymour southwest through Knox and Haskell Counties, to Stanford, in Jones County, about 60 miles. The road connects with the Fort Worth & Denver City (Colorado & Southern), and it is expected that the C. S. will soon take over the control.

Windsor, Essex & Lake Shore (Electric).—An officer writes that this company, which was recently granted a charter in Michigan, will build an electric railroad from Windsor, Ont., touching Essex, Kingsville, Leamington, Wheatley, Tillsbury and Chatham, with a short line from Tillsbury to Essex. Construction work has been commenced by the Keystone Construction Co., of Philadelphia, which has the contract; but no track has yet been laid. The maximum grade will be 2 per cent. The work includes the building of one steel bridge. W. L. Wilson, Port Huron, Mich., is President, and P. Haseltine, Detroit, Mich., is Manager. (October 13, p. 119.)

Wyoming & North-Western (C. & N.-W.).—A contract, it is reported, has been let to the Kilpatrick Bros. & Collins Contracting Co., of Beatrice, Neb., for building this road, which is an extension of the Chicago & North-Western, from Casper, Wyo., across the Shoshone Indian reservation to Lander. (See Construction Record.)

RAILROAD CORPORATION NEWS.

Alabama Great Southern.—The annual report for the year ended June 30 shows net earnings of $601,325, a decrease of $23,600 as compared with last year. The gross earnings were $3,308,300, an increase of $208,855. The net income was $324,984, an increase of $4,372, leaving a surplus after dividends of $139,547; equal to 1.8 per cent. earned on the $7,830,000 common stock.

Buffalo, Rochester & Pittsburg.—See Lake Shore & Michigan Southern.

Bush Terminal.—This New York City company has sold to F. J. Lisman & Company, of New York, $1,500,000 5 per cent. gold bonds of 1955, making $4,250,000 outstanding of the total issue of $10,000,000.

Carolina Northern.—This road, which has been in the hands of a receiver for some time, has been sold, under order of the court, to a committee of bondholders, of which Howard S. Graham, of the firm of Graham & Company, bankers, Philadelphia, is Chairman. The consideration is said to have been $268,000. (September 1, page 72.)

Chicago Terminal Transfer.—Nearly all the bonds and a large amount of the stock of this company have been acquired by the Hill interests. This company owns 84 miles of road and leases and has trackage rights over 17 miles more. There are $15,140,000 first mortgage 4 per cent. bonds of 1947 outstanding, and the capital stock consists of $17,000,000 4 per cent. non-cumulative preferred stock and $13,000,000 common stock.

Cuba.—The Cuban Congress has passed a bill authorizing the payment to the Cuba Railroad Company of $798,450. The first instalment, amounting to one-third of this sum, has already been paid, and the rest will be paid in two equal instalments on December 15 of this year and on December 15, 1906. The railroad is to repay this loan, without interest, in instalments within ten years, beginning December 15, 1906.

Illinois Central.—See Tennessee Central.

Lake Shore & Michigan Southern.—This company has arranged with the Buffalo, Rochester & Pittsburg for trackage rights over the B., R. & P. from Falls Creek, Pa., to Clearfield, 32 miles. This makes unnecessary the construction of this length of road on the Lake Shore's new Franklin and Clearfield road, which is being built to connect with the Beech Creek division of the New York Central.

Lehigh Valley.—This company has sold to Drexel & Company $7,000,000 collateral trust 4 per cent. bonds, which is part of an authorized issue said to be $19,000,000. These bonds are to be secured by pledge of the stock of Coxe Bros. & Company and of the Delaware, Susquehanna & Schuylkill. (Oct. 20, page 128.)

Mobile, Jackson & Kansas City.—This company has sold $4,000,000 of its first consolidated mortgage 5 per cent. bonds of 1953, which is the total amount outstanding, and $4,000,000 first mortgage 5 per cent. bonds of the Gulf & Chicago, the principal and interest of which are guaranteed by the M., J. & K. C., which controls and leases the road.

Nevada & California.—This company has taken over the 300 miles of road owned and operated by the Carson & Colorado. The Southern Pacific Company, of which the Nevada & California is a subsidiary, owns all of the $4,380,000 capital stock of the Carson & Colorado and also the $2,000,000 4 per cent. bonds outstanding.

Norfolk & Western.—On October 25, the directors declared a semi-annual dividend of 2 per cent. on the $66,000,000 common stock, thus putting it on a 4 per cent. basis. Since 1903 this stock has received 3 per cent. The first dividend was in 1901, when 2 per cent. was paid, and this was increased to 2½ per cent. in 1902. An issue of $2,000,000 car trust certificates was authorized at this week's meeting, also.

Pacific Coast.—This company has sold to Blodget, Merritt & Company $554,000 first mortgage 5 per cent. bonds of 1946, which is the entire amount authorized.

Pennsylvania.—The Philadelphia stock exchange has listed $100,000,000 3½ per cent. 10-year convertible bonds. (Oct. 6, page 112.)

Pullman Company.—At the annual meeting on October 19, the following directors were elected: Marshall Field, O. S. A. Sprague, Henry C. Hulbert, Robert T. Lincoln, Norman B. Ream, William K. Vanderbilt, J. Pierpont Morgan, Frederick W. Vanderbilt, W. Seward Webb and Frank O. Lowden.

The total revenue for the year was $26,922,023. The total expenses of operation were $13,884,983; depreciation on cars and reserve for depreciation on all the property of the company, $2,331,476; dividends declared, $5,919,982; proportion of net earnings of cars paid to associated interests, $651,010; leaving a net surplus of $4,134,572. The net assets of the company are $96,151,946, of which $74,000,000 is represented by capital stock and $22,151,946 is surplus, the latter $4,134,571 more than a year ago.

The number of passengers carried during the year was 14,969,219, and the number of miles run by cars was 444,986,296; passengers the previous year, 13,312,668; car miles, 408,234,382; showing an increase of over 12 per cent. in the number of passengers carried, and over 9 per cent. in the number of miles run. There were 184,147 miles of railroads covered by contracts for the operation of Pullman cars.

The value of the manufactured product of the car works of the company for the year was $16,512,387, and rentals amounted to $289,108, a total of $16,801,495, against $23,142,760 for the previous year. The average number of names on the pay rolls at Pullman for the year was 5,681, and wages paid $3,667,936, making an average annual wage of $645.65 for each person employed. In all departments the total number of persons in the employ of the company was 18,901, and wages paid during the year were $11,186,200. The number of employees for the previous year was 20,355, and the wages paid, $12,570,914.

Southern.—See Tennessee Central.

Tennessee Central.—The Standard Trust Company of New York, acting for the Southern and the Illinois Central, has taken a three-year option on a controlling interest in the stocks and bonds of the Tennessee Central and the Nashville Terminal.

United Railways of Havana.—This company has acquired the Cardenas & Jucaro, which is 211 miles long, at a premium of 25 per cent. on each share, payable half in bonds and half in stock of the United Railways at par value.

Western Pacific.—A meeting of the stockholders has been called for November 9 to authorize an issue of $25,000,000 second mortgage bonds. Fifty millions of first mortgage bonds have been already issued and it is not expected that this new amount will be issued for some time, and perhaps not at all.

GENERAL NEWS SECTION

NOTES.

Eight suits have been filed against the Pere Marquette at Cleveland for failure to comply with the safety appliance law.

The Grand Trunk Pacific offers a prize of $250 for the best name for its Pacific Coast terminal. It is understood that an Indian name will be preferred.

It is announced in the west that grain rates, both to the Atlantic seaboard and to the Gulf of Mexico, are to be advanced January 1 about 2 cents per 100 lbs.

According to western newspapers, the Lake Shore & Michigan Southern has paid about $50,000 for losses of baggage in the wreck at Mentor. To one woman, bound for Europe, who had nine trunks, the sum of $7,000 was paid.

On the Gulf, Colorado & Santa Fe a man connected with the company's floral department is putting palms and other plants in the city ticket offices at Galveston, Houston, Dallas, Fort Worth and other places. The Topeka *State Journal*, publishing this item, asks, Why not try the plan at all offices?

Following the Interstate Commerce Commission's investigation at Louisville, last July, indictments have been returned by the grand jury of the District Court for the Western District of Kentucky against Sebastian Zorn and Thomas G. Williams, members of the firm of Zorn & Company, grain dealers, and against Jesse A. Bushfield, an employee of said firm, for obtaining, by a fraudulent device, rebates on grain from Louisville to points in the southeast. The Louisville & Nashville, the Southern and the Illinois Central publish tariffs whereby the rates for grain from Louisville to the southeast are made to depend upon the origin of the traffic. Evidence of origin is contained in the expense bills, that is, receipts given by the carriers for transportation charges paid from the originating points to Louisville. These are presented by shippers to the Southeastern Mississippi Valley Association, which acts as joint agent of carriers operating in territory south of the Ohio river. If the association ascertains upon inspection that the expense bills are genuine it makes certificates to that effect and specifies the reductions in rates to which the holders of the expense bills are entitled. Armed with these certificates the shippers then go to the offices of the lines which run from Louisville to the southeast and obtain the reductions referred to. Apparently Zorn & Co. became short of genuine expense bills in the months of August and September, 1904. At any rate, for the purpose of procuring 3 cents per 100 lbs. reduction in rates from Louisville to the southeast during those two months, it used more than 100 expense bills which were duplicates and triplicates of expense bills formerly used for the same purpose. Whether or not the carriers, by publishing rates and regulations as aforesaid, are violating the provisions of the act to regulate commerce is a question now before the Commission for determination.

Disastrous Wreck Near Kansas City.

A westbound express train of the Atchinson, Topeka & Santa Fe was derailed in a cut a few miles east of Kansas City, Mo., on Monday last, and two express cars and three passenger cars ran against the rocky sides of the cut and were badly wrecked. Ten passengers and three employees were killed and about 30 persons were injured. The train was running about 35 miles an hour, and it is said that the derailment was due to a loose rail. The car next to the engine was forced against the wall almost immediately after leaving the track, and this made such an impassable barrier as to completely wreck the cars next following. Five sleeping cars and the dining car at the rear of the train were not derailed. The engine and tender appear to have passed nearly or quite over the loose rail, before they were dislodged, and the engineman and fireman, with their emergency equipment, got the engine back on to the track in 20 minutes. It was then run to the next station for help.

The Revolution in Russia.

The strike of railroad employees in Russia, briefly noted last week, proved to be but the beginning of what now seems to be a revolution; an almost bloodless revolution of the Empire. The strike of railroad men, which spread to the important railroads throughout the most thickly settled regions of the Empire, was followed by strikes in many large manufactories, and disorder became general and widespread, furious rioting being reported in the large cities. But on Monday the Czar issued a proclamation granting substantial liberties to all of the people, and the violence and agitation subsided. The reports are not at this writing full and clear, but there seems little doubt that the discontent of the people has been appeased, and that peace will soon reign. Many strikers returned to work. The Czar grants freedom of conscience, of speech and of association; practically universal suffrage and a constitutional government, including the right of habeas corpus.

Mr. Bacon's Convention.

The "Interstate Commerce Law Convention," held at Chicago last week, produced a sharp division between interests which desire radical rate regulation by Congress and those which are more moderate, or which believe that there should be little modification of present laws. Mr. E. P. Bacon, who appears to have controlled the original convention, saw to it that no one should be admitted to that body who did not unequivocally indorse the demand made by President Roosevelt last winter for the granting of specific rate-making powers to the Interstate Commerce Commission; and, accordingly, his convention was nothing more than a ratification meeting. But a large body of shippers who did not approve of this arbitrary action demanded admission to the convention with the right of free discussion; and, this being refused, they held another convention in another hall. Mr. D. M. Parry, President of the National Association of Manufacturers, was the principal figure in the "rump" convention, and in an address called for fair treatment to all interests, including the railroads, declaring that the power to make rates should continue where it is, thereby subserving the best interests of the country. "The right of communities to enjoy the advantages of population, wealth and geographical location will then be respected, the less developed sections will not be at the mercy of the more powerful sections, and rates will, on the whole, gradually decline, while the services rendered by the carriers will develop in efficiency."

A Chicago newspaper got up a story to the effect that an agent of the Bureau of Corporations, from Washington, had come to Chicago to find out whether delegates to the convention were unduly controlled by the railroad companies, the implication being that the railroads had used unfair means to influence the casting of votes by the members, or to pack the convention with men favorable to the railroad interests; but this story was soon demolished by a statement from the Washington office.

Some Eastern men who have investigated the matter allege that the Bacon Convention did not consist of shippers but of "unemployed politicians."

The charge is also being made that lists purporting to contain the names of organizations represented by Mr. Bacon and filed by him before Congressional committees were made up in large measure of organizations which had not authorized the use of their names. The anti-Bacon convention is said to have contained about 460 persons, as against some 200 in the Bacon gathering.

Seventy-Four Hours, Oakland to Jersey City.

On Monday, Tuesday and Wednesday of last week a special train carrying a party just arrived from Japan, including Mr. E. H. Harriman, Miss Alice Roosevelt, daughter of the President, and other persons returning from the Oriental excursion of the Secretary of War, was run from Oakland, Cal., to Chicago, in 50 hrs. 44 min., equal to 44.9 miles an hour. The route was over the Southern Pacific, the Union Pacific and the Chicago & North-Western. The train arrived in Chicago at 8:05 p. m. on October 25, and was at once taken, by way of the Belt Line, to the Lake Shore & Michigan Southern at Forty-third street, whence it started east at 9:07 p. m. The train made the run from Oakland to Omaha in 39 hrs. 54 min., including stops. The distance traversed was 1,787 miles, which makes the average speed 44.8 miles an hour. The run from Omaha to Chicago, 492½ miles, was made in 10 hrs. 50 min., equal to 45.5 miles per hour. The train arrived in Jersey City by the Erie road at 7:45 on Thursday, the 26th, 21 hrs. 38 min. from Chicago, and 74 hrs. 24 min. from San Francisco. These times are taken from different reports, which do not exactly agree, but which evidently are nearly correct.

United States Steel.

The net earnings of the United States Steel Corporation for the three months ended September 30 were $31,240,582. This sum is an increase of $12,466,650, as compared with the figures for the same period last year, but it is $1,182,373 less than the figures in 1903. The net earnings for the quarter ended June 30, 1905, were $30,305,116, and for the previous quarter, $23,025,896. The unfilled orders on hand on September 30 amounted to 5,865,377 tons, which is 267,817 tons greater than the unfilled orders on hand, March 31, the previous high record. From the total net earnings of the quarter ended September 30, appropriations aggregating $7,326,088 were deducted for sinking funds on bonds of subsidiary companies, depreciation, reserve and improvement funds. Further deductions were: $5,-

745,696 interest on bonds, $1,191,266 for U. S. S. sinking fund and $6,304,919 for the regular quarterly dividend of 1¾ per cent. on the preferred stock. An appropriation of $4,000,000 for already authorized expenditures made and to be made for acquiring additional property, for construction and the discharge of capital obligations, and $2,500,000 for contemplated appropriations and expenditures were also deducted, leaving a net surplus for the quarter of $4,172,613.

Atlantic Coast Line Fruit Traffic.

Press despatches say that the Atlantic Coast Line has renewed for another year the contract with the Armour Car Line by which 1,800 refrigerator cars are to be available for the Carolina fruit traffic next year. It is said that no other company was able to furnish more than one-fourth the number of cars required by the railroad company. In his statement before the Interstate Commerce Commission last month Mr. Emerson, Traffic Manager of the Atlantic Coast Line, said that of the fruit carried over his line this year 60,030 crates went by express, 43,882 crates in ventilated freight cars and 458,727 in refrigerator cars. Mr. Emerson said that the first shipments of fruits to the north by rail from the Carolinas were made about 1877. The refrigerators were large boxes on wheels which could be quickly transferred to steamers at Portsmouth, Va. About 1879 or 1880 certain Charleston shippers secured six or eight freight cars from the Seaboard Air Line and fitted them with ice boxes at their own expense. The Present extensive strawberry business was begun about 1890 on the line between Goldsboro, N. C., and Wilmington. The California Fruit Transportation Company furnished the first refrigerator cars; and up to 1894 the charge for refrigeration was 64 cents a crate. In 1898 this was reduced to 33 cents (to New York). In 1899 the East Carolina Truck & Fruit Growers' Association became dissatisfied with the refrigerator service and asked for bids from other car lines. The Armour lines made the lowest, and at the fruit growers' request the railroad made a contract with Armour. Under this contract the price of refrigeration was reduced to 21½ cents. The railroad company at all times offers rates for perishable freight in ventilated cars which are owned by the road.

Locomotive Tests at Purdue University.

The experimental locomotive of Purdue University, Schenectady No. 2, which has recently served in an important study designed to determine the value of very high steam pressures, is to be sent to the Schenectady works of the American Locomotive Company early in November to be fitted with a Cole superheater. It is expected that the locomotive will be returned with its new equipment early in January. During the absence of Schenectady No. 2 from the testing plant, a New York Central Atlantic (4-4-2) type locomotive is to be installed upon the plant for use under the direction of the Master Mechanics' Committee on Front-Ends. It is the purpose of this committee to repeat upon an engine of large size the experiments made under the patronage of the *American Engineer and Railroad Journal* on Schenectady No. 2, for the purpose of determining the constants in such equations as may be necessary to the logical design of all portions of the front-end mechanism. The Master Mechanics' Committee having the matter in charge consists of Mr. H. H. Vaughan, Superintendent of Motive Power, Canadian Pacific Railway, Chairman; Mr. F. H. Clark, General Superintendent of Motive Power, C. B. & Q. R. R.; Mr. Robert Quayle, Superintendent of Motive Power and Machinery, C. & N.-W. Railway; Mr. A. W. Gibbs, General Superintendent of Motive Power, Pennsylvania Railroad; Prof. W. F. M. Goss, Purdue University; Mr. G. M. Basford, American Locomotive Company.

Cars for the Philadelphia & Western.

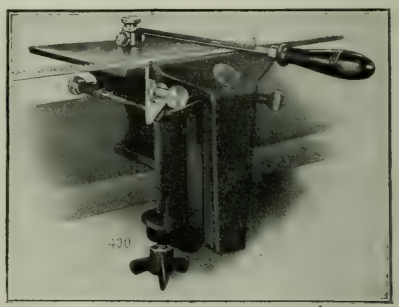
The Philadelphia & Western, which is a third-rail electric line, is having some fine cars built by the St. Louis Car Company, St. Louis, Mo. They are to be 40 ft. long over the body, 49 ft. 10 in. over the vestibules, and 51 ft. 4 in. over all. The height from top of rail to top of roof will be 13 ft. 4 in. The underframe consists of 5 in. x 8 in. yellow pine side sills, with 6 in. channels and fillers, 4½ in. x 6 in. yellow pine intermediate sills, and center sills of 6 in. I-beams with fillers. The intermediate and center sills extend the full length of the car from bumper to bumper, the platform being the straight type. There are upper and lower truss rods and 5 in. I-beam needle beams. The bolsters are formed of 10 in. plates, the end sills are 6 in. x 8 in. oak, and the flooring is double. There will be six double windows and one single window on each side, with upper and lower sash of plate glass. The lower sash will be equipped with balancers for raising and lowering, and the upper sash will be stationary. The latter will be ornamented with a neat fine line of gold. The half-elliptic ventilators will be of ornamental glass and will open on ratchets.

The interior finish will be mahogany with marquetry inlay lines. The ceiling will be semi-empire. There will be 12 reversible seats on each side and four corner seats. Continuous basket racks will be placed on each side. The end doors are double-sliding, and the vestibule doors single-sliding on each side, with trap-doors over steps. The steps will have sheet-iron sides and wooden treads, and the lower step will fold to clear the third rail. In each vestibule will be a double-acting swinging door, which will form the motorman's cab, and which can be folded back to enclose the controller, brakes, switch box, etc., and clear the vestibule for passengers and steps. The vestibule ends will have a single drop sash on each side and there will be a drop sash in the center of the door.

The bodies will be mounted on St. Louis Car Co.'s 60-I standard-gage trucks, having a 6 ft. 8 in. wheel base, and equipped for third-rail operation. They have a composite steel and wrought iron frame, 34 in. wheels and 4¼ in. x 8 in. journals. The cars will have the car company's arc headlight, sand boxes and vertical wheel brakes, will be equipped with Tomlinson couplers, and will have a pilot on each end.

A New Device for Filing Hand Saws by Hand.

The accompanying illustration shows a new device made by the New Britain Machine Company, New Britain, Conn., for the hand filing of band saws. It consists of a specially designed automatically-closing vise and of a roller guide which is attached to the end of the file. It is claimed by many that a band saw properly hand-filed cuts better than a machine-filed saw. Hand filing is an art that can only be acquired by constant practice and long experience. The greatest difficulty in hand filing is to give to all the teeth the same shape and to hold the file in a vertical position. The New Britain band saw filer obviates the above difficulty inasmuch as the file is guided mechanically in the horizontal direction and is also prevented from turning by means of the roller guide which is attached to the end of the file. The file, by means of this guide, can be set to any angle, and thus the contour of the saw teeth can be maintained uniform throughout the saw. The vise is fitted with a spring which regulates the pressure of its jaws on the saw. When filing, the tension of the jaws on the saw is ample to hold it firmly and to prevent it from chattering, and yet it allows the saw to feed along by a slight pressure of the file from left to right, as a pressure in this direction tends to release the jaws enough to allow



The New Britain Band-Saw Filer.

the saw to slip, and when the pressure is removed the saw is firmly held, as above noted. This free feeding feature is regulated by a stop pin at the right of the fixed jaw which prevents the overrunning of the file when sharpening or feeding. By moving the lever shown at the right of the vise the saw can be easily released when desired.

Record Discipline on the New Haven.

The New York, New Haven & Hartford has posted notices of the results of the Brown system for the month of September. The amount of money saved to the men as compared with suspensions was about $7,000. The saving by classes of employees, with other statistics, is as follows:

Engineers, four discharged, 48 suspended, 455 demerits, no merits, amount saved, $1,706; firemen, two discharged, none suspended, 1,265 demerits, 10 merits, amount saved $236; conductors, four discharged, none suspended, 485 demerits, 10 merits, amount saved $1,523; trainmen, 21 discharged, 1 suspension, 696 demerits, no merits, amount saved $1,460; yardmen, nine discharged, none suspended, 669 demerits, no merits, amount saved $1,553; operators, 10 discharged, none suspended, 310 demerits, no merits, amount saved $514.

Opportunities Abroad.

Consul-General Guenther, at Frankfort, reports the following foreign trade opportunities, prepared from German sources:

Austria and Bohemia.—The Imperial Railway Department at Vienna is asking bids for the construction of two bridges near St. Poelten; $3,000,000 is to be spent for improving the Elbe River and $3,125,000 to make the river Moldau navigable up to the city of Prague. Germany.—The city of Bremen has granted $323,000 for improving its harbor works and railroads. The city of Hamburg has granted over $1,424,000 to the Vulcan Shipbuilding Company, of Stettin, which is about to establish extensive works at Hamburg.

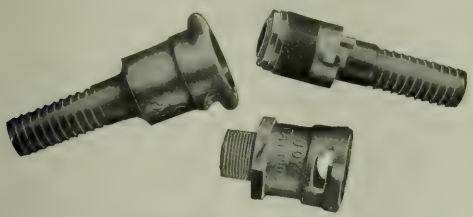
Peru.—A 10,000-ton dock crane is to be built at Callao; the Peruvian Government will pay 6 per cent. annual interest on the capital invested in this enterprise. The Peruvian Corporation, a financial company with headquarters in London, projects the construction of a railroad 75 miles long from Oroya to Huancaye; also a line from Cuzco to Sicuani, 90 miles long, and other railroads to important mining districts in Peru. Various tramway lines are also to be changed from horse to electric traction, and a new electric tramway line is projected to run between Chorillos and Lima. Russia.—The ministry of public communications is planning extensive river improvements to promote navigation on the west Siberian waterways, which are to act as feeders to existing and projected railroads. The cost of this work will be about $10,000,000.

Russia's Railroad to Persia.

Russia has extended its branch of the Trans-caucasian Railroad (from the Black Sea to the Caspian at Baku) down the river Araxes to the Persian border at Nakhitshevan. This branch was opened from Tiflis southwest over the mountains to Alexandropol in 1899; further in the same direction to Kars, near the Turkish border, and thence southeast, at right angles with the Tiflis-Kars section, to Erivan, due north of Mt. Ararat, in 1902; and only recently to the present terminus, which is some 175 miles west of the Caspian, and 100 miles northwest of the Persian city Tabriz, but separated from it by a range of mountains. The Russian newspapers hope for an increased trade with Persia by reason of this extension, but the country is not easily penetrable for lack of roads; and it is the country of the Kurds, who have been demonstrating their character recently at Baku. The railroad, however, should make Russia irresistible on the adjacent borders of Turkey and Persia. The present terminus is about 2,800 miles by rail from St. Petersburg and 2,400 from Moscow.

The Joy Automatic Hose Coupler.

The Joy automatic hose coupler is illustrated herewith. It is made in two parts, without springs, and is said to be thoroughly tight. The union is formed by a cam on the male end which carries



The Joy Automatic Hose Coupler.

offset lugs. This end is inserted and given a quarter turn, which drives the lugs home. The cam compresses the washer longitudinally, causing lateral expansion which insures the tightness of the joint, the tightness increasing with the pressure. The washer is held in place on the male end by a hexagonal nut and therefore cannot be lost. When worn out it is quickly replaced by removing the nut. Long life and ability to withstand hard service are special claims made for this coupler. Other claims are that it saves time by the ease and quickness with which it can be coupled and uncoupled; that it can be handled almost as readily in the dark as in the light; and that it works with precision at highest pressure. It is made either for hose connections on each end or for hose connection on one end and pipe connection on the other. It is made and sold by the National Pipe & Hose Coupler Co., Detroit, Mich.

Paris Subway.

The Journal of the German Railroad Union for August 5 contains some interesting figures and information regarding the Metropolitan Underground Railway of Paris. It was begun in 1900, during which year only three miles were in operation. Last year it worked 15½ miles. At the outset, both the engineering and financial difficulties in Paris seemed insuperable. The corporation was obliged by its charter to equip its first line out of the proceeds of its sale of stock, and was allowed to issue bonds only when an income fixed by law was reached. In this way 15 millions of dollars obtained from the sale of stock were first invested before bonds were issued. Both the engineering and financial difficulties have been overcome in a brilliant way. In 1900 the net income amounted to $270,000, and in 1904 to $1,050,000. In 1903 a shocking accident in the tunnel, by which 80 people were killed, lowered the amount of travel on the subway and reduced the income. Since then, however, it has regained its former popularity. The gross income has increased from $540,000 in 1900, to $2,150,000 in 1902, and to $4,090,000 in 1904. The amount of taxes payable to the city of Paris is considerable compared with our American standards. Every first class ticket is taxed two cents, and every second class ticket one cent. The result in 1904 shows a payment of taxes to the city of Paris amounting to over $1,300,000. The railroad is now about to issue bonds, the proceeds of which are to go to extending the lines. The concession extends to 1925. The tunnels and roadbed were built at the expense of the city; the power equipment, stations and cars at the expense of the corporation.

Manufacturing and Business.

The Goodwin Car Co., New York City, has moved its office from 96 Fifth avenue to the Whitehall Building, 17 Battery Place.

Mr. J. H. Regan, formerly Chief Clerk to the Second Vice-President of the Pressed Steel Car Company, has been elected Assistant Secretary of the company.

Frank B. Gilbreth, of New York, has taken a contract to dig for the Union Sulphur Company a barge canal from Sulphur, La., to the Gulf of Mexico, a distance of 16 miles.

The Harvey friction draft spring, which is controlled by The Frost Railway Supply Company, Detroit, Mich., has been specified on 60 passenger coaches which are now being made for the Chicago, Milwaukee & St. Paul. This spring is now used on 45 different railroads in the United States, Canada, Mexico and Cuba.

The Helwig Mfg. Co., St. Paul, Minn., has recently added another size to its line of pneumatic staybolt clippers. The new size cuts staybolts up to 1½ in. in diameter, and is similar in design to the smaller clippers which are fitted with small inserted knives which when worn out are readily replaced with but little cost.

The report of the Chicago Pneumatic Tool Co. for the three months ending Sept. 30, 1905, shows net earnings of $241,791.45. The fixed charges and quarterly dividend of $61,137.83 reduced this amount $134,876.12, leaving $106,915.33 to be applied to the surplus fund for the quarter. The company now has a surplus of $483,813.50, an increase of $229,782.78 for the first nine months of the current year. Business conditions seem to indicate a continuance of the prosperity which has produced this excellent showing.

The North Carolina Granite Corporation, Mt. Airy, N. C., is installing a Sullivan Corliss, two-stage air compressor for driving the Sullivan drills and other compressed air appliances, used at its quarries. This compressor has a capacity of 2,000 cu. ft. of free air per minute, at 78 revolutions, and is a good example of modern practice in air compression, as regards fuel economy and air efficiency. The air cylinders are connected to a Sullivan Corliss, cross-compound, condensing steam engine, especially designed and proportioned for this purpose. The air inlet valves are of the Corliss type, operated by independent eccentrics, and the discharge valves on both cylinders are of the automatic poppet type, moving in a direction parallel with the piston rod, with removable seats located in the cylinder heads. The devices for cooling the air during compression are unusually efficient. A similar machine is installed at the works of the Southern States Portland Cement Co., Rockmart, Ga., and has given very efficient service during the two years that it has been in operation.

Iron and Steel.

The steel rail mills of Canada—the Dominion Iron & Steel Co. and the works at Sault Ste. Marie—are now able to make 400,000 tons of rails yearly, which is believed to be far beyond any possible Canadian demand during the present year. The discussion concerning changes in the import tariff and in the bounties has not as yet produced any result, and it is believed that there will be no change as long as the present administration is in power. Bounties will be paid by the government only about a year longer. Since 1898 the bounties paid have amounted to $5,204,000. For the extreme western part of the Grand Trunk Pacific rails may be brought from England or from the United States, by reason of the high cost of transportation from Eastern Canada. English makers, being favored by the preference duty, have to pay duty of only $5.23 a ton; rails from the United States pay $7.

The Rail Joint Company.

Under this name the Continuous Rail Joint Company of America, the Weber Railway Joint Manufacturing Company and the Independent Railway Supply Company have been consolidated with a capital stock of $1,500,000, of which two-thirds is common stock and one-third preferred. The President of the new company is Frederick T. Fearey; Vice-Presidents, Lawrence F. Braine and Percy Holbrook; Treasurer, Fernando C. Runyon; and Secretary, Benjamin Wolhaupter. Messrs. Fearey, Braine and Runyon were officers in the Continuous Rail Joint Company, Mr. Holbrook was General Manager of the Weber Company, and Mr. Wolhaupter was Manager of the Independent Railway Supply Company. The new company expects to materially reduce the cost of manufacture and distribution, and it is proposed to consolidate plants to some extent.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Railway Association.

The chief results of the meeting of this association at Chicago, October 25, were embraced in the two subjects which were reported in the *Railroad Gazette* last week; the approval of an increased rate per day for interchanged freight cars, and the action looking to the adoption of elaborate and greatly improved rules for the transportation of explosives. The rest of the proceedings, as reported by the Secretary of the Association, are in substance as follows: President Stuyvesant Fish was in the chair and the attendance was 175. The Committee on Train Rules reported progress in revision of the Standard Code of Train Rules. The Committee on Car Service besides the 25-cent interchange rate, recommended changes in Rule 6 of the Car Service Rules, and Rules 1 and 3 of the Per Diem Rules; also a standard form of contract to be entered into between all companies which may desire to use each others' tracks in case of an obstruction or washout. The committee also recommended that on all roads whose aggregate mileage is 2,000 miles or more, the penalty rate shall commence after a car is held forty days instead of thirty. Theodore Voorhees (P. & R.) was re-elected First Vice-President. The Illinois Central was elected member of the Committee on Safety Appliances in place of the New York, New Haven & Hartford. The next meeting will be held in Chicago, April 25, 1906.

PERSONAL.

—Mr. E. O. Alston, who recently resigned as General Freight and Passenger Agent of the Georgia, Florida & Alabama, did so on account of a sudden break down in his health. He is at present at the Agnes Memorial Sanatorium, Montclair station, Denver, Colo., where he expects to remain for several months.

W. J. Black.

—Mr. William J. Black, who was recently appointed Passenger Traffic Manager of the Atchison, Topeka & Santa Fe, was born in St. Louis in 1864. His first railroad service was on the Vandalia as office boy in 1879. In 1884, he went to the Missouri Pacific as rate clerk in the Passenger Department, and two years later took the same position with the Atchison, Topeka & Santa Fe. He was made chief clerk of the Passenger Department in 1887 and Assistant General Passenger Agent in 1892. In 1897 he was appointed General Passenger Agent, where he remained until his recent appointment.

—Mr. W. L. Blair, Superintendent of the Eastern division of the New York, Chicago & St. Louis, entered railroad service as telegraph operator on the Cincinnati, Hamilton & Dayton in 1872, being then 14 years old. After six years' service in the telegraph department he entered the General Superintendent's office as clerk. He was appointed chief clerk in 1880, and the next year went to the New York, Chicago & St. Louis with the same title. He remained there until 1893, when he was appointed Superintendent of the Eastern division. In 1901 he was made Superintendent of Telegraph, which position he held until reappointed Superintendent of the Eastern division on October 20 of this year.

ELECTIONS AND APPOINTMENTS.

Buffalo & Susquehanna.—The office of C. P. Clark, General Manager, has been moved from Buffalo, N. Y., to Galeton, Pa. To provide for increased business and additional mileage a reorganization of this company's service has been made, as follows: The office of General Superintendent has been abolished, and the road at present operated and that under construction will be divided into two divisions. The Susquehanna division will include the main line from south yard limit at Wharton to Sykes, with prospective extension to Sagamore, when ready for operation. The Buffalo division will include the main line from Addison to Wharton, the Wellsville, Ansonia, Cross Fork and Keating Summit branches, also extensions beyond Wellsville.

W. C. Park has been appointed Superintendent of the Susquehanna division, with offices at DuBois, Pa. S. P. Henderson, Chief Despatcher, has been appointed Superintendent of the Buffalo division, with office at Galeton, Pa. The Engineer of Maintenance of Way will report directly to the General Manager on matters pertaining to maintenance and to the Chief Engineer in connection with construction. The General Master Mechanic will report directly to the General Manager. George A. Clark has been appointed Superintendent of Car Service, with office at Galeton, Pa., relieving J. W. Trounce, whose entire time is required in the capacity of General Sales Agent of the Goodyear Lumber Company and the Buffalo & Susquehanna Coal Mining Company.

Delaware & Hudson.—T. O. Cole, Superintendent of Car Service, has resigned, and is succeeded by Arthur Kemper.

Denver & Rio Grande.—J. G. Gwyn has been appointed to the new office of Assistant Chief Engineer.

C. H. Gregg, Superintendent of Dining Cars, has resigned. T. A. Dempsey succeeds Mr. Gregg, with headquarters at Denver, Colo.

Kansas City Southern.—F. W. Rawlins, Superintendent of Car Service of the Cincinnati, Hamilton & Dayton, has been appointed Superintendent of Transportation of the Kansas City Southern, with office at Kansas City.

Lake Shore & Michigan Southern.—D. C. Moon, Assistant General Superintendent, has been appointed General Superintendent, with office at Cleveland, Ohio, succeeding H. S. Storrs, deceased.

Litchfield & Madison.—E. A. Williams, General Passenger and Ticket Agent, has resigned, and the office has been abolished.

Mexican Central.—W. J. Wilcox, Master Mechanic at Chihuahua, has resigned. C. H. Burk, Master Mechanic at Mexico City, succeeds Mr. Wilcox. L. Strom succeeds Mr. Burk.

New York Central & Hudson River.—J. D. Remington has been appointed Special Agent of the Freight Department, with office at New York. He will report direct to the Freight Traffic Manager.

New York, Westchester & Boston.—Lewis P. Stillwell has been appointed Consulting Electrical Engineer. H. S. Putnam has been appointed Electrical Engineer.

Pecos System (A., T. & S. F.).—D. L. Myers, Chief Clerk to the Traffic Manager of the A., T. & S. F., has been appointed Traffic Manager of the Pecos System, with office at Amarillo, Tex., succeeding A. L. Conrad, promoted.

Philadelphia & Reading.—J. R. C. Wrenshall, Supervisor of the New York division, has been appointed Engineer of the Harrisburg division, with office at Harrisburg, Pa.

Silverton.—Arthur Ridgway, General Superintendent of this road and of the Silverton Northern, has resigned. E. H. Hudson succeeds Mr. Ridgway, with office at Silverton, Colo.

Terminal Railroad Association of St. Louis.—I. L. Burlingame, Superintendent, has been appointed to the new office of General Superintendent. J. J. Coakley, Assistant Superintendent and Station Master, succeeds Mr. Burlingame, and the position of Assistant Superintendent has been abolished.

Toledo, St. Louis & Western.—C. E. Spencer, Secretary and Treasurer, has resigned. J. S. MacKie, formerly Second Vice-President of the National of Mexico, succeeds Mr. Spencer, with office at New York.

Union Pacific.—L. B. Merriam has been appointed Resident Engineer at Cheyenne, Wyo., in charge of the double tracking of the Wyoming division between Cheyenne and Green River.

Vandalia.—J. C. Millspaugh has been appointed Assistant to the General Passenger Agent.

Wabash.—C. N. Travous has been appointed General Solicitor.

G. G. Yeomans, Assistant to the First Vice-President, has been appointed Assistant to the President, with office at Chicago.

Western Maryland.—J. T. Hendricks, General Agent of the Union Pacific in Philadelphia, has been appointed Assistant General Freight Agent of the Western Maryland and the West Virginia Central & Pittsburg.

Western Passenger Association.—Andrew Stevenson, Chief Rate Clerk, Chicago, has resigned. O. W. Palmer, Assistant Rate Clerk, succeeds him, and Y. B. Jones, of the Southeastern Passenger Association, Atlanta, Ga., succeeds Mr. Palmer.

West Virginia Central & Pittsburg.—See Western Maryland.

Wheeling & Lake Erie.—C. O. Dambach, Chief Clerk to the General Superintendent, has been appointed to the new office of Superintendent of Telegraph of this road and of the Wabash-Pittsburg Terminal and the West Side Belt.

Yazoo & Mississippi Valley.—M. Gilleas, Third Vice-President and General Superintendent, has resigned as General Superintendent. W. S. King, Assistant General Superintendent, has been appointed General Superintendent, with office at Memphis, Tenn., succeeding Mr. Gilleas.

LOCOMOTIVE BUILDING.

The Southern Pacific, it is reported, has ordered 140 locomotives.

The Lehigh Valley, it is reported, is in the market for locomotives.

The Norfolk & Western, it is reported, will shortly be in the market for 50 locomotives.

The New York, New Haven & Hartford, it is reported, has ordered 120 Atlantic type locomotives.

The Kansas City, Mexico & Orient has ordered 20 locomotives from the American Locomotive Co. for 1906 delivery.

The Oliver Mining Company has ordered 35 locomotives from the Baldwin Works and 20 locomotives from the American Locomotive Co.

The Indiana Harbor has ordered 20 simple consolidation (2-8-0) locomotives from the American Locomotive Co., instead of 10 mogul locomotives as reported in our issue of October 13. These locomotives will weigh 220,200 lbs., with 200,000 lbs. on the drivers; cylinders, 23 in. x 22 in.; diameter of drivers, 63 in.; radial stay boiler, with a working steam pressure of 200 lbs.; heating surface, 3,937 sq. ft.; 458 iron tubes, 2 in. in diameter and 15 ft. 6 in. long; carbon steel open-hearth wide firebox, $105^{1}/_{16}$ in. x 75¼ in.; grate area, 54.89 sq. ft.; tank capacity, 7,500 gallons of water, and coal capacity, 12 tons. The special equipment includes: Carnegie steel axles, Samson bell ringers, National-Hollow brake-beams, Lappin brake-shoes, Gould couplers, Rochester headlights, Nathan injectors and sight-feed lubricators, New York Central specification journal bearings and driving wheel tires, U. S. piston and valve rod packings, Consolidated Car Heating Co.'s safety valves, Leach sanding devices, Railway Steel Spring Co.'s springs, Crosby steam gages, National truck wheel tires and Paige tender wheel tires.

The Erie, as reported in our issue of September 29, has ordered 25 simple consolidation (2-8-0) locomotives and 25 simple Pacific (4-6-2) locomotives from the American Locomotive Co., for February and March, 1906, delivery. The consolidation locomotives will weigh 202,000 lbs., with 180,000 lbs. on the drivers; cylinders, 22 in. x 32 in.; diameter of drivers, 62 in.; radial stay extended wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,230 sq. ft.; 372 National Tube Co.'s tubes, 2 in. in diameter and 16 ft. long; Otis steel firebox, 104⅛ in. x 75 in.; grate area, 54.4 sq. ft.; tank capacity, 6,800 gallons of water, and coal capacity, 14 tons. The Pacific locomotives will weigh 225,000 lbs., with 147,800 lbs. on the drivers; cylinders, 22½ in. x 26 in.; diameter of drivers, 74 in.; extended wagon top radial stay boiler, with a working steam pressure of 200 lbs.; heating surface, 4,140 sq. ft.; 336 National Tube Co.'s tubes, 2¼ in. in diameter and 20 ft. long; Otis steel firebox, 108⅛ in. x 75¼ in.; grate area, 56.50 sq. ft.; tank capacity, 8,500 gallons of water, and coal capacity, 16 tons. The special equipment for both includes: Golmar bell ringers, Simplex brake-beams, Gould couplers, Hancock injectors, U. S. piston and valve rod packings, Consolidated Car Heating Co.'s safety valves, Leach sanding devices, Michigan sight-feed lubricators for Pacific locomotives, and Ashcroft steam gages.

The Lake Superior & Ishpeming, as reported in our issue of October 27, has ordered one simple Lima 12-wheel geared locomotive from the Lima Locomotive & Machine Co., for March, 1906, delivery, and one simple consolidation (2-8-0) locomotive from the American Locomotive Co., for April, 1906, delivery. The 12-wheel locomotive will weigh 250,000 lbs.; cylinders, 17 in. x 18 in.; diameter of drivers, 46 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; 310 steel tubes, 2 in. in diameter and 13 ft. 5 in. long; firebox, 114 in. x 62 in.; grate area, 49 sq. ft.; tank capacity, 4,000 gallons of water, and coal capacity, nine tons. The consolidation locomotive will weigh 205,000 lbs., with 182,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 57 in.; straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,689 sq. ft.; 425 charcoal tubes, 2 in. in diameter and 15 ft. 10 in. long; Otis steel firebox, 108 in. x 66 in.; grate area, 49.5 sq. ft.; tank capacity, 7,000 gallons of water, and coal capacity, 15 tons. The special equipment for both includes: Westinghouse air-brakes, Cooke & Strong bell ringer for 12-wheel locomotive, magnesia boiler lagging, Tower couplers, Star headlights, Seller's injector for consolidation locomotive, U. S. piston and valve rod packings for 12-wheel locomotive, Leach sanding devices for consolidation locomotive, Detroit sight-feed lubricators and Latrobe driving, truck and tender wheel tires.

CAR BUILDING.

The Duluth, Missabe & Northern has ordered 250 ore cars from the Standard Steel Car Co.

The Alabama Great Southern has ordered 250 flat cars from the American Car & Foundry Co.

The Boston & Maine, it is reported, will shortly be in the market for a large number of freight cars.

The New York, New Haven & Hartford, it is reported, is about to close contracts for five sleeping cars.

The Delaware & Hudson, it is reported, will build a number of composite hopper cars at its own shops.

The Northern Pacific, it is reported, has bids out for upwards of 150 refrigerator cars of 70,000 lbs. capacity.

The American Smelting & Refining Company has ordered six gondola cars from the Western Steel Car & Foundry Co.

The Chesapeake & Ohio, it is reported, has ordered one dining, two parlor and two passenger cars from the Pullman Co.

The Atchison, Topeka & Santa Fe has ordered 500 flat cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Barrett Manufacturing Company, it is reported, has ordered 25 tank cars of 10,000 gallons capacity from the Bettendorf Axle Co.

The Cleveland Electric, as reported in our issue of October 6, has ordered 50 convertible street cars from the G. C. Kuhlman Car Co.

The Merchants Coal Company, Baltimore, it is reported, is figuring on the purchase of upwards of 1,000 hopper coal cars of 100,000 lbs. capacity.

The New York Central & Hudson River has ordered 2,000 gondola cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Baltimore & Ohio, it is reported, has ordered 10 passenger cars from the Pullman Co. and is in the market for 10,000 additional freight cars.

The New York Central Lines, as reported in our issue of October 27, have ordered 8,000 cars from Haskell & Barker, 9,000 from the Pullman Co., and 3,000 from the Pressed Steel Car Co.

The Norfolk & Western, it is reported, has ordered 500 hopper cars of 100,000 lbs. capacity from the Middletown Car Works and 1,000 box cars from the American Car & Foundry Co., and will shortly be in the market for about 400 steel flat cars.

The Muncie & Portland Traction, of Portland, Ind., as reported in our issue of September 1, has ordered five cars from the Cincinnati Car Co., for December 15 delivery. These cars will be 50 ft. 7 in. long, 8 ft. 10⅜ in. wide, and 9 ft. 6 in. high, over all. The special equipment includes: Baldwin trucks and Standard Wheel Works rolled wheels.

The Minneapolis, St. Paul & Sault Ste. Marie, as reported in our issue of October 27, has ordered 50 refrigerator cars of 50,000 lbs. capacity from the American Car & Foundry Co. These cars will weigh 35,600 lbs., and will measure 29 ft. 2½ in. long x 8 ft. 3 in. wide x 6 ft. 10 in. high inside. The special equipment includes: Common Sense bolsters, Westinghouse air-brakes and McCord journal boxes.

The Minneapolis & St. Louis, as reported in our issue of October 27, has ordered 900 box cars and 200 stock cars of 60,000 lbs. capacity from the American Car & Foundry Co. for April and May, 1906, delivery. The special equipment includes: Simplex bolsters and brake-beams, Streeter brake-shoes, Harrington sectional brasses, Tower couplers, Security doors, Miner draft rigging, Hutchins sectional roofs, Railway Steel Spring Co.'s springs and arch-bar trucks.

The Lake Superior & Ishpeming, as reported in our issue of October 27, has ordered 100 steel ore cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for April, 1906, delivery. Seventy-five of these cars are for the Marquette & Southeastern. All cars will weigh 32,800 lbs., and measure 22 ft. long, 8 ft. 6 in. wide and 9 ft. 7 in. high, over all. The special equipment includes: Tower couplers, Westinghouse friction draft rigging and McCord journal boxes.

The Minneapolis, St. Paul & Sault Ste. Marie, as reported in our issue of October 20, has ordered 1,000 box cars from the American Car & Foundry Co. These cars will be of 60,000 lbs. capacity and will weigh 34,500 lbs. The inside measurements will be 34 ft. 4 in. long, 8 ft. 4 in. wide and 8 ft. high; both body and underframes will be of wood. The special equipment includes: Archer trucks, Common Sense bolsters, Westinghouse brakes, McCord journal boxes and Simplex brake-beams.

The Louisville & Nashville, as reported in our issue of October 27, has ordered 60 flat bottom gondola cars of 60,000 lbs. capacity from the American Car & Foundry Co. for December delivery. These cars will weigh about 25,000 lbs., and will measure 36 ft. long x 8 ft. 9 in. wide x 3 ft. 4¾ in. high inside. The special equipment

will include: Commonwealth bolsters and trucks, Sterlingworth brake-beams, Westinghouse air-brakes, More-Jones brasses, Janney couplers, Miner tandem draft rigging and American Car & Foundry Co.'s standard paint and wheels.

The Chesapeake & Ohio, as reported in our issues of October 20 and 27, has ordered 500 steel hopper bottom self-clearing gondola cars of 100,000 lbs. capacity from the Standard Steel Car Co. and 500 steel flat bottom gondola cars of 100,000 lbs. capacity from the American Car & Foundry Co. The self-clearing gondola cars will be 32 ft. 3 in. long, 10 ft. 1⅝ in. wide and 10 ft. high, over all. The flat bottom gondola cars will be 40 ft. long, 9 ft. 7 in. wide and 4 ft. 2 in. high, all inside measurements. The special equipment for both includes: Westinghouse air-brakes, Climax couplers, Miner tandem draft rigging and arch-bar trucks.

The Erie, as reported in our issues of September 22 and October 27, has ordered 2,200 steel self-clearing hopper gondola cars of 100,000 lbs. capacity from the Pressed Steel Car Co. and Standard Steel Car Co., for February, 1906, delivery. These cars will be 31 ft. 11 in. long, 10 ft. wide and 10 ft. high, over all. The special equipment includes: Simplex truck bolsters, Damascus brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Climax brasses, Climax, Major and Gould couplers; Dayton door fastenings, Security doors, Miner tandem draft rigging, Erie standard paint, Railway Steel Spring Co.'s springs, Erie standard Barber roller trucks and 700-lb. wheels.

The Evansville & Mt. Vernon Traction, as reported in our issue of October 13, has ordered three convertible steel channel bottom passenger cars and one 45-ft. baggage car from the St. Louis Car Co. The passenger cars will weigh 45,000 lbs., and measure 43 ft. 2 in. long, 9 ft. wide and 12 ft. 6 in. high, over all. The special equipment for the passenger cars will include: St. Louis Car Co.'s vertical wheel brakes and independent motor driven air-brakes, St. Louis Car Co.'s spiral journal bearing brasses, Burrow's curtain fixtures, Pantasote curtain material and St. Louis Car Co.'s reversible seats and trucks. Other specialties are: St. Louis Car Co.'s arc headlights and locomotive type pilot on each end.

The Chicago, Milwaukee & St. Paul, as reported in our issue of October 20, has ordered 15 passenger cars from Bainey & Smith. These cars will have a seating capacity for 68 persons and will weigh 92,000 lbs. The inside measurements will be 60 ft. long x 9 ft. wide; over-all dimensions will be 60 ft. 6 in long x 9 ft. 2½ in. wide x 15 ft. high. The bodies and underframes will be of wood, and the special equipment will include the following: Diamond special brake-beams, Christie brake-shoes, Hewitt solid lead-lined brasses, Washburn long-shank couplers, Forsyth curtain fixtures, Pantasote curtain material, C., M. & St. P. standard draft rigging fitted with Harvey friction draft springs, C. M. & St. P. standard steam heating system, journal boxes, paint, six-wheel trucks fitted with brakes on all wheels and cast-steel wheels 33 in. in diameter, Pintsch gas and electric light, open-hearth steel platforms, Kalamine iron roofs, Dayton walk-over seats and Pullman wide vestibules.

BRIDGE BUILDING.

Bunker Hill, Ill.—Recent heavy rains and high water at this place have carried away three steel bridges over Wood river and Cahoka creek. Railroad service was delayed, connection being made for St. Louis via Litchfield over the Wabash.

Cambridge, Ohio.—Bids are wanted November 8 by Guernsey County Commissioners for building a steel bridge over Chapman creek. D. R. Wallace is Auditor.

Chicago, Ill.—Jackson & Corbett, who recently submitted a bid of $28,446 for building a temporary structure until the new bascule bridge is built at North avenue, have reduced their bid $3,000. Other bids were: Fitz Simon & Connell Co., $29,266; Great Lawes Dredging & Dock Co., $30,017, and T. P. McDonough, $31,735.

La Crosse, Wis.—Plans are being made by the city authorities to build a steel bridge over the La Crosse river to cost $30,000, and also a steel viaduct on Rose street over the railroad tracks.

Menominee, Wis.—The Chicago, St. Paul, Minneapolis & Omaha will build a bridge over the Red Cedar river to cost $20,000.

Milwaukee, Wis.—A resolution has been passed by the City Council which requires the Chicago, Milwaukee & St. Paul to replace the present viaduct over the valley.

Montevista, Colo.—Bids are wanted November 6 by T. W. Jaycox, State Engineer, at Denver, for building a bridge over the Rio Grande river 150 ft. long.

Paisley, Pa.—The Uniontown & Wheeling Short Line will build a bridge over the Monongahela river at McCanns Ferry to carry two tracks.

Peoria, Ill.—Bids recently opened by the Bridge Committee for the new bridge were for a steel structure or of reinforced cement, and vary from $200,000 to $250,000.

Portage La Prairie, Man.—This municipality and the Grand Trunk Pacific are arranging to jointly build a combined railroad and highway bridge over the Assiniboine river.

Portage, Wis.—Bids are wanted November 7 by the Common Council for building the steel superstructure of a highway bridge over the Wisconsin river to consist of four spans of 160 ft., with a 24-ft. roadway and a 6-ft. sidewalk. D. A. Hillyer is City Clerk.

Roxbury, Me.—The Portland & Rumford Falls is building a steel bridge 65 ft. long on concrete abutments over Noisy brook; also one over the Swift river two miles above Byron. The contract for the concrete abutment work has been given to Metevier & Fisher.

St. Louis, Mo.—There is a movement to secure the building of a free municipal bridge over the Mississippi river. The cost of the proposed structure would be between $3,000,000 and $3,500,000.

Seymour, Tex.—The Wichita Valley, an officer writes, has given a contract to W. F. Hopkins, of St. Louis, Mo., for building a steel deck plate girder bridge 180 ft. long, on six concrete piers, over the Brazos river.

Urbana, Ohio.—Champaign and Clark County Commissioners have decided to jointly build two bridges. S. S. Twichell is a member of the Clark County Board.

Waukegan, Ill.—Plans are being made for building a concrete bridge at South Genesee street. It will consist of three or five arches and cost about $70,000.

Winnipeg, Man.—The City Councils of this place and St. Boniface will jointly build a bridge between these two places over the Red river, at a cost of $160,000. Address Ald. Fry, Winnipeg.

Other Structures.

Decatur, Ala.—Work has been started on a union passenger station for the joint use of the Southern and the Louisville & Nashville. The proposed station will be of brick and will cost about $65,000.

Menominee, Wis.—The Chicago, St. Paul, Minneapolis & Omaha will build a new station here 29 ft. x 91 ft. to cost $20,000.

Mobile, Ala.—The Mobile & Ohio is to put up a two-story warehouse.

Omaha, Neb.—The Union Pacific, an officer writes, will put up brick shop buildings with its own men as follows: Blacksmith shop 90 ft. x 376 ft., office building and laboratory 50 ft. x 170 ft., iron house 50 ft. x 162 ft., and stripping shed 43 ft. x 176 ft.

Philadelphia, Pa.—The Philadelphia & Reading has given a contract to Herman Wohlsen, of Lancaster, for putting up a steel freight house near the Prince street station, to be 130 ft. x 171 ft.

Winnipeg, Man.—The Grand Trunk Pacific and the Canadian Northern have decided to jointly build a union station here. Provision will also be made to accommodate the Northern Pacific and the Great Northern. The Grand Trunk Pacific will take over the present terminals of the Canadian Northern, and will buy additional property to carry out the plan. The title of the lands secured will be vested in the Dominion government. Capital stock to equal the cost of improvements will be issued, of which the government will retain a sufficient percentage to give it a controlling interest. The freight yards of the G. T. P. will be located in St. Boniface, immediately across the Red river from Winnipeg. The site of the terminals is in the heart of the business portion of the city, and is about a quarter of a mile from the Canadian Pacific station.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atlanta & Carolina (Electric).—An officer writes that this company, which proposes to build an electric railroad from Atlanta southeast via East Atlanta, Panthersville, Arabia Mountain and Lithonia to Conyers, Ga., 25 miles, has given the general contract to the Atlanta & Carolina Power Co., of which Dr. H. S. Wilson is President, and M. T. Edgerton, Secretary and General Manager. Contracts for grading and track laying will soon be let. The maximum grade will be 2 per cent., with a maximum curvature of 8 degrees. The work includes the building of two steel bridges and one cut under an existing steam road. John R. Hatch is President; M. T. Edgerton, Secretary and Manager, and M. Mason, Chief Engineer, Atlanta, Ga. (October 20, p. 126.)

Baltimore Belt Line Terminal (Penna.).—Under this name, according to reports, the Philadelphia, Baltimore & Washington will organize a company to build a belt line 10 miles long around Baltimore, Md. The cost of the proposed work will be about $6,000,000.

Bangor Terminal.—Application has been made by this com-

pany for a charter in Maine to build a railroad from some point on the Northern Maine Seaport in the town of Hermon, in Penobscot County, east to some point in Bangor, in the same county, at a point near the Maplewood Park, about six miles. The entire line will lie in the town of Hermon and the city of Bangor. The directors include: Arthur Chapin, Linwood C. Tyler, Charles D. Sanford, A. H. Thaxter and G. I. Rice, all of Bangor.

BATTLE CREEK & SOUTHEASTERN.—Incorporation has been granted this company in Michigan, with a capital stock of $500,000, to build a railroad from Battle Creek, Mich., South to Coldwater, a distance of about 30 miles, to be operated by any motive power other than steam. The general office of the company will be at Battle Creek, and the directors are: William E. Ware, Edward F. Pangburn, of Battle Creek, and Howard H. Zigler, Martin E. Murphy and Charles E. Miles, of Columbus.

BUFFALO, NIAGARA & TORONTO.—Incorporation will be asked for by a company under this name in Ontario to build a railroad from Niagara-on-the-Lake through Niagara township, St. Davids village, Stamford, Willoughby and Bertie townships to Fort Erie, with one branch from St. Davids to St. Catharines and another from Fort Erie to Port Colburne and Welland. The names of the incorporators are not given, but they are said to be residents of St. Catharines, Ont.

CANADIAN PACIFIC.—The Board of Railway Commissioners has approved the plans of this company for a line from the eastern boundary of Stratford, in Perth County, Ont., through North Easthope, on the north side of the Avon river, to the boundary of Waterloo county. Plans have also been approved for a line from Linwood to Listowel through the townships of Mornington and Elmer.

CHICAGO, BURLINGTON & QUINCY.—See Union Pacific below.

COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—L. S. Berg, President of the New Orleans Terminal Co., is reported to have said that he is interested in this company, which proposes to build a New Orleans connection for the Colorado & Southern and Fort Worth & Denver City. The new line, in which the St. Louis & San Francisco is admitted by Mr. Berg to be interested, is to connect New Orleans, La., and Houston, Tex., paralleling the Southern Pacific. Connection can be made with the line which the Fort Worth & Denver City is to build southeast from Fort Worth, its present terminus, to Houston and Galveston. The C. S., N. O. & P. proposes to run from New Orleans to Baton Rouge over the Yazoo & Mississippi Valley tracks. From Baton Rouge, construction work is soon to be begun on a line due west to De Quincy, La., on the Kansas City Southern, 47 miles from Beaumont. From that point, the new company expects to have trackage rights over the Kansas City Southern into Beaumont, and from Beaumont the plan is to run west to Houston, perhaps using the Beaumont, Sour Lake & Western, which now runs from Beaumont west to Sour Lake, 22 miles. Between Houston and Fort Worth, the Trinity & Brazos Valley will form part of the Fort Worth & Denver City extension. On completion of these plans, the Yoakum interests will have a line from New Orleans to Denver.

FALLON RAILWAY.—Articles of incorporation have been filed by a company under this name in California, with a capital of $500,000, to build a railroad from Hazen to Fallon, in Churchill county, Nev., 22 miles. The directors include: William Hood, of San Francisco; N. T. Smith, of San Carlos; J. L. Willcutt, of Oakland; J. E. Foulds, of Berkeley, and Frank Shay, of Oakland, Cal.

FALLS CITY, SYCAMORE SPRINGS, SABETHA & SOUTHWESTERN.—Incorporation has been granted this company in Kansas, with a capital of $100,000, to build a railroad from Falls City, Neb., south through Nemaha, Pottawatomie, Jackson and Shawnee Counties, Kan., to Topeko, about 100 miles, with a western line from a point near Sabetha, in Nemaha County, Kan., west through the counties of Marshall, Washington, Cloud, Republic, Jewell, Mitchell, Smith, Osborne, Phillips, Rooks, Norton, Graham, Sheridan, Decatur, Rawlins and Thomas to the west line of the State, 320 miles air line. The directors and incorporators include: Samuel Kimmel, E. S. Towle, W. H. Crook, W. E. Dorrington, Albert Maust, J. H. Miles and Edwin A. Towle, all of Falls City, Neb.; E. V. Kauffman and H. Reding, of Sabetha; W. A. S. Bird, of Topeka; J. T. Slusher and Roy Hesseltine, of Sabetha; George Boone, Jr., of St. Joseph, Mo., and George L. Campen, of Lincoln, Neb.

GRAND TRUNK PACIFIC.—At a meeting of the shareholders of the Grand Trunk, in London, October 12, the president, Sir Charles Rivers Wilson, gave interesting particulars concerning the Grand Trunk Pacific enterprise. The length of the entire line from New Brunswick to the Pacific coast will be about 3,400 miles. From Winnipeg to the Atlantic coast, the surveys, still in progress, indicate that the distance will be about 1,800 miles. On the western portion, the original estimate of 1,500 miles will be exceeded by about 250 miles, making the distance from Winnipeg to Edmonton 775 miles; from that point west to the eastern section of the mountains, 561 miles, and the balance to the Pacific coast, 418 miles, making a total of 1,754 miles. In addition to this, there will be the Lake Superior branch, which is to be 203 miles long. The company has secured terminals at Fort William, on Lake Superior. Through the co-operation of the government, it now has 1,600 acres of land at that place. The municipality of Fort William has contributed $300,000 and agreed to exemption from all taxes for fifteen years. The Pacific terminus will be at a place called Kai-En, an island about 25 miles south of Port Simpson, where the company has obtained about 10,000 acres of land. Since this project was first undertaken, about 2½ years ago, all legislation connected with the work has been completed and 9,300 miles have been surveyed. Financial arrangements have been completed for building the line from the Lake Superior branch of the Prairie section and the money secured. Contracts have been let and the work is now in progress.

HOUSTON, SABINE & RED RIVER.—Incorporation has been granted to a company under this name in Texas, with a capital of $500,000, to build a railroad from Houston to Alexandria, La. The survey extends through Harris, Newton, Liberty, Hardin, Tyler, Jasper and Sabine counties. It starts at Houston, passes Jasper, Sabine, Burr Ferry, in Vernon Parish, Louisiana, thence to Alexandria. The ultimate destination will be Natchez, Miss. The incorporators include: Ed. Kennedy, J. J. Sweeney, J. H. Agen, of Wisconsin; J. H. Cotton and Edgar Watkins. H. W. Cortes, of Houston, is President, and Ed. Kennedy, Vice-President and General Manager.

ILLINOIS CENTRAL.—This company, it is said, has decided to improve its road in the neighborhood of Mattoon, Ill., cutting down Magnet hill, and depressing the tracks through the city for a distance of about two miles.

LAS VEGAS & TONOPAH.—This company, recently incorporated in Utah to build a railroad from Las Vegas, Nev., for a distance of 113 miles to Tonopah, Nev., and the mining districts, has secured capital to begin construction work. Bids are to be asked during the present month. A. Maguire, of Las Vegas, Nev., is Chief Engineer. (October 20, p. 127.)

LOUISVILLE & NASHVILLE.—This company is surveying a branch line to run from Louise, a station on its Clarksville Mineral branch in Montgomery county, Tennessee, to the Tabor iron mines, a distance of about five miles.

MANILA & SOUTHWESTERN.—This company, which was chartered last year in Arkansas to build a railroad from Malden, Mo., south to Kennett and Hornersville, Mo., thence southwest via Manila, Ark., and Culberhouse to Brinkley, Monroe County, Ark., about 150 miles, has about three miles of road ready for track laying. The company is doing its own construction work. R. L. Williford, of Manila, is President, and W. Kerr, Jonesboro, Chief Engineer.

MEXICAN ROADS.—The Descubridora Mining Co., which owns copper mines and the railroad from Conejos station, on the Mexican Central, to its mines, in the state of Durango, is planning to build an extension from Conejos to Inde, a distance of about 40 miles. J. F. Stone represents the company.

MISSOURI ROADS (ELECTRIC).—A syndicate has recently been formed by Thomas Nevins & Son, of New York, and Denison Prior & Co., of Cleveland, with a capital of $5,000,000, to build a high-speed electric railroad to carry freight and passengers from Kansas City, Mo., to St. Joseph, Mo., with branches to Leavenworth and Atchison, Kan. The work includes the building of a bridge over the Missouri river. Entrance will be made into Kansas City over the tracks of the Metropolitan Street Railway.

MIDLAND & MANITOBA.—This company has been granted incorporation in Manitoba, with a capital of $500,000, to build railroads to connect with those branches of the Great Northern which terminate at places south of the international boundary. Preliminary arrangements are being made for grading a section of the line from Portage la Prairie to the United States boundary near Emerson. C. S. Mellen, President of the New York, New Haven & Hartford, is said to be an incorporator. Superintendent Thean, of Portage la Prairie, can give information.

NEW YORK & NORTH JERSEY RAPID TRANSIT.—This company has accepted the franchise granted by the Board of Aldermen of Paterson, N. J., and will at once buy a private right of way from that place to the Hudson river. Part of the proposed road will be on an elevated structure. (See Construction Record.)

NORTH CAROLINA CONNECTING.—Incorporation has been granted a company under this name in North Carolina, with a capital of $450,000, to build a railroad from Springhope, N. C., on the Atlantic Coast line, northwest to Roxboro, about 60 miles; also to build branches. The names of the incorporators are not given.

NORTHERN CENTRAL.—This company, it is reported, has given a contract to Kerbaugh & Co. for building a double track freight line around the city of York, Pa., a distance of 20 miles. The proposed line will start at the Big Conewago creek, a short distance south of Yorkhaven, running south of Emigsville, thence around

the north and west sides of York, rejoining the main lines near the Maryland state line. The work will require a number of deep cuts.

Oklahoma & Northwestern.—An officer writes concerning this proposed road that construction work is now under way by the company's men from Doxey, Okla. T., in a northwesterly direction for a distance of about 75 miles, and that track laying will be commenced in about 60 days. E. E. Niess, 171 La Salle street, Chicago, is President, and Henry Jarvis & Co., of the same place, are the engineers. (October 20, p. 127.)

Pennsylvania.—See Baltimore Belt Line Terminal above.

Pittsburg-San Jose.—This company has completed its railroad from San Jose del Sitio, Mexico, where the company's offices are located, to Vallecillos, a distance of about 16 miles. M. B. Place, General Manager of the road, is quoted as saying that engineers will soon begin surveys for extending the road north to a connection with the Kansas City, Mexico & Orient.

St. Louis & North Arkansas.—This road, which operates a line from Leslie, Ark., north to Seligman, Mo., a distance of 130 miles, proposes to build an extension northwest through Barry and Lawrence Counties, Mo., to Pittsburg, Kan., a distance of about 90 miles. It is supposed that the extension is being built in the interest of the Frisco.

Shelbyville & Ohio River (Electric).—This company, which proposes to build a line from Shelbyville, Ky., through Eminence and Newcastle to Carrollton and Milton, has issued $1,000,000 in bonds to provide funds for construction. According to the announced plans of the promoters, this work is to begin shortly, commencing at Eminence, at Newcastle and at Shelbyville. The company proposes to build a large power house at Eminence. (Aug. 25, p. 63.)

Sonora (So. Pac.).—According to advices from Mexico, this company has made a deposit of $540,000 with the Government to guarantee the construction of the proposed line between Guaymas and Guadalajara. The extension will run through Tepic and the citizens of that place have petitioned President Diaz to use his influence to have a branch built from Tepic to San Blas, on the Pacific Coast. A contract has already been let to Henry Lund & Co., of San Francisco, for 50,000 tons of rails to be used on this line.

Spokane & Inland (Electric).—This company, it is said, has let the contract for building and equipping its proposed road from Spokane to Moscow, Idaho, which are 60 miles apart, air line. The company has been organized by Spokane capitalists; J. P. Graves is President. The Westinghouse single-phase alternating current power system will be used. (March 31, p. 103.)

Southern Pacific.—See Sonora above.

Union Pacific.—This company is said to have let a contract to W. C. Bradbury, of Denver, for building a branch from O'Fallon's, Neb., which is 25 miles west of North Platte, west along the north bank of the North Platte river to Northport, a distance of about 200 miles. The Chicago, Burlington & Quincy, it is said, also plans to build a road from some point east of North Platte to Bridgeport, which is on the south bank of the river, opposite Northport.

Uniontown & Wheeling Short Line.—Application will be made by a company under this name for incorporation in Pennsylvania to build a railroad from Uniontown, in Fayette county, Pa., west to Wheeling, W. Va., 68 miles. The proposed route is from Uniontown through Ache Junction, to Leckrone in Fayette county, to the Monongahela river, which it crosses at McCann's Ferry, thence following Little Whitely creek, Muddy creek and the south fork of Ten Mile creek to Waynesburg, the county seat of Greene county; thence to Rogersville and Rutan, to the headwaters of the North Fork of Wheeling creek through Bristoria and Ryerson, through Durbin and Crow's Mills, Greene county, at the Pennsylvania and West Virginia state line; thence along Big Wheeling creek through Viola, Marshall county, W. Va., and Elm Grove, Ohio county, W. Va., into Wheeling and Benwood. The projected road reduces the distance from the Connellsville coke field to Wheeling by more than fifty miles. In Greene county, Pennsylvania, the line will open a rich coal territory, at present without railroad facilities. The incorporators include: J. V. Thompson, of Uniontown, and D. F. Maroney.

Waterville & Oakland (Electric).—The managing director, Col. A. E. Gerald, of this company, has under consideration the proposed construction of an electric railroad from Waterville south to Augusta, Me., about 25 miles. Two locations are under consideration; one to continue the present Waterville & Oakland line from Oakland along the east side of Snow pond, across the town of Sidney to Augusta, and the other to leave Augusta on the east side, follow the river road to Riverside, then to Webber pond, thence to East Vassalboro, North Vassalboro and Winslow. The last named route is believed to be the most favorable.

Western Pacific.—This company is reported to have let a contract to H. S. Hudson, of Tacoma, Wash., for building that section of its proposed road from Oakland, Cal., northeast to Oroville, about 130 miles.

RAILROAD CORPORATION NEWS.

Buffalo & Susquehanna.—The report for the year ended June 30 shows gross earnings of $1,129,865, an increase of $167,169. Operating expenses and taxes amounted to $753,245, an increase of $117,745, leaving net earnings of $376,620, an increase of $49,424, or 15 per cent. A 4 per cent. dividend was paid on the $3,000,000 preferred stock and 5 per cent. on the $3,518,000 common stock, leaving a surplus of $28,114.

Chicago & Alton.—The New York Stock Exchange has listed an additional $5,362,000 3 per cent. refunding mortgage bonds of 1949, making the total amount outstanding $37,350,000. Of the proceeds of these bonds, $350,000 was used to buy the Quincy, Carrollton & St. Louis, and the remainder was used for double tracking and other improvements.

Consolidated (N. Y., N. H. & H. electric lines).—The stockholders have ratified the lease of the Springfield & Eastern to the Springfield Street Railway Co., which is owned by the Consolidated. The Springfield & Eastern operates 30 miles of road between Ludlow and Monson, Mass., and has $370,000 stock and $330,000 bonds outstanding.

Cumberland River & Nashville.—A mortgage for $2,500,000 has been executed by this company to the Union Savings Bank & Trust Co., of Cincinnati. The mortgage covers all the road and rights of way of the company, which proposes to build from Corbin, Ky., southwest to the Tennessee line, 95 miles, and eventually to Nashville.

Little Kanawha.—The suit brought to appoint a receiver for this company on the ground that the syndicate was mismanaged has failed and the temporary injunction, restraining the syndicate from selling its property, was vacated. The claim of the plaintiff has been that the attempted sale of the Green County Railroad impaired the entire value of the syndicate's assets.

Long Island.—This company has now about 40 miles of double track operated by electric motive power; from Flatbush avenue to Belmont Park, from Woodhaven Junction to Rockaway Park and from Jamaica to Springfield Junction. By January it is expected that electrification will be extended from Springfield Junction via Valley Stream and Cedarhurst to Beach Channel. This will complete all the lines which the company intends at present to operate by electricity. The cost of this work will be about $5,500,000.

Manila & Dagupan.—This road runs from Manila, P. I., north to Dagupan, 120 miles, and the original cost was $5,353,000. The annual report for the year 1904 shows that the net profits amounted to about 15 per cent. on the cost of the road. The gross earnings were $1,475,069, and expenses, $660,724, leaving net earnings of $815,145.

Mobile & Ohio.—The annual report, for the year ended June 30, shows a surplus, after dividends, of $165,271. This is a decrease of $46,756 as compared with last year; but the dividends paid were $242,824, twice as much as was paid last year, as the dividend rate was increased from 2 per cent. to 4 per cent. The gross earnings were $8,267,602, an increase of $527,896, and the net earnings, $2,216,717, an increase of $276,921.

Pennsylvania.—The directors have authorized the issue of $10,000,000 3½ per cent. car trust certificates and the sale of $3,500,000 similar certificates previously authorized. They are to be retired at the rate of 10 per cent. per year, and the principal and interest are guaranteed by the Pennsylvania Company. It is stated that the certificates authorized will not be offered for sale this year.

St. Joseph & Grand Island.—The surplus earned by this company during the year ended June 30 amounted to $48,098, which is 0.87 per cent. on the $5,500,000 first preferred stock. No dividends were paid. Both gross earnings and expenses decreased, leaving net earnings of $304,034, an increase of $66,459. The surplus last year was $3,103.

Wabash.—The annual report for the year ended June 30 shows a deficit after fixed charges of $1,459,372. Last year there was a surplus of $119,290. The gross earnings were $24,696,600, an increase over last year of $1,672,973; but operating expenses increased $2,819,936, making the net earnings $4,193,156, a decrease of $1,146,962.

Western of Havana.—This road runs from Havana, Cuba, southwest to San Juan, 125 miles, being the only road of any importance in Cuba west of Havana. The gross earnings for the year ending June 30 were $1,024,000, an increase of $238,000. Operating expenses were $515,000, an increase of $76,400, leaving net earnings of $510,000, an increase of $161,000. The total surplus, including the balance on hand on June 30, 1904, amounted to $522,000, and of this amount $33,600 has been spent for special renewals.

GENERAL NEWS SECTION

NOTES.

The yard masters at various points on the Pennsylvania Railroad have had their working day reduced from 12 hours to 8.

The Southern Railway now runs a Pullman compartment sleeping car between Washington and Asheville, for the "high-class travel" between those points. The service will be twice a week each way.

At the new Angus shops of the Canadian Pacific the company will establish two dining-rooms, with a seating capacity of 400, and it is proposed to furnish the mid-day meal for employees at cost, or less.

Philadelphia newspapers say that the Pennsylvania Railroad has issued a notice to its freight agents and solicitors cautioning them to observe strictly the spirit and the letter of the Interstate Commerce law regarding freight rebates and discriminations.

The Exchequer Court at Ottawa, Ontario, has awarded H. M. Price $55,856 damages against the Dominion Government for losses due to forest fires on land adjacent to the Intercolonial Railway, the court holding that the fires were caused by sparks from locomotives.

The Missouri, Kansas & Texas is to take a trainload of editors to Indian Territory and other attractive regions on the company's lines for the purpose of advertising the country as a good place for settlers. The guests to be invited are the country editors of Illinois, Indiana, Ohio and Kentucky.

Chicago reporters say that the western railroads complain that eastern connections do not furnish full and correct information on waybills as to gross, tare, and net weight of cars for points west of Chicago. It is claimed that the Central Freight Association weighing and inspection bureaus at Buffalo, Pittsburg and elsewhere fail to weigh many of the cars going west.

A complaint has been filed with the Kentucky Railroad Commission, by a number of coal shippers in eastern Kentucky against the Ashland Coal & Iron Railroad and Chesapeake & Ohio. The shippers complain that recently the two railroads have violated an agreement made under an order of the Commission two months ago by restoring a full local rate over both lines on through shipments.

A correspondent of the *New York Herald* says that very large quantities of freight are seriously delayed at the Atlantic terminus of the Panama Railroad because of the inability of the road to carry it. It is said that 800 cars are needed for the traffic, while the company has available only 200. More than half of the 500 cars owned by the road are now in use for carrying supplies for the construction forces of the canal.

The New Hampshire state railroad commissioners have made a ruling on the method of conducting hearings on railroad accidents which will prevent attorneys for clients who may be plaintiffs in suits against the railroad from questioning witnesses. The commissioners will conduct the examination of witnesses and will decline to furnish copies of the testimony. The hearings on accidents will be public as heretofore.

At Fort Worth the ticket scalpers have turned on the railroads and have secured from the state court a temporary injunction restraining the railroads from interfering with brokers who sell unused portions of tickets. The scalpers allege that the contract made with a passenger when selling tickets is a pretence; the railroad company stipulates that the tickets are not transferable, but under the law it is claimed that they are transferable. The petition alleges that such a form of agreement is an attempt to stifle competition and violates the anti-trust law of Texas. The ticket scalpers are trying to protect their business during the state fair at Dallas.

A committee of the General Managers' Association of Texas Railroads has protested against the State Board of Health's rules governing the disinfecting of passenger cars, and the Board has agreed to modify them. The rule requiring one cuspidor in a car for each seat or every two chairs will be modified so that cuspidors shall only be used when demanded by a passenger. A supply of them will be carried in each car and they will be furnished to passengers on request. The rule requiring the use of a disinfecting solution in cuspidors has been abolished, but the cuspidors must be kept clean. The railroads have agreed to pay the expenses of sanitary inspectors to see that passenger cars are kept clean.

The Interstate Commerce Commission, in a general investigation, holds that the freight rates in force from St. Louis to Texas common points prior to March 15, 1903, afforded reasonable compensation to the carriers, and as they had been in effect for a long period, and the material advances of such rates on that date were made through concerted action of the carrier, justification for the advances should be clearly shown; but as there is no complainant demanding relief from some particular rate, and no particular rates have been investigated; and as there is no evidence that the financial condition of the roads is weak, the commission does not feel warranted in making an order condemning such advances, though it is believed that they were improper.

Interstate Commerce Commission Decisions.

The Interstate Commerce Commission, in the case of the City Gas Company of Norfolk, Va., decides that the Baltimore & Ohio, in carrying coal from Pennsylvania to Baltimore must not charge a lower rate on that going to points "inside the Capes" than on that going to Norfolk. It appears that on coal for Norfolk proper the railroads leading to that city have made an agreement not to compete, whereas on coal carried to other places, both along the bay between Baltimore and Norfolk and to points "outside the Capes," competition is free. The decision says that the B. & O. does not desire to participate in the coal traffic to Norfolk, and this discrimination in favor of other points is declared unjust and illegal.

The Interstate Commerce Commission has announced its decision in an opinion by Commissioner Fifer, in the case of Spiegel v. the Chesapeake & Ohio and the Pennsylvania. It was claimed that the rates on lumber to Philadelphia were unlawfully higher from Afton, Va., and other points than those for the longer distance over the same line from Staunton and Basic City. Effective competition was shown by defendants at Basic City and Staunton, and the Commission decides that the higher rate from the Afton group does not constitute unlawful discrimination.

Concessions to Russian Railroad Strikers.

According to a press despatch of November 4, the Russian Government, speaking through Count Witte, has had a conference with the leaders of the railroad strike and has granted seven important points, as follows:

1. The remuneration of all railroad employees is increased and the Budget of 1906 will be revised to provide therefor.

2. The creation of a commission on which the employees are to have elected representatives to consider questions of improvement in their condition.

3. Permission is given railroad employees and workmen to have a co-operative organization like those of Western Europe and the United States.

4. The abolition of military regulations applying to railroads.

5. Freedom of meeting for employees of railroads to discuss questions of a strike without notice being given to the police.

6. Inviolability of the person of strikers and the re-employment of men dismissed for striking.

7. Cancelling of all circulars limiting the employment of Poles on the Polish Southwestern and the Western Railroads, and giving permission to use the Polish language in private on Polish railroads.

It is said that under this settlement all the railroads have resumed normal operations.

The $2 Chicago Stock-Yards Charge.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the stock yards case, remanded to it by the Supreme Court of the United States.

Prior to June 1, 1894, live stock was delivered at the Union Stock Yards in Chicago without additional charge. On that date the Burlington and other defendant railroad companies imposed a terminal charge of $2 per car. Complaint was made by the Texas Cattle Raisers' Association, with the Chicago Live Stock Exchange as intervener, and the commission decided that any charge in excess of $1 would be unreasonable. This case went to the Supreme Court of the United States, and that court, while agreeing with the commission that $2 was unreasonable, held that from certain territory where a reduction in through rates had been made effective in 1896 the charge might not be unreasonable, and as that territory was not defined in the record, the court was constrained to dismiss the case, but remanded it to the commission for further proceedings. The commission now finds that excluding the territory covered by the reduction of 1896, live stock rates were on May 31, 1894, reasonable compensation for the service performed, including delivery at the Union Stock Yards. At all times since that date such rates have been, and now are, sufficiently high to include a delivery at the stock yards, but the cost of delivery in Chicago has been increased by the trackage charge paid by defendants to the Stock Yards Company. Such increased cost of delivery, that is to say, such trackage charge,

s fairly estimated for all the defendants at one dollar per car. The ommission holds (1) that delivery to the Union Stock Yards prior o June 1, 1894, was included in the rate and was in no sense a gratuity; (2) that outside of the excluded territory, a terminal harge for delivery to the Union Stock Yards in Chicago of $1 per ar is reasonable, and defendants' terminal charge of $2 per car, ex- ected since June 1, 1894, is unreasonable. The case is retained for further proceedings in the matter of reparation.

The "Pennsylvania (18-Hour) Special."

A report is published to the effect that this train, westbound, has reached Chicago on time 138 days out of 142; and of the four deten- tions the longest was 13 minutes, caused by the derailment of a freight train near Chicago.

A press despatch from Chicago, of November 4, says that the 18- hour train arriving in that city on the morning of that day (on time) left Harrisburg, Pa., two hours late. The distance from Harrisburg to Chicago is 717 miles, and if the train started two hours late it thus made the run in 12 hrs. 21 min.; equal to 58.06 miles an hour. From Harrisburg to Altoona, 132 miles, the time was 116 min., equal to 68.3 miles an hour. On this division the grades westbound are nearly all ascending, or level, few or none being descending.

Central Railroad Terminal Improvements at Jersey City.

The Central Railroad of New Jersey has begun the work of reclaiming a tract of swamp land in the Communipaw section of Jersey City, estimated to be a mile square. It lies between the present freight yard and the tracks leading to the National Docks & Storage Company on the west and between the main line tracks and New York bay. It will require a great quantity of earth, and a year and a half will be consumed in completing the job. On the river front south of the ferry terminus on the North river a new open pier 1,100 ft. long will be built. This will be followed by other piers and coal trestles, both on the river and the bay fronts. A new 20-stall roundhouse is to be built at the west end of the yard. On account of the riparian rights involved the com- pany made application to the Government last spring for permission to begin the work, and this was granted late in the summer. The cost of the present work is estimated at $1,500,000. The contractor is J. A. Taylor, Jersey City.

Hall Signals on the New York Central.

The Hall Signal Company has closed a contract with the New York Central for the equipment of the West Shore Railroad between West Cornwall and Haverstraw, 20 miles, with Hall automatic nor- mal-danger block signals.

Mississippi Railroad Commission.

The forthcoming report of the Mississippi Railroad Commis- sion will show the total railroad mileage in the State on September 30 to be 3,503.79 miles, an increase of 361.58 miles in two years. The total valuation of railroad property in 1905 is given at $36,316,800, which nets the State in taxes $65,141.30. Sleeping car, express, tele- graph and telephone companies are valued at $1,487,543, on which the State receives $8,925 in taxes. During the last two years 96 persons were killed and 876 were injured on the railroads in the State, as compared with 122 killed and 440 injured during the prev- ious biennial period.

Steam Turbines in Washington Terminal Station.

When the large Union Station at the Washington terminal of the Pennsylvania Railroad is completed, steam turbines will be used as prime movers partially on account of the limited amount of space devoted to that purpose. Four 500-kw. steam turbines have been ordered from the Westinghouse Machine Company, adapted for driv- ing alternating-current 60-cycle generators running at 3,600 r.p.m. Dry saturated steam will be used at 150 lbs. pressure and 25 in. vacuum, and the turbines will be capable of developing 670 electrical h.p. each. The alternating-current generators will be of the turbo rotating-field type, with two poles and a frequency of 7,200 alterna- tions per minute at a normal speed of 3,600 r.p.m. They will deliver three-phase current at 2,300 volts, and, being of the enclosed type, will operate practically without noise.

Manufacturing and Business.

The San Francisco office of the National Tube Co. has been moved from 420 California street to the Union Trust Building.

The Atchison, Topeka & Santa Fe's new elevator to be built in Chicago to replace the one recently destroyed by fire will have a capacity of 1,400,000 bushels and cost $600,000.

Mr. C. H. McCullough, Jr., has been elected a Vice-President and General Manager of the Lackawanna Steel Co., with office at Buf- falo, N. Y.

W. W. Rosser, formerly with the Washburn Coupler Co., has ac- cepted a position with the T. H. Symington Company as Sales Agent in the Western Office, Railway Exchange, Chicago.

Mr. A. P. Peck, who has been electrical sales agent for the Na- tional Electric Co., has been appointed sales agent of the Allis- Chalmers Co., and will work in the New York district.

Burns & McDonnell, Kansas City, Mo., civil, hydraulic and sani- tary engineers, have removed their offices into larger quarters at 709 and 710 Dwight Building. This firm makes a specialty of municipal sanitary and hydraulic engineering.

Vice-Consul Battiste at Port au Prince reports that the Haytian Legislature has granted a concession to the National Railroad Co. of Hayti, in which a number of Americans are interested, to build a railroad from Gonaives to Hinche.

The Railroad Supply Co., Chicago and New York, reports a large and increasing demand for its "Chicago" channel pins tinned by a special process. It is claimed that these pins drive easier and quicker and make a more permanent and better contact between rail and bond wire.

The Independent Pneumatic Tool Co. has received an order from England for 200 "Thor" piston air drills, reversible wood boring ma- chines and pneumatic riveting and chipping hammers. On account of increased business, the company intends to enlarge its plant at Aurora, Ill.

I. M. Cook, for the past eight years lumber buyer for the Pull- man Company, has opened an office at 1338 Monadnock Building, Chicago, to engage in business on his own account. His experience with the Pullman Company extended over a period of 19 years. He will handle lumber of all kinds, also veneers, and will make a special- ty of car stock.

The Wilmarth & Morman Co., Grand Rapids, Mich., reports busi- ness for October to have been unusually good, particularly in foreign shipments, many machines having been sent to England, France, Norway and Canada. Domestic shipments included the New York Central and Louisville & Nashville railroads and a considerable num- ber of business and industrial concerns.

At the meeting of the board of directors of the American Steel Foundries on November 2, the following elections and appointments were made: Delmer W. Call, Assistant to President; W. W. Butler, Second Vice-President; R. H. Ripley, Fourth Vice-President. Mr. Call, who assumes a prominent position in the management of the company, has for a great many years been connected with the Na- tional Malleable Castings Co., Cleveland, Ohio.

The Indestructible Fibre Co., 45 Broadway, New York, has re- ceived the order for the car head-linings, ¼ in. thick, and for the hood material, ½ in. thick, for the 125 New York Central cars to be built by the American Car & Foundry Co., and electrically equipped, for service between New York City and Westchester. The material which the Fibre Co. will furnish will not only be fireproof, but, in case of accident, it will not splinter. The company has a new plant at Massena, N. Y., for making car head-linings and hood materials.

PERSONAL.

—Mr. A. J. Stone, in becoming Assistant General Manager of the Erie, returns to that road after an absence of just two years. He had served in various capacities in branches of the operating department, beginning in 1887, and became Assistant to the General Manager in 1902. In November, 1903, he went to the Delaware & Hudson as Assistant to the Second Vice-President, and a month later was made General Superintendent, where he has been until his recent appointment on the Erie as Assistant General Manager.

—Mr. E. B. Pryor, who was recently elected Fourth Vice-Presi- dent of the Wabash, was born in West Virginia in 1854. His entire railroad service has been on the Wabash. He started in 1880 as a clerk on the Wabash, St. Louis & Pacific, predecessor of the Wabash, and was later appointed general bookkeeper and chief clerk of general accounts. In 1887, he was made Assistant Auditor, and three years later was appointed also Assistant Secretary and Assist- ant to the Vice-President. In 1903, he was made Assistant to the President, from which office he received his present promotion.

—Mr. A. DeBernardi, who was recently appointed General Superintendent of the Central district of the Missouri Pacific, was born in Missouri in 1865, and his entire railroad service has been with the Missouri Pacific. He started his railroad work in 1882 as a laborer, becoming section foreman in 1885 and working up through successive stages to the position of division roadmaster in 1893. In 1899, he was made trainmaster, and in 1900, Division Superintendent at Concordia, Kan. The next year he was trans- ferred to Osawatomie, Kan., where he remained until his recent appointment.

—Mr. W. S. St. George, who was recently appointed General Passenger and Ticket Agent of the Missouri, Kansas & Texas, is 53 years old. He was born in Ireland, but came to this country at an early age and began railroad service as a clerk on the Port Royal & Augusta in 1876. He became contracting agent and then

resigned and was out of railroad service for a while. In 1882, he resumed railroad work as freight agent at Savannah for the Savannah, Florida & Western. At the end of that year, he went to the Cincinnati, New Orleans & Texas Pacific as General Southern Agent and was later made General Agent of the entire system. In 1884 he was appointed General Eastern Agent, remaining there for ten years, and then taking the same position on the Missouri, Kansas & Texas, where he has been until his present appointment.

—Mr. D. C. Moon, who has been appointed General Superintendent of the Lake Shore & Michigan Southern, began railroad work in 1872 as a telegraph operator on the Dunkirk, Allegheny Valley & Pittsburg, a leased line of the New York Central. He was agent for a short time, then train despatcher, then in the Auditor's office, and, in 1890, trainmaster. Three years later he was appointed Assistant Superintendent of the road, and in 1896, Superintendent at Dunkirk, N. Y. In 1899 he was transferred with the same title to the Rome, Watertown & Ogdensburg division of the New York Central. He was promoted to the office of Assistant General Superintendent of the Lake Erie & Western in 1902, and the next year was made Assistant General Superintendent of the Lake Shore & Michigan Southern, with office at Cleveland, where he remained until his recent appointment.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—J. D. Stuart, Assistant Freight Auditor, has resigned. E. L. Mooney succeeds Mr. Stuart, with office at Topeka, Kan.

Brooklyn Rapid Transit.—Eugene Klapp, Chief Engineer, has resigned. W. S. Menden succeeds Mr. Klapp.

Cincinnati, Hamilton & Dayton.—W. C. Andrews has been appointed Acting Superintendent of Car Service, succeeding F. S. Rawlins, resigned.

See Erie.

Delaware, Lackawanna & Western.—B. H. Hawkins has been appointed Master Mechanic at Buffalo, N. Y., succeeding F. W. Williams, resigned.

Erie.—The authority of the vice-presidents has been extended over the Cincinnati, Hamilton & Dayton and the Pere Marquette, as follows: G. F. Brownell, First Vice-President, will have charge of the legal department, including real estate and taxes; G. A. Richardson, Second Vice-President, will have charge of finance, accounting and the coal companies; H. B. Chamberlain, Third Vice-President, of traffic; J. M. Graham, Fourth Vice-President, of engineering and construction; Russell Harding, of operation and maintenance.

M. P. Blauvelt, Comptroller of the Erie, has been made Comptroller of the Cincinnati, Hamilton & Dayton and the Pere Marquette also. J. L. Cramer, Comptroller of the Cincinnati, Hamilton & Dayton, has been appointed Assistant Comptroller of the three roads.

E. A. Williams, Assistant General Manager, has been appointed General Mechanical Superintendent of the Erie and of its allied and controlled lines, with office at New York.

Galveston, Harrisburg & San Antonio.—G. E. Bissonnet, Auditor of Passenger Accounts, has resigned. F. J. Cox, Chief Clerk in the Passenger Auditing Department, succeeds Mr. Bissonnet, with office at Houston, Tex. See Southern Pacific.

Grand Trunk Pacific.—A. C. Dennis, Assistant Division Engineer at Winnipeg, has been appointed Division Engineer at that place, succeeding E. R. McNeil, deceased.

Michigan Central.—The authority of J. R. Smart, Superintendent of Dining Car Service of the New York Central and of the Lake Shore & Michigan Southern, has been extended over the Michigan Central. C. R. Emery, heretofore Superintendent of Dining Cars of the Michigan Central, is now Assistant Superintendent of that department.

Missouri Pacific.—C. H. Miller has been appointed Engineer of River Protection.

New Orleans & Northeastern.—P. Millard, Purchasing Agent, has resigned. W. J. Kelleher, Secretary to the President, succeeds Mr. Millard.

New York Central Lines.—B. B. Mitchell, General Freight Traffic Manager of the Michigan Central, has been appointed Freight Traffic Manager of all the New York Central Lines west of Buffalo, except the New York, Chicago & St. Louis, with office at Chicago.

Pere Marquette.—See Erie.

Southern Pacific.—G. E. Bissonnet, Auditor of Passenger Accounts of the Galveston, Harrisburg & San Antonio, has been appointed Ticket Auditor of the Pacific system, with office at San Francisco.

Tennessee Central.—The following new officials have been elected to serve until December 1: President, J. M. Overton, succeeding J. C. Vanblarcom; Treasurer, J. P. Howell, succeeding E. A. Faulhaber; Directors, J. M. Overton, C. N. Burch, A. P. Humphrey and W. J. Murphy. The former directors were: J. C. Vanblarcom, G. A. Clark, John A. Pitts and W. D. Witherspoon.

LOCOMOTIVE BUILDING.

The Lehigh Valley will shortly order a number of locomotives.

The Kansas City, Mexico & Orient, it is reported, has ordered six locomotives.

The Great Northern, it is reported, is figuring on a number of new locomotives.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered two locomotives from the American Locomotive Co.

The Philadelphia & Reading, it is reported, has reserved space with the Baldwin Works for 50 additional freight locomotives for 1906 delivery.

The Spokane & Inland, as reported in our issue of September 22, has ordered six electric locomotives from the Westinghouse Electric & Manufacturing Co.

The Baltimore & Ohio, as reported in our issue of October 20, has ordered 210 consolidation locomotives and 35 Pacific locomotives. The consolidation locomotives will weigh 209,200 lbs., with 186,600 lbs. on drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 60 in.; straight top boiler with wide firebox, having a working steam pressure of 205 lbs.; total heating surface, 2,809 sq. ft.; 282 charcoal iron tubes, 2¼ in. in diameter x 15 ft. 10 in. long; firebox, 107⅜ in. x 75¼ in.; grate area, 56.24 sq. ft. The tender will have a capacity for 7,000 gallons of water and 13 tons of coal. The Pacific locomotives will weigh 218,000 lbs., with 140,500 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of driving wheels, 74 in.; straight top boiler with wide firebox, having a working steam pressure of 205 lbs.; total heating surface, 3,395 sq. ft.; 276 tubes, 2¼ in. in diameter x 20 ft. long; firebox, 107⅝ in. x 75¼ in.; grate area, 56.24 sq. ft. The tender will have a capacity of 7,000 gallons of water and 13 tons of coal. The special equipment for these engines includes: Westinghouse air-brakes, magnesia boiler lagging, Diamond special brake-beams, Perfecto brake-shoes for the engines and Streeter brake-shoes for the tenders, Major couplers, Hancock injectors, B. & O. standard journal bearings, U. S. metallic piston and valve rod packings, Hayden safety valves, Leach sanding devices, Detroit bull's-eye sight-feed lubricators, B. & O. standard springs and heating equipment, and Ashcroft steam gages.

CAR BUILDING.

The National of Mexico, it is reported, is in the market for 10 beer cars.

The Cornwall & Lebanon, it is reported, is in the market for passenger cars.

Blair & Company, New York, have ordered one private car from the Pullman Co.

The Clarendon & Pittsford has ordered 20 flat cars from the Middletown Car Works.

The Pittsburg & Lake Erie, it is reported, is in the market for a number of passenger cars.

The Northern Pacific, it is reported, will soon consider the purchase of new passenger cars.

The National of Pehauntepec has ordered 300 box cars from the American Car & Foundry Co.

The Grand Trunk Pacific, it is reported, has ordered 3,000 box cars from the Canada Car Co.

The Mexican Central has ordered 70 Rodger ballast cars from the American Car & Foundry Co.

The Chicago & Milwaukee Electric has ordered 10 cars from the Pullman Co. and is figuring on additional cars.

The Atlantic & Birmingham Construction Co. is in the market for additional freight and passenger equipment.

The Cincinnati, New Orleans & Texas Pacific has ordered 250 flat cars from the American Car & Foundry Co.

The Lake Shore & Michigan Southern has ordered 600 Rodger ballast cars from the American Car & Foundry Co.

The Spokane & Inland has ordered 18 interurban passenger cars and two interurban express cars from the J. G. Brill Co.

The Central of New Jersey has ordered 50 cars from the Middletown Car Works. These cars will have steel underframes.

The Buffalo, Rochester & Pittsburg, it is reported, will shortly be in the market for new passenger equipment for 1906 delivery.

The Milwaukee Refrigerator Transit Company, Milwaukee, Wis., will buy or build 100 additional refrigerator cars about the first of the year.

The Great Northern, as reported in our issue of October 20, has ordered 300 ore cars of 100,000 lbs. capacity from the American Car & Foundry Co.

The Lehigh Valley has ordered 1,500 box cars of 80,000 lbs. capacity and 1,000 gondola cars from the Standard Steel Car Co. and 500 box cars from the American Car & Foundry Co.

The Armour Car Lines, Chicago, are building 200 of their standard fruit cars at their Chicago shops. These will be followed by an additional 400 of the same type, which will probably be completed this winter.

The Northern Pacific has ordered 500 National coal dump cars and will build at its own shops about 3,000 stock, coal and box cars in addition to the 3,000 cars ordered from the Pullman Co. and reported in our issue of November 3.

The Chicago, Burlington & Quincy has ordered 400 Hart convertible ballast cars from the American Car & Foundry Co. for February, 1906, delivery. These cars will weigh 39,500 lbs., and will measure 36 ft. long x 9 ft. wide x 8 ft. 3¼ in. high over all.

The Chesapeake & Ohio has ordered 2,000 gondola cars from the Western Steel Car & Foundry Co., 1,000 gondola cars from the American Car & Foundry Co., and 1,000 gondola cars from the Standard Steel Car Co., and is reported as having ordered 13 passenger cars from the Pullman Co.

The Cold Blast Transportation Company, as reported in our issue of October 27, has ordered 200 refrigerator beef cars of 60,000 lbs. capacity from the American Car & Foundry Co. for December, 1905, delivery. These cars will be 34 ft. 6 in. long and the bodies and underframes will be of wood.

The Atchison, Topeka & Santa Fe has ordered 100 tank cars from the Standard Steel Car Co. and 1,000 box cars from the American Car & Foundry Co. These are in addition to the 500 flat cars ordered from the Western Steel Car & Foundry Co. which were reported in our issue of November 3.

The Delaware, Lackawanna & Western, as reported in our issue of November 3, has ordered 500 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., 500 box cars of 60,000 lbs. capacity from Barney & Smith, and is building 2,400 box cars, 200 stock cars and 100 carriage cars all of 60,000 lbs. capacity at its own shops.

The Indianapolis & Cincinnati Traction has ordered 10 passenger and four express freight cars from Barney & Smith for February, 1906, delivery. All of these cars will be 55 ft. long and 8 ft. 10 in. wide over all. The special equipment includes: Westinghouse air-brakes, Van Dorn couplers, Pantasote curtain material for the passenger cars and Baldwin trucks.

The Cincinnati, New Orleans & Texas Pacific is in the market for 250 flat cars of 80,000 lbs. capacity. These cars will be 40 ft. long and 8 ft. 10 in. wide, over sills. The special equipment includes: Buffalo brake-beams, Westinghouse air-brakes, Ajax brasses, Climax couplers, Miner tandem draft rigging, Harrison dust guards, Symington journal boxes, Railway Steel Spring Co.'s springs and arch-bar trucks.

The Twin City Rapid Transit is building 51 passenger cars at its Milwaukee shops. These cars will weigh 60,000 lbs. each, and will measure 34 ft. long x 9 ft. 3 in. wide x 11 ft. 8 in. high. The special equipment includes: Jones & Laughlin axles, National electric air-brakes, Curtain Supply Co.'s curtain fixtures and material, Baker heating system, Symington journal boxes, Baldwin trucks and Pittsburg standard wheels.

The Coal & Coke, as reported in our issue of October 27, has ordered three passenger coaches from the Pullman Co., for March, 1906, delivery. These cars will be 52 ft. long, 9 ft. 8 in. wide, over all, and 10 ft. ¼ in. high at eaves. The special equipment includes: Sterlingworth brake-beams, Westinghouse air-brakes, Janney couplers, Forsyth curtain fixtures, Pantasote curtain material, Safety heating system, and Coal & Coke Railway Co.'s standard paint.

The Atlantic Coast Line has ordered 15 wide-vestibule passenger cars from Barney & Smith. These cars will be 60 ft. long and the special equipment will include Westinghouse high-speed brakes and American slack adjusters, Climax journal boxes, Damascus bronze solid journal bearings, standard steel platforms, Westinghouse friction draft-gear, Barney & Smith walk-over seats, Pintsch gas lighting system, and Ajax diaphragms.

The New Orleans Great Northern, as reported in our issue of October 27, has ordered three coaches, three baggage, mail and express cars and one buffet parlor car from Barney & Smith. All cars will be 70 ft. long, 9 ft. 8 in. wide, and the coaches and buffet car will be 6 ft. 8½ in. high, the baggage, mail and express cars 6 ft. 1½ in. high, all inside measurements. The special equipment for all includes: Barney & Smith brake-beams, Christie brake-shoes, Tower couplers, Forsyth curtain fixtures and Blount door fastenings for coaches and buffet car, Magnus Metal Co.'s journal boxes, Pintsch light, Barney & Smith standard trucks and Pullman vestibules for coaches and buffet car.

BRIDGE BUILDING.

Indianapolis, Ind.—Plans have been completed by County Engineer Harry Klausman and accepted by the Board of County Commissioners for the new bridge to be built at Thirtieth street over Fall creek. This will be the last bridge to be built out of the appropriation made for new bridges after the floods of 1904. The proposed structure will be a Melan arch consisting of three spans of concrete or reinforced concrete construction, 291 ft. long and 40 ft. wide, to cost $75,000.

Ironton, Ohio.—A contract has been given to the American Bridge Co. which calls for 12,000 tons of fabricated steel for the new bridge to be built over the Ohio river between this place and Ashland for the Cincinnati, Hamilton & Dayton.

Little Rock, Ark.—County Road and Bridge Commissioner Reichardt has made surveys for a steel bridge 14 miles from this place in Brodie township.

Milwaukee, Wis.—The finance committee of the City Council has approved the issuance of $150,000 of bonds to pay part of the cost of the two bridges to be built at First avenue and at Sixth street. The committee also recommends the building of the Park bridge over the North-Western tracks at Riverside Park.

Morgan City, La.—The Southern Pacific has decided to build a steel bridge over the Atchafalaya river at this place to cost $500,000. The proposed bridge will be built on nine cylinder concrete piers just below the present structure and will consist of six fixed spans 235 ft. 6 in. each, with a draw 272 ft. long, making a total of about 1,682 ft. The company is also remodeling the San Jacinto bridge, and when this work is completed, the Southern Pacific line between New Orleans and San Francisco will, it is said, be able to carry the heaviest rolling stock.

Oklahoma City, Okla. T.—The County Commissioners at a recent meeting decided to build a new steel bridge 100 ft. long over the Canadian river at the foot of Robinson street.

Owen Sound, Ont.—The Town Council will build a steel bridge over the Sydenham river to cost $10,000.

Paisley, Pa.—The bridge to be built over the Monongahela river at McCann's Ferry by the Uniontown & Wheeling Short Line will be a double-deck structure somewhat similar to the Allegheny river bridge at Tenth street, Pittsburg. The upper deck will be used for a steam railroad and will carry one track. The lower deck will carry two tracks for an electric road and will also accommodate the highway traffic. The length of the entire structure will be between 1,500 and 1,600 ft. The channel span will be 425 ft. long and 120 ft. above the river.

Pittsburg, Pa.—A contract has been given by the Pittsburg & Lake Erie for building a concrete bridge over Turtle creek on the Monongahela division, to consist of three 36-ft. arches to carry five tracks, to the Dravo Contracting Co., to replace the present structure carrying two tracks. A contract has also been let for a bridge over Brady's run at Bridgewater, near Beaver Falls, to consist of two arches of 20 ft. each and one of 28 ft. to carry four tracks, to Stratton-Lewis & Co. The same company recently let the contract for a two-track steel bridge over the Shenango river at Newcastle Junction, and an addition to the present double-track bridge, making it four-track. The company is four-tracking many of its bridges on the main line north of Pittsburg and double-tracking those on the division south of Pittsburg. A contract has also been let to Robert A. Cummings for building a concrete retaining wall along the river road at Esplan Borough.

Pittston, Pa.—The Warwick Iron & Steel Co. will at once begin building a steel bridge 600 ft. long on concrete piers over the Schuylkill river; it will be used to carry cars containing slag from its furnace to North Coventry.

Sioux City, Iowa.—Plans are being made for building a subway on Iowa street under the tracks with approaches and superstructure about 1,600 ft. long, to cost about $255,000.

Tacoma, Wash.—The County Commissioner of Pierce County, Wash., has extended to November 24 the time for receiving bids for

the piling work on Lincoln avenue and building a drawbridge over Hylebos creek near Tacoma. A. J. Weisbach is Deputy County Commissioner.

Three Rivers, Que.—An officer of the St. Maurice Valley writes that this company will build a steel deck truss bridge at Head Race 112 ft. long; also a steel arch bridge 270 ft. long over the St. Maurice river at the Gorge crossing, and a second bridge over the same river to consist of seven spans each 150 ft. long. W. S. Hart, of this place, is Secretary and Treasurer.

Topeka, Kan.—The Atchison, Topeka & Santa Fe and the Topeka Street Railway Co. are planning to jointly build a viaduct over the tracks of the former at Branner street.

Toronto, Ont.—The City Engineer has recommended to the Board of Control the building of a swing bridge or a rolling lift bridge over the western gap, to be used as a street car route to the island. The cost of the bridge will be about $200,000.

Other Structures.

Battle Creek, Mich.—The Grand Trunk is putting up a stone passenger station 250 ft. long to cost $100,000.

Faithhorn, Ill.—A contract has been given by the Chicago Southern to Magnus Yeager, of Danville, Ill., at $400,000 to build a new roundhouse, station, offices and other buildings at this place, which is 10 miles south of Chicago Heights.

Kalamazoo, Mich.—The Grand Rapids & Indiana Railroad has bought 40 acres of land at Kalamazoo and is planning to make extensive improvements in the spring, including a new roundhouse, a water tank, coal sheds and other buildings.

Lynchburg, Va.—The Southern Railway has agreed to build an additional receiving freight house 25 ft. x 420 ft. here.

Malone, N. Y.—The New York Central & Hudson River, it is said, has plans ready for putting up shops here to cost $170,000.

Pine Bluff, Ark.—The St. Louis, Iron Mountain & Southern and the St. Louis Southwestern will jointly build a union station at this place.

Pueblo, Colo.—The Denver & Rio Grande has bought about 93 acres of land as a site on which it will build new shops and a roundhouse at a cost of about $300,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Bangor & Aroostook (Northern Maine Seaport).—This company has completed its line from Lagrange south to Stockton and Searsport, on Penobscot Bay, and an officer says that the road will be in operation some time this month, probably on the 20th. Completion of this line gives the Bangor & Aroostook a tidewater connection. A branch line, under the name of the Bangor Terminal, is being built from the town of Hermon, in Penobscot County, east to Bangor, which will give an entrance into that city. From the southern terminus of the road on Penobscot Bay, a line of steamers will be run to Boston and New York.

Boston Elevated.—This company has reached an agreement with the city officials of Boston, subject to the approval of the City Council, for building two two-track subways between Harvard Square, Cambridge, and Boston. One line will be through Massachusetts avenue and Main street to the new Cambridge bridge, and the other through Cambridge street to the new Charles river dam.

Brooklyn Grade Crossing Commission.—The lowest bid for the work on section No. 2 of the Brighton Beach improvements, which calls for the depressing of about 6,800 ft. of roadbed and elevating rails from Avenue G to Church avenue, Flatbush, is said to be that of Charles Crawford, whose bid was $509,000, which was $9,000 less than the next lowest bidder. It is the intention to begin work this fall and have it completed by May 1, 1907. At one point in section No. 2, the Brighton Beach tracks will be raised to go over the Long Island tracks near Vandeveer Park, the former's tracks being depressed at that point.

Canadian Pacific.—This company is building an extension of the Crow's Nest Pass branch to Macleod, Alberta.

Central Railway of Oregon.—This company, which was incorporated last June in Oregon, with a capital of $2,000,000, has recently issued bonds to carry out the work of building its proposed belt line in the Grande Ronde valley, Union County, Ore. The proposed line will connect Elgin, Cove, Union, Hot Lake and La Grande, and will be a feeder for the O. R. R. & N.

Chicago & North-Western.—See Wyoming & Northwestern.

Chicago, Milwaukee & St. Paul.—See White River Valley.

Cleveland, Cincinnati, Chicago & St. Louis.—A contract is reported let by this company to O. D. Guilfoil, of Terre Haute, Ind., for grading and filling on its road from Burnett, Ind., to Carbon, and for laying a second track for a distance of about 10 miles on this section of the road. The double track work from Markles Station to Burnett has been completed by Contractor Wells, of St. Louis.

Colorado Southern, New Orleans & Pacific.—This company, it is said, has given a contract to the Kenefick, Hammond & Quigley Construction Co., of Kansas City, Mo., for building its proposed road from De Quincy, La., on the Kansas City Southern, east to Baton Rouge, a distance of 250 miles, with a southern branch 50 miles long to connect with the Southern Pacific. (November 3, p. 143.)

Decatur, Sullivan & Mattoon Transit.—An officer writes that this company has been granted a charter in Illinois, but has not as yet determined the route of its proposed electric railroad, which is to run from Decatur, Ill., southeast to Mattoon, a distance of about 42 miles. The character of the work will be light, maximum grades being 1 per cent. and maximum curvature 2 degrees. There will be one steel bridge and two trestles. No contracts have yet been let. A. B. Starbuck, of Mattoon, Ill., is President; J. M. Clokey, Vice-President, and W. A. Steele, Secretary and Treasurer. (October 27, p. 134.)

Deepwater.—See Tidewater below.

Fulton County Narrow Gage.—This company has changed its road from narrow to standard gage from Galesburg to Lewiston, Ill., 50 miles. The rest of the road, from the latter point to Havana, on the Illinois river, will be widened next spring.

Gila Valley, Globe & Northern.—This company has given a contract to Sherer & Co., of Los Angeles, Cal., for rebuilding its line from San Carlos to Fort Thomas, a distance of 31 miles. The line will leave the river at San Carlos and follow higher ground above the flood level for the entire distance; and will be straightened and leveled.

Kansas City, Galveston & Mexico.—A charter has been granted a company under this name in Oklahoma Territory, with a capital of $10,000,000, and offices at Guthrie, Kansas City, Mexico City and New York, to build a railroad from Kansas City to Port Progresso, State of Yucatan, Mex. The proposed main line is through Kansas, Indian Territory and Texas, passing through Denison, Dallas, Waco, Austin and San Antonio. Three branches are also proposed. One from Wagoner and Sapulpa, Ind. T., west to Guthrie; another from Dallas west to Fort Worth, and a third from Austin to Houston and Galveston. The incorporators are: G. V. Pattison, H. W. Pentecost, N. D. McGinley and others, of Guthrie.

Kansas City Southern.—Surveys, it is said, have been completed by this company for a line eight miles long from its Lake Charles line west to Sulphur, La.

North Carolina Connecting.—The incorporators of this company, mentioned last week, include: D. W. Gunn, of Roanoke, La.; D. J. Nysewander and S. P. Douglas, of Toledo, Ohio; T. F. Whittlesy, of Mobile, Ala.; W. H. Hood and R. H. Hood, of Henderson.

Northern Maine Seaport.—See Bangor & Aroostook above.

Oglesby & Granville.—A contract is reported let by this company to the Gentry Construction Co., of Chicago, for building its proposed road from Oglesby, in La Salle County, Ill., west to Granville, in Putnam County, a distance of 12 miles. Grading has been commenced. S. T. Crapo, Chicago, is President, and D. C. Dunlock, Granville, Ill., is Chief Engineer.

Oklahoma Central.—Announcement has been made that this company has let contracts for work on its proposed road from Lehigh to Chickasha, Ind. T., as follows: M. B. Ryan, of Shawnee, Okla. T., all the bridges, trestles and culverts; E. N. Taylor, of Atoka, Ind. T., 400,000 ties and pilings; Walls, Hale & Crain, for grading the first 11 miles out of Lehigh; A. B. McKinley, all bridges and timber for the first three miles; and to the Wisconsin Bridge & Iron Co., Chicago, for building a steel bridge 86 ft. long over Leader creek. W. J. Terry, of Ada, Ind. T., will have charge of the construction work.

Pacific & Idaho Northern.—This company, which operates a line from Weiser, Idaho, to Council, a distance of 60 miles, has given a contract to J. W. & B. W. Slick, of Salt Lake, to grade 6½ miles north from Council. The contract calls for the completion of the work within 90 days. Grading has already been completed on an additional 8½ miles, and track laying will soon be commenced on this section. (June 16, p. 199.)

Pennsylvania.—This company has agreed with the city authorities of Philadelphia for the elevation of its tracks in that city from Venango street to Norris street. From Venango street to Cambria street there will be an embankment walled by masonry, and from that point to Norris street a steel viaduct. The

Philadelphia & Reading tracks will pass under the structure at Trenton avenue near Lehigh avenue. Bids, it is said, are being asked by the Pennsylvania for the work. The cost is estimated at $1,500,000, of which the city will pay $750,000.

This company proposes to extend and improve the west-bound classification yard at Hollidaysburg. The work is extensive, but the plans have not yet been completed.

Pine Bluff, North & South.—This company, which was organized in Arkansas to build a railroad from Point Pleasant, Ark., to Roanoke, 46 miles, has decided to begin work at once. Z. Orte is President. (April 21, p. 131.)

Pittsburg, Binghamton & Eastern.—E. W. Sawyer, Superintendent of this company, says that work will at once be started on the road. Three construction crews will be organized. One between Canton and Ansonia, where connection is to be made with the Buffalo & Susquehanna; another will work from Towanda east and west, and the third from Binghamton westward. An auxiliary company—the Central Pennsylvania Coal Co.—has been organized, and has leased 7,000 acres of coal fields in Lycoming and Tioga Counties. A branch railroad will be built south from the main line to these coal fields. (August 18, p. 55.)

Providence & Burrillville Street.—This company has opened its new electric line from Providence, R. I., north to Woonsocket, a distance of 14 miles.

St. Maurice Valley.—An officer writes confirming the report that this company has given a contract to Ross & McRae for building its proposed railroad from Three Rivers, Que., northwest to Shawinigan Falls, following the south bank of the St. Maurice river and crossing at Grés Rapids, approximately 22 miles. Ten miles of the proposed route consists of prairie work, and the balance of heavy clay and rock work . The grades northbound will be 1 per cent., and 0.5 per cent. southbound, with a maximum curvature of 8 degrees. The work includes the building of a steel deck truss bridge at Head Race, 112 ft. long; at the Gorge crossing of the St. Maurice river, a steel bridge 270 ft. long, and at a second crossing of the same river a bridge of seven spans, each 150 ft. long. W. S. Hart, of Three Rivers, is Secretary and Treasurer of the company. (October 20, p. 127.)

Tidewater.—This company, which proposes to build a railroad from tidewater at Norfolk, Va., west to the western boundary of Virginia, where Mercer County, W. Va., joins Giles County, Va., a distance of 350 miles, has 100 miles under construction from Norfolk west, and has recently asked for bids to build from that point westward. This road is being built in connection with the Deepwater, which will continue the line from the Virginia state line about 110 miles to Deepwater, W. Va.

White River Valley (C., M. & St. P.).—This company has put in operation its new line from Chamberlain, S. Dak., on the Chicago, Milwaukee & St. Paul, west to Presho, a distance of 40 miles. The road will be extended west an additional 160 miles to Rapid City. (April 28, p. 144.)

Wise Terminal.—This company, which owns a line 6 miles long, running from Norton in Wise County, Va., north to Glamorgan, Va., is putting in a new connection with the Norfolk & Western at Norton. This road recently ran a preliminary survey from its terminus at Glamorgan north to a connection with the proposed extension of the Chesapeake & Ohio's Big Sandy branch from Pikeville, Ky. It will probably make location this winter and be ready to commence work in the spring. The new line will open up a rich coal and timber district.

Wyoming & Northwestern (C. & N. W.).—An officer writes regarding the extension being built by this company from Casper, Wyo., northwest via Wolton and Shoshoni, a new town, thence southwest to Lander, approximately 145 miles, that work is now under way by the Kilpatrick Bros. & Collins Contracting Co., of Beatrice, Neb., which has the contract for all the construction, except the buildings. Eight miles of track have been laid. E. C. Carter, Chief Engineer, Chicago, Ill.

RAILROAD CORPORATION NEWS.

Atlantic Coast Electric.—The property of this company has been sold under foreclosure to A. H. Joline, for a price said to be $700,000. (June 23, p. 207; June 30, p. 216.)

Bangor & Aroostook.—The gross earnings of this road for the year ending June 30 were $2,159,072, an increase over the figures for last year of $143,716. Net earnings were $782,359, an increase of $25,945. One hundred and five thousand dollars was paid for betterments, this being an increase of $25,500. The surplus after charges was $125,999, an increase of $9,155.

Canadian Pacific.—The gross earnings increased in September, 1905, as compared with September, 1904, $651,699, and the increase in net was $507,202. Corresponding increases in the figures for the three months ended September 30 were $1,204,536 and $959,040. The comparatively large increases in net earnings thus shown are due to the fact that this year the Canadian wheat crop is so large that the road has been able to move a large quantity of it before such cold weather sets in as to make operating expenses large.

This company has leased the Tilsonburg, Lake Erie & Pacific, and will take possession November 15. The road runs from Port Burwell to Ingersoll, Ont., 35 miles, and has $400,000 stock and an authorized funded debt of $875,000.

Detroit & Mackinac.—The annual report for the year ended June 30, 1905, shows gross earnings of $990,555, an increase over the previous year of $9,240, and operating expenses of $635,071, an increase of $31,914, leaving net earnings of $355,484, a decrease of $22,674.

Gainesville Midland.—The stockholders have authorized an issue of $625,000 5 per cent. 30 year bonds, the proceeds of the sale of which are to be used to pay for the extension from Jefferson, Ga., to Athens, 19 miles, and to retire the present issue of $225,000 6 per cent. bonds of 1909.

Illinois Central.—The gross earnings for the three months ended September 30 were $11,724,891, a decrease, as compared with the same period last year, of $635,208. The net earnings were $3,081,723, an increase of $876,859.

Louisiana & Arkansas.—During the year ended June 30, 1905, gross earnings increased from $704,671 to $844,536. Operating expenses were $521,712, an increase of $33,917, making the increase in net earnings $105,947. The surplus for the year was $201,522, an increase of $86,065. There was a large decrease in the value of improvements charged to capital and in the maintenance of way account. There were 20 miles more operated than in 1904.

Norfolk & Western.—The gross earnings for the three months ended September 30 were $6,920,295, an increase over the figures for 1904 of $1,150,403, or about 20 per cent. The operating expenses were $4,204,823, an increase of $841,086, leaving net earnings of $2,715,472, an increase of $309,317. The operating ratio for this period increased from 58 per cent. to 61 per cent.

Raleigh & Charleston.—This company has been incorporated with a capital of $850,000 as a reorganization of the Carolina Northern, which was recently sold at a receiver's sale. The Carolina Northern runs from Lumberton, N. C., to Marion, S. C., 40 miles, and has $500,000 capital stock outstanding.

Reading.—The September gross earnings of this company, whose properties consist of the Philadelphia & Reading Railway and the Philadelphia & Reading Coal & Iron Co., were $6,076,478. This amount is the largest on record except that for last May, which was $7,192,524. These results are due more to the prosperity in the coal trade than to any great increase in the earnings of the railroad. In May, the output of anthracite coal by the Reading was 1,262,074 tons, the total output of all other companies being 6,005,158 tons. In September, the figures were 1,067,916 tons and 5,082,232 tons respectively. The gross earnings of the company during September, 1904, were $4,789,696. The net earnings for September, 1905, were $1,852,684, as compared with $1,955,435 during May. The gross earnings of the Philadelphia & Reading Railway during September, 1905, were $3,509,358, as compared with $3,550,477 for May, 1905, and $2,817,874 for September, 1904. The net earnings for the three periods were respectively $1,593,212, $1,522,398 and $1,259,657. The surplus over fixed charges of the Reading Co. for September, 1905, was $984,184. Deducting from this amount $233,334, which is one-twelfth of the annual dividend on the $70,000,000 first and second preferred stocks, there is left $750,851 available for dividends on the common stock. This figure shows that the company is at present earning at the rate of 12 per cent. per year on its common stock, it having earned about 10 per cent. on the common stock during the year ended June 30, 1905. The trading in this stock on the New York Stock Exchange has been very active since June 30. At that date it was quoted at 99½ and it is now about 140; 24 points of this advance having been made during the last two months and 16 during the last two weeks.

Southern Pacific.—The increase in gross earnings for the three months ended September 30 was $2,615,891, and in net earnings $1,273,933. For the month of September, the increase in gross earnings was $744,709, and in net earnings, $296,493.

Union Pacific.—During the quarter ended September 30, gross earnings increased $2,518,406, and net earnings, $1,324,247. The increases in gross and net for the month of September were $781,650 and $405,263 respectively.

GENERAL NEWS SECTION

NOTES.

The Erie Canal is to be closed November 28.

According to a press despatch the Denver & Rio Grande is to have ticket collectors on its passenger trains.

At Marengo, Iowa, November 9, Eric von Kutzeben was sentenced to imprisonment for life for maliciously derailing a passenger train of the Chicago, Rock Island & Pacific at Homestead, Iowa, on the 21st of March last.

A press despatch from Winnipeg says that the Canadian Pacific is to carry 2,000,000 bushels of wheat by rail from Fort William to St. John, N. B. The wheat is to furnish the loads for the first sailings from St. John of the Canadian Pacific transatlantic steamers.

The Railroad Commission of Georgia has taken measures to recover in the courts the legal penalties against the Louisville & Nashville for failure to obey an order to put up a station building at Blackwells and failure to furnish certain information asked for by the Commission.

The Railroad Y. M. C. A. in the yard of the Pere Marquette road at Grand Rapids, Mich., will soon have a new building, the last contracts having just been let. The building is to cost $15,000 and a good share of the first cost and of the running expenses will be borne by the Pere Marquette Railroad Company.

Two new ferryboats for the Central Railroad of New Jersey were launched at the yards of the Harlan & Hollingsworth Company, Wilmington, Del., November 11. The boats were christened "Cranford" and "Somerville," and are identical in every respect. They are of the double screw, double deck type, with landings from each deck. The hulls are entirely of steel and are divided by five water-tight compartments.

The Supreme Court of the United States on November 13 reversed the decision of the Kentucky Court of Appeals in the case of the Union Refrigerator Transit Company vs. the Commonwealth of Kentucky, and held that the cars owned by the company and used in other states cannot be taxed in that state, even though it be a Kentucky corporation. The opinion of the court was delivered by Justice Brown.

The Los Angeles *Examiner* reports the total shipments of citrus fruits eastward from southern California for the year ending October 31, as follows: Oranges, 25,553 cars; lemons, 4,336 cars. From northern California there were 1,835 cars of oranges, making a total from California of 31,725 cars, an increase of 2,104 cars over the preceding year. According to the same authority the number of cars of oranges sent north from Florida this year has been 7,500.

A public spirited citizen of Camden, N. J., offers a prize of a thousand-dollar death-benefit certificate in a fraternal insurance organization to the conductor of the Camden & Suburban Street Railroad who secures the best record of good conduct and courteous attention to passengers, and a similar prize to the most efficient motorman. The marking of the conductors and motormen is to be entrusted to a committee selected from among passengers who regularly ride on the cars.

The Railroad Commission of Georgia, basing its decision on numerous inquiries and complaints, has ordered that after the first of May next, no railroad shall be allowed to collect freight charges based on a weight which depends on the marked weight of an empty car, unless the car has been weighed since November 1. In other words, all cars must be reweighed within the next six months. The weighing must be done by a sworn weigher, and he must send his sworn certificates for all cars to the office of the commission.

The Railroad Young Men's Christian Associations along the line of the Buffalo, Rochester & Pittsburg now have an educational director who attends to that department of the work at the three principal points on the company's lines—Buffalo, DuBois and Salamanca Junction. President Yates, of the railroad company, writing recently in commendation of the work of the Y. M. C. A., said that his company had contributed to it during the past year about $30,000, in addition to ordinary expenses, this sum having been appropriated chiefly for important additions to the Y. M. C. A. buildings at the places above named.

For the delegates attending the recent "Interstate Commerce Law" convention, at Chicago, a special round trip rate was requested, and the railroads agreed to carry them home at one-third fare, provided 100 delegates asked for the reduction; but, although about 900 persons attended the regular and the "rump" conventions, only 91 asked for the special rate. On this state of facts a Chicago reporter concludes that the other 809 rode on passes. As, presumably, the reduced rate did not apply on tickets for short distances, the reporter's conclusion does not by any means follow; but it will amuse his readers—especially with his scare head "FOES OF RAILROADS TRAVEL ON PASSES."

The Attorney-General of the United States has brought suit in the Federal Court in Wisconsin, Eastern District, to test the legality of commissions paid by railroads to refrigerator car companies. The suit is against the Pere Marquette, the M., K. & T., the Wisconsin Central and other roads, the Milwaukee Refrigerator Transit Company and the Pabst Brewing Company. The refrigerator company is owned by stockholders of the brewing company and controls shipments from the brewery; and the railroads have paid the refrigerator company 12 per cent. commission on shipments of beer in the refrigerator company's cars. This percentage, apparently, is in addition to the regular mileage paid for the use of the cars. The suit is brought under that clause of the law which makes it unlawful, by any device whatever, to carry freight at less than the published tariff rate.

At Washington last Monday representatives of the railroad labor unions called on President Roosevelt to protest against freight rate legislation. There were representatives of five of the brotherhoods, the engineers, firemen, conductors, switchmen and trainmen. They averred that rate legislation logically meant the lowering of rates. This they contended would be followed by a lessening of the earning power of railroads and, consequently, by reduction of wages. George Huntley, of the conductors' organization, was the chief speaker. He assured the President that no taint of partisanship or political coloring existed in any degree among the remonstrants. In response President Roosevelt assured the delegation that it was not his purpose or the purpose of those who favored railroad rate regulation to do anything that might injure the railroads of the country or incidentally the employees of the railroads. He said that it was his purpose that all classes—railroads, shippers and employees—should have perfectly fair treatment. He was of the opinion that the proposed legislation would not necessarily mean a reduction in rates; discrimination was the main thing aimed at. Those who had complained to the President had in some cases charged discrimination not only by rates that were too high but by rates (made to favor some big shipper) that were too low.

Decreased Personal Injury Damages in Texas.

From a statement of the auditor of the Texas Railroad Commission printed in the *Galveston News* it appears that in the last fiscal year the railroads of Texas paid out for damages on account of persons killed and injured 27 per cent. less than in the year preceding—which encourages the belief that the efforts of Mr. Markham and others to expose and kill off the outrageous "damage-suit industry" of the state, have had good effect. The principal figures in the statement are:

Payments made on account of injuries to persons by Texas railroad companies:

Name of railroad.	Year ended June 30, 1904.	1905.
Galveston, Harrisburg & San Antonio	$311,760	$188,515
Gulf, Colorado & Santa Fe	217,330	164,907
Houston & Texas Central	122,049	83,388
International & Great Northern	153,259	175,058
Missouri, Kansas & Texas Ry. of Texas	308,889	208,718
Texas & New Orleans	191,940	82,745
Texas & Pacific (in Texas)	138,313	106,948
Total, including these and 45 other roads	$1,873,793	$1,368,583

Combination of European Makers of Railroad Equipment.

The Arthur Koppel Co. and Orenstein & Koppel, both of Berlin, Germany, which are two of the largest makers of complete railroad equipments in the world, have formulated a working agreement which practically amounts to a consolidation and hereafter will conduct their combined business in all parts of the world under one management. Both companies make and sell all kinds of railroad equipment for broad, standard and narrow gage roads, including track and switches, ties, locomotives, cars, etc., of every type. The Arthur Koppel Co. has six works in Europe and two subsidiary companies' works in Russia. About 75 district sales offices are established in all parts of the world. Orenstein & Koppel have large works in Berlin and a large number of branch sales offices in Europe and Asia. The combined capital of the two companies is 17,000,000 marks. In this country the consolidated sales will be handled through the New York office of the Arthur Koppel Co.,

which will be in charge of Louis H. Abenheimer and Robert Lindenthal, General Managers. Mr. Abenheimer was formerly in charge of the Egyptian branch of the company and Mr. Lindenthal has been for some years in charge of the local office.

British Thomson-Houston Contracts.

The British Thomson-Houston Company, Limited, which is controlled by and represents the British interests of the General Electric Company of New York, has been awarded the contract for the motor equipments to be installed on the trains to be operated by the Great Western Railway Company and the Metropolitan Railway Company on the new Hammersmith and City line, London. There will be 20 trains in all. Each will have six coaches. The B. T.-H. type G. E. 76 motors will be used. The Sprague-Thomson system of control will also be employed. The value of the contract is about $750,000.

A "Passive" Strike in Austria.

Press despatches of November 10 report that the employees of the railroads of Austria have begun a "passive" strike, such as that which occurred in Italy a few months since. The strikers do not leave their work, but they endeavor to carry out the requirements of their regulations so strictly as to greatly impede the traffic.

Coaling Stations for the Pennsylvania.

The Pennsylvania is building coaling stations at Thorndale, on the Philadelphia division, and at Denholm, on the middle division. The stations are to coal and water six locomotives at one time. Parallel tracks for six trains are being laid.

Still Appropriate.

Little Willie—"Papa, why does the railroad company have those cases with the axe and saw in every car?" Father—"I presume they are put in to use in case any one wants to open a window."—*Puck.*

New Automatic Signals on the Reading.

The Philadelphia & Reading is equipping with Hall automatic disk block signals (normal danger) its double-track line between Harrisburg, Pa., and Shippensburg, 41 miles; also certain double-track sections on other divisions, making in all 50 miles of automatic block signaling, double-track.

Some Rapid Machine Calculations.

In the second annual Office Appliance and Business System Show, Madison Square Garden, New York City, October 28 to November 4, 1905, there was a series of adding machine and calculating machine contests which produced some surprising results in the way of speed and accuracy in machine calculation. Miss May Maher, an operator in the offices of the Chicago, Burlington & Quincy Railroad, Chicago, added 500 items, each on a separate piece of paper, and handled the papers, in 4 min. and 19 sec. Miss Mae Barclay, with the Illinois Central, Chicago, performed the same task in 4 min. and 21 sec.; and Miss Ollie Crow, also of the Illinois Central, did the same thing in 4 min. and 28 sec. Each of the three was accurate, and beat the world's record for rapid addition which previously was held by Miss Annie Maloney, of Marshall Field & Co., Chicago, who made the time of 4 min. and 55 sec. at the Coliseum, Chicago, in March, 1905. The machine used by all of the winners in both of these tests, which were open to all makes of machines, was the "Comptometer," made by Felt & Tarrant Manufacturing Co., Chicago.

In another contest at Madison Square Garden, also open to all makes of machines, 25 multiplications were performed by Miss Thea E. Swanson with Swift & Co., Chicago, in 2 min. and 5 sec. The second prize in this contest was won by Miss Caroline Engl, of the Western Electric Company, New York, in 2 min. and 18 sec. The multiplication examples averaged four places by three places, as 1637 x 374. There were four contestants, the slowest time being 2 min. 35 sec. The prize winners obtaining these remarkable results in both adding and multiplying contests used the "Comptometer."

The Mexican Car & Foundry Company.

The Mexican Car & Foundry Company, which has within the last few days put in operation a good sized plant in the vicinity of Mexico City for the building of railroad cars, has secured some contracts from railroads in the Southern Republic. The San Rafael & Atlixco has ordered 50 freight and four passenger cars, and the Chihuahua & Pacific have ordered a baggage car. These contracts call for deliveries inside of 90 days. The Mexican Car & Foundry Company was organized about two years ago by Isaac M. Hutchison, of Mexico City, who represents the interests of the American Locomotive company, the Niles-Bement-Pond Company, the Chicago Pneumatic Tool Company and other prominent North American manufacturing concerns. Mr. Hutchison is president of the company, whose stock is understood to be largely held in the states. Robert J. Gross, one of the Vice-Presidents of the American Locomotive Company, has just been elected a director of the Mexican company. It is officially stated, however, that the American Locomotive Company is not identified with the enterprise.

A New Design of Mechanical Draft Fan.

In handling hot gases with a fan, as in an induced draft plant for boilers, the fan shaft cannot be given a suitable bearing at the inlet side, as it would be constantly surrounded by hot flue gases. The best practice has been to use an over-hung wheel, having in addition to the two engine bearings, a bearing on the engine side of the fan, but none on the inlet side. This construction, though, gives

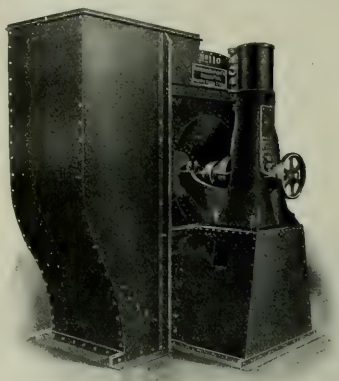


Fig. 1—A New Design of Mechanical Draft Fan.

trouble through difficulty in lining up this bearing with the two engine bearings. Fig. 1 shows a method lately adopted for overcoming this trouble. All three journal boxes are cast in the engine frame and can be bored with the same boring bar, assuring perfect alinement. This also avoids the need of a self-alining bearing, simplifying the arrangement. The bearing being supported by the engine bed instead of by the fan housing further simplifies the construction by doing away with the additional bracing which would otherwise be required. The wheel (Fig. 2) has some new features of construction. Instead of three spiders there is one heavier one, built of I beams cast into the hub. The blades are braced upon each other. It is claimed that this construction is as strong and rigid as the three-spider form. The use of a single spider obviates the necessity for more than one hub on the shaft. This concentrates the load

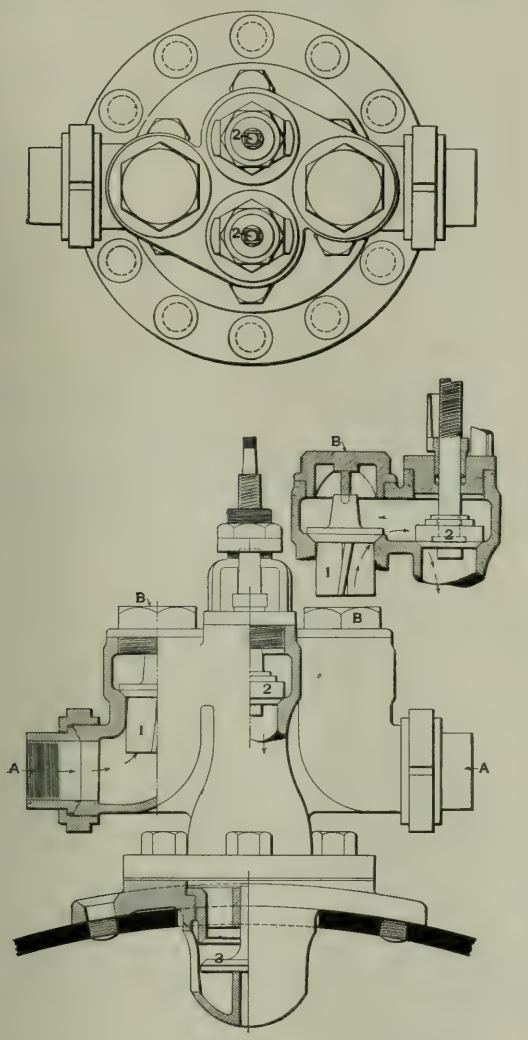
Fig. 2—Wheel for New Design of Mechanical Draft Fan.

of the wheel upon a comparatively short length of shaft. Also, the deep cone in the casing and the position of the fan bearing brings the load of the fan quite near to the fan housing; in fact, the bearing is included within the width of the fan blades. This point is claimed to be of considerable importance, since, with the three-spindle design of fan the center of gravity would be some distance out from the bearing and there would be a tendency of the shaft to move on the fan bearing as a fulcrum and cause an upward thrust in the engine and on the engine journal caps. With the single spider this trouble is not experienced. The engine is of the enclosed type, oiled by a specialy devised pump which distributes quantities of oil over the reciprocating and revolving parts, including the eccentric outside of the frame. It is claimed that tests in practice have shown that the engine will run several months with-

out oiling or adjustment. These fans are made by the American Blower Co., Detroit, Mich.

The Phillips Double Boiler Check Valve.

The Phillips double boiler check valve is illustrated herewith. It unites the customary right and left check valves in a single device. Taking up one side, the feed pipe from the injector is attached at A, the path of the water through the valve being indicated by arrows. Valve 1 is raised from the seat by the water, which passes through the opening at valve 2, the latter normally being left open. Valve 3 is a safety valve, to prevent the escape of boiler water or steam in case of an accident to the part of the device about the boiler shell. Should check valve 1 get out of order or need regulating, valve 2 is closed and cap B removed, permitting valve 1 to be examined and the seat reground if necessary. The valves 2-2 for the two sides are independent so that pressure may be shut off on either side, as desired.



The Phillips Double Boiler Check Valve.

The valve is placed on top of the boiler and is thus removed from the scale or mud that may be in the boiler. The valve is made principally of brass. The saddle base is cast iron and a copper gasket is used in the joint between it and the upper part. There are about 500 of these check valves now in use, and the makers have some strong testimonials from users regarding their merits.

The valve was invented by Mr. C. Phillips, Master Mechanic of the Queen & Crescent at Meridian, Miss. It is sold by Jas. E. Minor, 92 Liberty street, New York. There are two styles, F and G, the latter being the one illustrated.

The Recent History of Federal Control of Railroads in the United States.*

BY W. M. ACWORTH.

To attempt to compress within an hour's lecture the recent history of Federal control of railroads in the United States is, I fear, really to attempt to squeeze into a pint pot not merely a quart but a whole barrel. And the more so because, in speaking to an English audience, it is necessary to begin by describing the limitations of the American constitution and distinguishing between state and Federal rights.

We in England know Parliament as a body, in the words of the Bidding Prayer, "over all persons and over all causes within these dominions supreme." Our Parliament might next session repeal the Habeas Corpus Act, abolish trial by jury, confiscate all the land in the country, or do any other impossible thing that it thought fit. There is no redress and no appeal except to a revolution. The highest law court in the land has only to interpret what an Act says. If once its meaning is clear the court has only to enforce the Act, be it ever so repugnant to common honesty or common morality.

In the United States there is no supreme authority. And this for two reasons. In the first place the United States consist of 45 several states, each of which is supreme within its own sphere. And that sphere is a pretty wide one. For example, one state might hang a man for pocket-picking, while the adjoining state might abolish capital punishment altogether. For another example, in some states marriage is, I believe, indissoluble; in others you can get a divorce for incompatibility of temper at a few days' notice. The Federal Government has no power to deal with any matters except such as have been voluntarily assigned to it by the several states. The whole power of the Federal Government to control railroads comes from two lines in the constitution of the United States which declare that the states delegate to Congress "power to regulate commerce with foreign nations and among the several states and with the Indian tribes." The last function is less important nowadays than it was when the constitution was framed.

The second reason why there is no supreme authority in America is this. The Americans have, what we have not, a written constitution, or rather 46 written constitutions, the Federal Constitution and the constitutions of each separate state. The constitution, Federal or state, is the fundamental law and cannot be altered except by very deliberate and exceptional procedure. Till it is altered, the constitution—Federal or state, as the case may be—overrides all laws, which may be passed by the legislatures whether Federal or state. If an Act of Congress or of a state legislature is claimed to be unconstitutional, the courts are appealed to, and if they decide in favor of the claim the law is no law and any citizen may disobey it with impunity. For example, Congress some years ago passed an Act imposing an income tax on all incomes above a certain amount. The Supreme Court of the United States decided that this tax was illegal as contravening a provision of the Federal Constitution that all taxation should be equal. American legislatures then can only pass laws subject to their not being repugnant to the constitution as interpreted by a law-court.

One point more. The constitution provides for a separation of power into three parts, judicial, legislative and executive—executive or judicial functions cannot be given to or assumed by Congress, the President cannot exercise legislative or judicial functions, a law-court cannot act in a legislative or executive capacity. To take a specific instance. Our Parliament a year or two back enacted that the London Water Companies should sell their property to the Metropolitan Water Board at such a price as should be fixed by three arbitrators, only one of whom was a lawyer. Such an Act would be unconstitutional in America. No man can be deprived of his property "without due process of law" which has been decided to mean without the right to appeal to a regular law-court. In listening therefore to what I have to say as to the regulation of railroads by the Federal Government in America, I ask you to keep constantly before your minds (1) the existence of the double authority state and Federal; (2) the existence of a supreme and practically almost unchangeable law, the written constitution; and (3) the impassable line of demarcation between legislative, judicial and executive functions.

Railroad regulation in America naturally began with the several states. The railroad company obtained its charter—as we should say, its Act—from the legislature of the state in which it was situated. Such control over its rates, its method of construction and operation, its taking of land, its employment of servants and so forth, as was exercised, was exercised by the individual state. And if a railroad company confines its operation to a single state it still remains subject to that state and that state only. No legislation of Congress has power to affect it. But the moment it engages in interstate commerce—and this practically every railroad

*A lecture delivered on Oct. 25, at the School of Economics, University of London.

company does, for even if its own lines do not cross the frontier of the state in which it is domiciled, it exchanges traffic with other companies whose lines do cross that boundary—that moment it becomes subject to the Federal power to regulate commerce among the several states. Speaking broadly we may say that at the outset railroads were local concerns, regulated by the state; they have become national concerns and the problem of their regulation has become a national, that is Federal, matter.

The early state regulation was usually of a very slight and perfunctory kind. Everyone was much too anxious to get a railroad to dream of discouraging enterprise by so much as mentioning the word restriction. Sometimes, but not, I think, usually, the original charters contained a schedule of maximum rates. Such schedules, even where they existed, became within a few years as obsolete as the powers to charge 6d. per ton-mile for coal which were in force on some lines in England till the year 1892. Supervision of construction was, as far as I know, unheard of. Regulations as to operation mainly concerned themselves with matters such as the lawfulness of running trains on the Sabbath day or the requirement that every train should stop at the state capital.

The period of state activity in railroad regulations began about 1865. Between that date and the end of the century a vast mass of state legislation was passed. Most of it was an exercise of what is known in America as "the police power," the power, that is assumed to be inherent in every government to protect the safety and provide for the wants of its citizens. For instance, every railroad company in the state might be required to run at least one passenger train each way daily, or trains might be required to come to a dead stop before reaching a grade crossing, a point, that is, where two lines intersect one another on the same level. [The non-railroad mind, even in England, has never been able to grasp the fact that a crossing at right angles is neither more nor less safe than an ordinary junction.]

But much more important than the direct action of the state legislatures was their indirect action. More than two-thirds of the states—including every important state with the single exception of Pennsylvania, almost the most important state of all—have appointed Railroad Commissions, bodies usually with three members, charged with the execution of the state railroad laws and the supervision of the railroads within the state. At one time, in the seventies, these commissions were of very great importance. At the present day, mainly owing to the fact that the great bulk of the traffic is interstate, and so exempt entirely from state control, their importance has relatively declined. But they continue to exist, as corporate organizations usually do, once they are brought into existence. Some of them, that of Massachusetts first and foremost, are eminently useful; some, that of Texas first and foremost, are eminently noxious; the majority, to use the American phrase, "cut no figure at all" in the matter of railroad regulation.

The 30 commissions fall into two broad groups, commonly distinguished as "strong" and "weak," or "commissions with power" and "commissions without power." For my own part, if I had to find a phrase, I would call them "commissions with power" and "commissions with powers." For the commissions with nominally large powers have undoubtedly in practice done far less good than the commissions with powers nominally so small as "hardly," in Mr. Charles Francis Adams words, "to seem worthy of the name" of power at all. But, as Mr. Adams points out, in his admirable little book, "Railway Problems," while the strong commissions mean "the constable," the weak commissions mean "public opinion"; and in a free and law-loving community public opinion is always in the long run a better disciplinarian than the constable. The type of the weak commission is that of Massachusetts, which—in matter of rates at least—can only inquire, report and recommend; of the strong commission that of Illinois, which can prescribe rates and issue definite orders.† It was, I think, necessary for me to give this very rough and brief sketch of state railroad regulation, in order that you might be in a position to understand the situation in which the Federal or national authority has intervened.

(*To be continued.*)

C. L. Rate on Cotton Permissive, Not Mandatory.

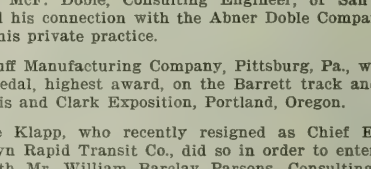
The Interstate Commerce Commission in an opinion by Chairman Knapp, Commissioner Prouty dissenting, has decided the case of the Planters' Compress Company against the Cleveland, Cincinnati, Chicago & St. Louis Railway Company and others, which involves the rates on round-bale and square-bale cotton. Cotton is transported by defendants and carriers generally at the same rate per 100 lbs., whether shipments are made by the carload or in less quantities. The usual shipment weighs about 25,000 lbs., when the common method of square-bale compression is used, though considerably more might be loaded in an ordinary car. The round-bale process permits the shipment of 45,000 lbs. or more per car, and complainant wanted lower rates on a carload minimum of 45,000 lbs. The high carload minimum could not be complied with by shippers using the square-bale process without considerable difficulty and greater expense. The cotton grower would benefit by a general reduction of cotton rates, but no advantage would result to either the cotton grower or the middleman from such a differential, and complainant's proposal would not advance the interests of the public. After considering all the conditions and circumstances, including the effect of the proposed differential upon carriers from producing territory as well as on the defendants, the Commission decides as follows:

If the rate on an article is reasonable, to those who ship the great bulk of that article, in the form in which it is commonly prepared for transportation, that rate does not become unreasonable to the shipper of a small quantity of the same article merely because he chooses to prepare his shipments in a form which affords the carrier a greater profit per 100 lbs., particularly when the preparation of that article in the more profitable form would impose some degree of hardship upon a large majority of shippers because of its greater expense or for other reasons. While carriers may lawfully establish carload and less than carload rates on cotton, with a reasonable difference between the two rates and a reasonable carload minimum securing to shippers generally the lower carload rates, it does not follow that they are bound to do so, much less that they can be required to establish a differential based upon an unusual carload minimum. Defendants' refusal to grant lower rates on cotton in carloads of 45,000 lbs. or more is held not to be a violation of the regulating statute.

†Some of the strong commissions fix maximum rates; some actual rates which the railroads are required to charge. The importance of the distinction is more theoretical than practical. For the maxima tend to be fixed at a point below which the railroad companies have no desire to go.

Erie Railroad Monument at Deposit, N. Y.

On Friday, November 10th, there was dedicated at Deposit, N. Y., a handsome granite monument to commemorate the first breaking of ground for the construction of the Erie Railroad, which occurred 70 years ago. The dedication drew a considerable company of people and there was music by a chorus of 250 voices. Addresses were made by James T. Rogers, of Binghamton; John B. Stanchfield, of Elmira, and the Assistant General Traffic Manager of the road, Mr. D. W. Cooke. The inscription on the monument reads:


Here, on the morning of
November 7, 1835,
Ground was broken for the
Construction of the Erie Railroad,
Designed to connect
the Atlantic Ocean with the Great Lakes.
Its completion to Lake Erie was
publicly celebrated in New York
and along the route to Dunkirk,
May 14, 15, 16, 1851.

Manufacturing and Business.

The Dominion Bridge Co., of Montreal, it is said, has decided to open a branch factory in Winnipeg, and shops will be put up early next year.

Robert McF. Doble, Consulting Engineer, of San Francisco, has severed his connection with the Abner Doble Company in order to resume his private practice.

The Duff Manufacturing Company, Pittsburg, Pa., was awarded the gold medal, highest award, on the Barrett track and car jacks at the Lewis and Clark Exposition, Portland, Oregon.

Eugene Klapp, who recently resigned as Chief Engineer of the Brooklyn Rapid Transit Co., did so in order to enter into partnership with Mr. William Barclay Parsons, Consulting Engineer, at 60 Wall street, New York City.

F. E. Baxter, heretofore Division Engineer at Salt Lake City, of the Rio Grande Western, has become Vice-President and General Manager of the Baxter, Straw & Storrs Construction Co., general railroad contractors, of Salt Lake City, Utah.

Bids are wanted November 21 by Alfred Anderson, Assistant Purchasing Agent of the Panama Railroad Co., 24 State street, New York, for furnishing semaphores for the Panama Railroad, as mentioned in advertising columns on page 22 of this issue.

The Damascus Bronze Co., Pittsburg, Pa., has shipped a carload of material to Japan consisting of babbitt metal and Damascus nickel bronze bearing metal. This is the second export order they have had within the past two months; the first order going to Korea.

At a meeting of the directors of the Taylor Iron & Steel Co. held in New York on October 31, the following officers were elected: President, Robert E. Jennings; Vice-Presidents, Percival Chrystie and Dr. Henry M. Howe; Secretary and Treasurer, T. F. Budlong; General Manager, Knox Taylor.

The Boston Elevated is to replace its present economizers by large machines of special construction made by the B. F. Sturtevant Co., Boston, Mass. Two of these will be installed at the central

power station on Albany street, and the third at the East Somerville power station.

The De La Vergne Machine Company, New York, has received a contract for three 500 h.p. Koerting gas engines to be direct connected to three 325 k.w., 550-volt direct current Crocker-Wheeler generators for the Boston Elevated Railway Company. These engines will be put in operation about Jan. 1, 1906.

Henry F. Shaw, of Boston, well-known in railroad circles for his devotion to the problem of balancing the reciprocating parts of locomotives, has presented to Purdue University a model locomotive embodying his latest design. The model is constructed on the scale of 1 in. to the foot, and is an excellent piece of work.

A large order for freight elevators was recently closed through the Pittsburg office of the Otis Elevator Company for a single installation of 44 freight elevators in the new building of the Pittsburg Terminal Warehouse Company of Pittsburg, Pa. These elevators have a lifting capacity of 6,000 lbs. and a car travel of about 100 feet.

W. W. Butler, Second Vice-President of the Simplex Railway Appliance Company, has been elected Second Vice-President of the American Steel Foundries, to fill the vacancy caused by the resignation of W. D. Sargent, of New York. Mr. Sargent continues a director, having served on the board since the organization of the company.

G. E. Pellissier, formerly Civil Engineer in charge of construction of the Holyoke Street Railway Co., has taken a position with the Goldschmidt Thermit Company. He will inspect and report on street railway work in connection with the Thermit welded joint, and steam railroad work in connection with locomotive frame welding and welding of driving wheel centers.

The Public Works Department of Argentina, South America, now has under consideration work involving an expenditure of about $78,000,000. The principal items include: Railroads, $21,631,558; dredging, $5,841,000; bridges and roads, $8,871,000, and other improvements. The government has recently authorized the Entre Rios Railways Co. to extend its line to Buenos Ayres, crossing the Panama river by means of steam ferries. Quesada Bros. has also been authorized to build an electric line from Buenos Ayres to Lujan, and the government will build a railroad from Cerrillos to Rosario at a cost of $520,000. C. B. Madero will extend the electric street line from Riachuelo to Lanus or Banfield.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Central Railway Club.

At the regular meeting of this club in Buffalo November 10, there was a paper on "Railroad Accidents" by J. B. Morford, of the Michigan Central, and one on "Fuel Combustion" by G. F. Dillon, of the Scranton Correspondence Schools.

Maintenance of Way Master Painters.

The Association of Maintenance of Way Master Painters of the United States and Canada held its second annual convention in Cincinnati, Ohio, November 14 and 15. Papers on the following subjects were read: "Best Interior Natural Finish for Georgia Pine," by W. S. Hopkins (G. C. & S. F.), and F. E. Holipeter, Detroit Union Station; "Best Method of Accounting for Labor and Material," by J. S. Rice (L. S. & M. S.); "Material for Painting Stations Where Soft Coal is Burned," by Richard Beynan; "Best Method of Removing Dirt and Rust from Iron Bridges," by C. J. Bogardus (Erie); "The Best Guide in Selecting a Bridge Paint," by W. B. Parker. The Secretary of the Association is H. J. Schnell, 100 William street, New York.

American Society of Mechanical Engineers.

The fifty-second meeting of this society will be held in the Edison Building, 44 West Twenty-seventh street, New York, December 5, 6, 7 and 8. At the opening session President John R. Freeman will present the annual address. The next day a business meeting will be held in the main saloon of the steamship "Amerika" at the docks of the Hamburg-American Line at Hoboken, N. J., after which a visit will be made to the new Henry R. Worthington hydraulic works at Harrison, N. J. In the evening there will be an illustrated lecture on "Photography of Invisible Phenomena" by Prof. R. W. Wood, of Johns Hopkins University. Thursday morning, at West Twenty-seventh street, a number of papers will be presented, followed by a discussion on the subject of "Bearings," and in the afternoon there will be a reception at the New York School of Automobile Engineers, 46 West Fifty-sixth street. The usual reception will be held at Sherry's in the evening. At the closing session on Friday morning, professional papers will be presented.

PERSONAL.

—Mr. H. W. McMaster, General Superintendent of the Wheeling & Lake Erie, was born in 1860. His first railroad service was at the age of thirteen as an operator on the Detroit, Lansing & Northern. Here he remained five years and then went to the Grand Rapids & Indiana with the same position, later becoming train despatcher. In 1882, he went to the Chicago & North-Western as train despatcher and remained there two years; he then became chief train despatcher on the Union Pacific and was soon promoted to be trainmaster on the same road. In 1889, he went to the Northern Pacific as chief train despatcher and was later trainmaster, holding that position until 1900. At that date he went to the Wheeling & Lake Erie and was Assistant Superintendent and Superintendent of that road and of the Wabash-Pittsburg Terminal until appointed to his present position.

H. W. McMaster.

—Mr. E. A. Williams, who was recently appointed General Mechanical Superintendent of the Erie and of its affiliated and controlled lines, entered railroad service as a machinist's apprentice on the Milwaukee & Prairie du Chien in 1865. In 1877 he went to the Chicago, Milwaukee & St. Paul as roundhouse foreman, and three years later became general foreman of the Southern Minnesota division. In 1886, he was appointed Assistant General Master Mechanic at Milwaukee, where he remained for four years, going at the end of that time to the Minneapolis, St. Paul & Sault Ste. Marie as Master Mechanic. He was made Mechanical Superintendent of that road in 1893 and in 1901 became Superintendent of Rolling Stock on the Canadian Pacific. In 1904, he went to the Erie as Assistant General Manager, where he has been until his recent promotion.

E. A. Williams.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—C. M. James, heretofore Acting Engineer of Roadway, has been appointed Engineer of Roadway, with office at Wilmington, N. C.

Buffalo, Rochester & Pittsburg.—W. H. Wilson, heretofore Master Mechanic of the Erie, at Susquehanna, Pa., has been appointed Superintendent of Motive Power of B., R. & P., with office at DuBois, Pa., succeeding E. E. Davis, resigned.

Canadian Pacific.—F. W. Cooper has been appointed Resident Engineer at London, Ont.

Chicago & Eastern Illinois.—W. S. Dawley, Engineer of Maintenance of Way, has been appointed Chief Engineer, with office at Chicago. R. H. Howard, Assistant Engineer of Maintenance of Way, succeeds Mr. Dawley, with office at Chicago.

Chicago & North-Western.—F. R. Moulton, Trainmaster at Belleplaine, Iowa, has been appointed Superintendent of the Iowa & Minnesota division, with office at Mason City, Iowa, succeeding E. G. Schevenell, promoted.

Chicago, Burlington & Quincy.—O. L. Dickeson is now Assistant Superintendent of Transportation of the lines west of the Missouri river, with office at Omaha, Neb.

Chicago Great Western.—George Reith, Superintendent of Terminals at Oelwein, Iowa, has resigned. William Matthie succeeds Mr. Reith.

Chicago, Rock Island & Pacific.—J. B. Berry, Chief Engineer of the Union Pacific, has been appointed Chief Engineer of the Rock Island, with office at Chicago, succeeding W. L. Darling, resigned.

Cincinnati, Hamilton & Dayton.—D. W. Cooke, Assistant General Traffic Manager of the Erie, has been appointed to the same position on the Cincinnati, Hamilton & Dayton and the Pere Marquette, with office at New York. D. G. Edwards, Passenger Traffic Manager, has resigned and the office has been abolished. R. H. Wallace, General Passenger Agent of the Erie, has been appointed to the same position on the C., H. & D. See Erie.

Luis Jackson has been appointed Industrial Commissioner of this road and of the Pere Marquette, with office at New York.

Cleveland, Cincinnati, Chicago & St. Louis.—P. H. Delano has been appointed Engineer in charge of construction on the Cincinnati division, with office at Middletown, Ohio.

Copper Range.—R. T. McKeever, General Manager, has been elected also Vice-President, with office at Boston, Mass.

Dayton, Lebanon & Cincinnati.—The joint receivership of C. A. Alderman and W. E. Moore has been terminated and W. E. Moore has been appointed sole receiver, with office at Lebanon, Ohio.

Erie.—S. P. Shane, Freight Traffic Manager, has been also appointed to the same position on the Cincinnati, Hamilton & Dayton, and his office has been moved from Chicago to New York. F. A. Wann, formerly Vice-President in charge of traffic of the Pere Marquette, has been appointed Freight Traffic Manager of the Erie, with office at Chicago. C. L. Thomas, General Freight Agent at Chicago, has been appointed Assistant Freight Traffic Manager of Lines West of Buffalo and Salamanca, and also to the same position on the C., H. & D. H. G. Krake has been appointed General Freight Agent of Lines West of Buffalo and Salamanca, with office at Chicago.

H. H. Harrington, General Foreman at Susquehanna, Pa., has been appointed Master Mechanic at that point to succeed W. H. Wilson, resigned. (See Buffalo, Rochester & Pittsburg.)

Florida.—W. T. Cosby has been appointed General Freight and Passenger Agent, with office at Live Oak, Fla.

Galveston, Harrisburg & San Antonio.—J. M. Lee has been appointed Superintendent of the San Antonio Branch division, with office at San Antonio, Tex.

Grand Trunk Pacific.—G. U. Ryley has been appointed Land Commissioner, with office at Montreal.

Great Northern.—J. H. O'Neill, Division Superintendent at Whitefish, Mont., has been appointed Acting Assistant General Superintendent of the Western district, with office at Spokane, Wash., succeeding H. A. Kennedy, promoted. Howard James has been appointed Director of Purchases, and S. B. Plechner, Purchasing Agent, both with office at St. Paul, Minn.

Illinois Central.—R. E. Gaut, Assistant Engineer of Bridges, has been appointed Engineer of Bridges, succeeding F. H. Bainbridge. H. H. Hadsall succeeds Mr. Gaut, both with offices at Chicago. These appointments apply also to the Yazoo & Mississippi Valley.

Isthmian Canal Commission.—W. G. Tubby, General Store Keeper of the Great Northern, has been appointed Superintendent of Construction of the Panama Canal.

Kansas City Southern.—J. F. Murphy, Superintendent of Terminals at Kansas City, has resigned.

Lake Erie & Western.—L. L. Hyde, heretofore General Agent at Chicago of the Lake Shore-Lackawanna Fast Freight Line, has been appointed Assistant General Freight Agent of the Lake Erie & Western, with office at Peoria, Ill., succeeding M. R. Maxwell.

Licking River.—The office of F. J. Pischel, Treasurer, has been removed from Farmers to Yale, Ky. J. A. Kauffman has been appointed General Manager, with office at Yale, succeeding E. R. Miller, resigned.

Louisiana & Arkansas.—J. H. Conlan, Superintendent, has resigned, and the office has been abolished. J. H. White is General Superintendent, with office at Stamps, Ark.

Minneapolis & St. Louis.—D. C. Noonan, Superintendent, has been appointed to the new office of General Superintendent in charge of transportation and equipment, with office at Minneapolis. E. D. Hogan, Trainmaster at Minneapolis, succeeds Mr. Noonan, with office at Minneapolis.

Missouri, Oklahoma & Gulf.—O. M. Sewell has been appointed General Superintendent in charge of operation and traffic, with office at Muskogee, Ind. T.

Northern Central.—Henry Tatnall, Fifth Vice-President of the Pennsylvania, has been elected also Treasurer of the Northern Central, succeeding A. W. Hendrix, deceased.

Northern Pacific.—G. S. Fernald, Commissioner of Taxes, has resigned. M. T. Sanders succeeds Mr. Fernald. (See Pullman.)

Pere Marquette.—A. Patriarche, General Traffic Manager, has been appointed Freight Traffic Manager. See Erie and Cincinnati, Hamilton & Dayton.

Pullman.—G. S. Fernald, heretofore Commissioner of Taxes of the Northern Pacific, has been appointed Assistant General Solicitor of the Pullman Co., with office at Chicago.

Rio Grande Western.—C. A. Blake, Assistant Engineer, has been appointed Division Engineer at Salt Lake City, succeeding F. E. Baxter, resigned.

South & Western.—G. A. Kent, Chief Engineer of this company and of the Lick Creek & Lake Erie and the Carolina Co., has been appointed Chief Engineer of the Coal Land department. M. J. Caples, General Manager, has assumed the duties of Chief Engineer in addition to his duties as General Manager. The following engineers are officers of the Lick Creek & Lake Erie and the Carolina Co. as well as the South & Western: W. A. Doane, Principal Assistant Engineer, with office at Bristol, Va.; W. A. Hankins, Principal Locating Engineer, with office at Bristol, Va.; A. W. Jones, Engineer of the First division, with office at Fink, Va.; William Palmer, Engineer of the Second division, with office at Clinchport, Va.; Ward Crosby, Engineer of the Third division, with office at Lovedale, Tenn.; C. L. Ruffin, Engineer of the Fourth division, with office at Erwin, Tenn.; C. O. Vandevanter, Engineer of the Fifth division, with office at Spruce Pine, N. C.; S. P. Daniel, Engineer of the Sixth division, with office at Rutherfordton, N. C.

F. Powell has been appointed General Claim Agent of this road and of the Lick Creek & Lake Erie, the Crane's Nest Coal & Coke Co., the Dawson Coal & Coke Co., the Clinchfield Coal Co., and the Carolina Co., with office at Bristol, Va. He will also perform the duties of Right-of-Way Agent and such other duties as may be assigned to him.

Trinity & Brazos Valley.—S. M. Hudson, Auditor of the Fort Worth & Denver City, has been appointed also Auditor of the Trinity & Brazos Valley, with office at Cleburne, Tex., succeeding E. Hickman, resigned.

Union Pacific.—J. B. Berry, Chief Engineer, has resigned. R. L. Huntley, Principal Assistant Engineer, succeeds Mr. Berry, with office at Omaha, Neb. See Chicago, Rock Island & Pacific.

Western Pacific.—H. N. McCartney has been appointed Principal Assistant Engineer, with office at Sacramento, Cal. J. B. Wallace has been appointed Engineer of Right of Way, with office at Sacramento. John T. Williams has been appointed Engineer in charge of construction from San Francisco to Stockton, Cal., 65 miles, with office at Oakland, Cal., and is in temporary charge from Stockton to the Yuba river, 50 miles. Emery Oliver has been appointed Engineer in charge of construction from Oroville, Cal., to Spanish Creek, 60 miles, with office at Oroville, and is in temporary charge from the Yuba river to Oroville, 15 miles. Charles Harlowe has been appointed Engineer in charge of construction from Deephole to Elko, Nev., 180 miles, with office at Winnemucca, Nev.

Wheeling & Lake Erie.—C. C. Needham, Claim Agent, has been also appointed Real Estate and Tax Agent for the lines of this company and those of the Wabash-Pittsburg Terminal west of the Ohio river, with office at Canton, Ohio. Archibald Mackrell, Real Estate and Tax Agent of the Wabash-Pittsburg Terminal, has been also appointed Claim Agent for the lines east of the Ohio river, including the lines of the Pittsburg Railroad, Terminal & Coal Co., with office at Pittsburg, Pa.

Yazoo & Mississippi Valley.—See Illinois Central.

LOCOMOTIVE BUILDING.

The Duluth & Iron Range has ordered 10 locomotives from the American Locomotive Co.

The Queen & Crescent has ordered three locomotives from the American Locomotive Co.

The Lake Shore & Michigan Southern is reported in the market for about 70 locomotives.

The Atlantic Coast Line has ordered 20 locomotives from the Baldwin Locomotive Works.

The New York Central Lines have ordered 318 locomotives from the American Locomotive Co.

The Norfolk & Western, it is reported, is asking bids on 50 locomotives for 1906 delivery.

The Chicago, Burlington & Quincy has ordered 50 locomotives from the American Locomotive Co.

The Delaware, Lackawanna & Western will order 50 locomotives. The contract has practically been placed.

The Pennsylvania has placed an order with the Baldwin Locomotive Works for 250 locomotives to be built in 1906.

The Intercolonial has ordered some engines from the American Locomotive Co. at the Montreal shops. The number is given as 15.

The Philadelphia & Reading, as reported in our issue of November 10, has ordered 50 locomotives from the Baldwin Locomotive Works.

The Minneapolis, St. Paul & Sault Ste. Marie denies having ordered two locomotives from the American Locomotive Co., as reported in our issue of November 10.

The Lehigh Valley, as reported in our issue of November 3, has ordered 30 locomotives, 15 from the Baldwin Locomotive Works and 15 from the American Locomotive Co.

The Western Maryland, as reported in our issue of October 20, has ordered one 16-wheel Shay locomotive from the Lima Locomotive & Machine Co. This engine will weigh 330,000 lbs.; cylinders, 17 in. x 18 in.; diameter of drivers, 46 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; 310 charcoal iron National Tube Co.'s tubes, 2 in. in diameter x 18 ft. 5 in. long; firebox, 114 in. x 62 in.; grate area, 49 sq. ft.; water capacity, 8,000 gallons, and coal capacity, nine tons. The special equipment will include: Westinghouse air-brakes, open-hearth steel axles, Keasby & Mattison boiler lagging, American Brake-Shoe Co.'s brake-shoes, Tower couplers, Dressel headlights, Nathan injectors, U. S. piston and valve rod packing, Crosby safety valve, Leach sanding devices, Union Spring & Manufacturing Co.'s springs, Latrobe driving wheel tires and cast-steel wheel centers. This engine is for road service on the West Virginia division on a 3 per cent. grade between Hendrix and Thomas, a distance of 10 miles. The grade is on the western slope of the Allegheny Mountains on what is termed the Black Water branch of the Cheat river.

The Kansas City, Mexico & Orient has ordered three Allfree-Hubbell type (4-4-0) locomotives, three Allfree-Hubbell type (2-6-0) locomotives and four Allfree-Hubbell type (2-8-0) locomotives from the American Locomotive Co., for November and December delivery. The 4-4-0 locomotives will weigh 123,500 lbs., with 84,500 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 69 in.; wagon top boilers, with a working steam pressure of 200 lbs.; tank capacity, 7,000 gallons of water, and coal capacity, 12 tons. The 2-6-0 locomotives will weigh 165,000 lbs., with 143,000 lbs. on the drivers; cylinders, 20 in. x 28 in.; diameter of drivers, 63 in.; wagon top boiler, with a working steam pressure of 200 lbs.; tank capacity, 7,000 gallons of water, and coal capacity, 14 tons. Two of the 2-8-0 locomotives will weigh 200,000 lbs., with 180,000 lbs. on the drivers; cylinders, 23 in. x 30 in.; the other two 2-8-0 locomotives will weigh 180,000 lbs., with 160,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; all 2-8-0 locomotives will have diameter of drivers, 57 in.; straight boiler, with a working steam pressure of 200 lbs.; tank capacity, 7,000 gallons of water, and coal capacity, 14 tons. The special equipment for all includes: Westinghouse air-brakes, magnesia boiler lagging, Chicago brake-beams, American brake-shoes, Climax couplers, Handlan-Buck headlights, Ohio injectors, Magnus journal bearings, Sullivan piston and valve rod packings, Crosby safety valves and steam gages, Economy sanding devices, Chicago bull's-eye sight-feed lubricators, Railway Steel Spring Co.'s springs, Paige truck wheel tires and Davis cast-steel wheel centers.

CAR BUILDING.

The Atchison, Topeka & Santa Fe has ordered 30 smoking cars.

The Iowa Central, it is rumored, is in the market for about 500 coal cars.

The Atlanta & Birmingham, it is reported, is in the market for nine passenger cars.

The Bessemer & Lake Erie, it is reported, is in the market for passenger equipment.

The Buffalo & Susquehanna, it is reported, is in the market for freight equipment.

The Missouri Pacific, it is reported, is figuring on 3,000 to 5,000 additional freight cars.

The Denver, Northwestern & Pacific has ordered eight passenger cars from the Pullman Co.

The Mexican Central has ordered 70 Rodger ballast cars from the Rodger Ballast Car Co.

The Norfolk & Western has ordered 1,000 box cars from the American Car & Foundry Co.

The Minneapolis, St. Paul & Sault Ste. Marie, it is reported, is in the market for passenger cars.

The Lake Shore & Michigan Southern, it is reported, will shortly order upward of 1,000 furniture cars.

The Shippers Refrigerating Car Company, Chicago, is preparing specifications for additional equipment.

The Atchison, Topeka & Santa Fe has ordered 1,000 box cars from the American Car & Foundry Co.

The New York Central & Hudson River has ordered 1,000 box cars from the American Car & Foundry Co.

The Mather Horse & Stock Car Company, Chicago, has ordered 680 stock cars from the American Car & Foundry Co.

The Elgin, Joliet & Eastern has ordered 500 gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Atlantic & Birmingham has ordered 1,350 box and flat cars of 60,000 lbs. capacity from the South Atlantic Car & Manufacturing Co.

The Delaware, Lackawanna & Western is figuring on 1,000 steel hopper coal cars and 700 steel gondola coal cars of 80,000 lbs. capacity.

The Ferrocarril Central Norde of Argentine has ordered 80 box cars, 40 gondola cars and 20 stock cars from the Middletown Car Works.

The Pittsburg & Lake Erie has ordered 1,000 coal cars from the Pressed Steel Car Co. and 2,200 freight cars from the American Car & Foundry Co.

The San Rafael & Atlixco has just ordered 50 freight cars and four passenger cars from the Mexican Car & Foundry Co. Delivery of these cars is to be made in 90 days.

The New York Central & Hudson River is asking bids on a large number of passenger cars and has ordered 125 steel motor cars. The bodies will be made by the American Car & Foundry Co. and the trucks will be made by the American Locomotive Co.

The Lehigh Valley, as reported in our issue of October 20, has ordered 3,000 freight cars as follows: One thousand gondola cars of 100,000 lbs. capacity and 1,500 box cars of 80,000 lbs. capacity from the Standard Steel Car Co., and 500 box cars from the American Car & Foundry Co.

The Chicago, Milwaukee & St. Paul will build six flat cars of 100,000 lbs. capacity at its West Milwaukee shops. These cars will be 50 ft. long x 9 ft. 2¾ in. wide x 4 ft. 3¼ in. high. The special equipment includes: Congdon brake-shoes, Hennessy double friction draft rigging and Barber trucks.

The Boston & Maine has ordered 20 passenger cars from the Pullman Company for 1906 delivery. These cars will have a seating capcaity of 72 persons each, and will be lighted by the Pintsch mantle lights. It has also ordered 1,000 drop and gondola cars of 60,000 lbs. capacity from the Laconia Car Company.

The Clarendon & Pittsford has ordered 15 flat cars of 80,000 lbs. capacity from the Middletown Car Works for January, 1906, delivery, instead of 20, as reported in our issue of November 10. These cars will be 30 ft. long by 8 ft. 9 in. wide. The special equipment includes Tower couplers and Miner tandem draft rigging.

The Rodger ballast cars and the Hart convertible cars reported in our last issue ordered by the Mexican Central, the Lake Shore & Michigan Southern, and the Chicago, Burlington & Quincy, are to be built by the American Car & Foundry Co., but were ordered from the Rodger Ballast Car Co., Chicago, and not from the American Car & Foundry Co. as reported.

The Central of New Jersey, as reported in our issue of November 10, has ordered 50 stock cars from the Middletown Car Works for 1906 delivery. These cars will have a capacity of 60,000 lbs., and will be 36 ft. over all, 8 ft. 1½ in. wide x 8 ft. 3 in. high inside. The bodies and underframes will be of wood. The special equipment includes: Westinghouse quick action brakes, Tower all-steel couplers and Miner draft rigging.

The Cincinnati, New Orleans & Texas Pacific, as reported in our issue of November 10, has ordered 250 flat cars from the American Car & Foundry Co. These cars will have a capacity of 40 tons and will be 40 ft. long x 8 ft. 10 in. wide over all. The body and underframes will be of wood. The special equipment includes: Open hearth steel axles, American Steel Foundries' bolsters, Buffalo brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, Ajax brasses, Climax couplers, Miner draft rigging, Harrison dust guards,

Symington journal boxes, Railway Steel Spring Co.'s springs, Archbar trucks and 33-in. cast-iron M. C. B. wheels.

The Boston & Maine, as reported in our issue of November 3, has ordered 1,000 drop-end gondola cars from the Laconia Car Co. for May, 1906, delivery. These cars will have a capacity of 60,000 lbs. and will weigh 26,000 lbs. They will be 34 ft. long x 8 ft. 1 in. wide x 3 ft. high inside measurements. The bodies and underframes will be of wood. The special equipment includes: Wrought-iron axles, Pressed steel bolsters, Simplex brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, lead-lined brasses, Gould couplers, Miner tandem draft rigging, cast-iron journal boxes and Wood dust guards, Crucible steel springs, pressed steel trucks and cast-iron car wheels.

The Brooklyn Rapid Transit System, Brooklyn, N. Y., as reported in our issue of September 29, has ordered 100 semi-convertible surface passenger cars from the John Stephenson Co., and 50 semi-convertible surface passenger cars from the Laconia Car Co. All cars will weigh completely equipped 47,000 lbs., and measure 42 ft. 6 in. long, 8 ft. 2½ in. wide, and 11 ft. 11 in. high, over all. The special equipment includes: Lappin brake-shoes, Westinghouse air-brakes, Streeter brasses, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, J. L. Howard & Co.'s door fastenings, Consolidated Car Heating Co.'s heating system, Heywood Bros. and Wakefield seats, Baldwin trucks, John Stephenson Co.'s vestibules and Schoen rolled steel wheels.

The Delaware, Lackawanna & Western, as reported in our issue of November 10, has ordered 500 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., and 500 box cars of 60,000 lbs. capacity from Barney & Smith, all for February, March and April, 1906, delivery. All cars will weigh about 34,000 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment includes: Simplex bolsters, Pennsylvania Brake-Beam Co.'s brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Westinghouse air-brakes, Magnus Metal Co.'s brasses, Smith door fastenings, Miner tandem draft rigging, Woodman journal boxes, Sherwin-Williams Co.'s paint, Murphy inside roofs, Simplex Railway Appliance Co.'s springs, and Barber roller-bearing trucks.

The Chicago & North-Western has ordered 25 non-vestibule coaches, five vestibule coaches and 10 baggage cars from the Pullman Co., for February, March and April, 1906, delivery. The coaches will be 55 ft. 6½ in. long, over sills, 9 ft. 8 in. wide and 6 ft. 8½ in. high, inside measurements. The baggage cars will be 63 ft. 2 in. long, 10 ft. 2¼ in. wide and 14 ft. 9½ in. high, over all. The special equipment for all includes: National-Hollow brake-beams, Christie brake-shoes, Westinghouse air-brakes, Chicago couplers, Chicago & North-Western standard draft rigging, Chicago & North-Western standard heating system for vestibule coaches and baggage cars, Chicago & North-Western standard paint for baggage cars, Chicago & North-Western standard platforms for vestibule coaches and baggage cars, Chicago & North-Western standard roofs for baggage cars, Chicago & North-Western standard trucks for non-vestibule coaches and steel-tired wheels.

BRIDGE BUILDING.

Arnprior, Ont.—The Renfrew County Council will rebuild the Clay Bank bridge over the Madawaska river about three miles from this place.

Braddock, Pa.—A contract has been given by the Pittsburg & Lake Erie to the Dravo Construction Co. for building a new bridge over Turtle creek.

Carthage, Mo.—Bids are wanted Nov. 30 by William Kohlman, County Surveyor, for building two steel bridges in Jasper County.

Cleveland, Ohio.—The county has notified the city officials that it is ready to pay its share of the cost, between $50,000 and $60,000, for building a new bridge near Washington Park at the junction of Fleet and Independent streets. Bids will soon be asked for the work.

Danville, Ill.—The Cleveland, Cincinnati, Chicago & St. Louis is building a large concrete bridge here.

Edmonton, N. W. T.—The Provincial Government will take steps for the construction of a traffic bridge across the river at Kipp.

Florenceville, N. B.—The bridge across the St. John river at this place will be rebuilt.

Fredericton, N. B.—C. H. LaBillois, Commissioner of Public Works, is receiving bids for rebuilding Wallace Mill bridge in Restigouche county. It is probable that extensive repairs will be made to the International bridge, between St. Stephen and Calais.

Lethbridge, Alberta.—The Canadian Pacific, it is said, is making surveys to locate the site for its proposed bridge to be built over the river here. The bridge will have to be over a mile long.

Manitowoc, Wis.—The City Council has authorized the asking of bids for putting up a bascule bridge at Main street. The plans which are being made for the proposed structure call for a bridge with an 80-ft. opening and 22-ft. roadway, with a 6-ft. walk.

Omaha, Neb.—The Chicago, Burlington & Quincy is planning to build three steel bridges on its proposed line through the Big Horn basin in Wyoming.

Owensboro, Ky.—Residents are agitating the question of building a combined highway and railroad bridge over the Ohio river here.

South Bend, Ind.—The Board of County Commissioners has given a contract to the Lafayette Engineering Co. for removing the old Jefferson street bridge from its present site and building the substructure for the bridge which is to be relocated near Springbrook Park at their bid of $18,924. The commissioners also awarded a number of contracts for small bridges.

Toronto, Ont.—The Canadian Pacific, the Grand Trunk and the city of Toronto will each pay one-third of the cost of building a steel combined highway and railroad bridge at Yonge street to cost $200,000.

The Ontario Government will ask for call bids for some bridges to be built in northern Ontario. Particulars from the Minister of Public Works.

Other Structures.

Albany, Ga.—The Atlantic Coast Line station recently destroyed by fire at a loss of about $20,000 will at once be rebuilt.

Cincinnati, Ohio.—The Chesapeake & Ohio has approved the plans for its proposed freight terminal to be built on West Third street at a cost of $500,000.

Danville, Ill.—The Cleveland, Cincinnati, Chicago & St. Louis has bought a large plot of ground to be used as a site for new shops for the two divisions entering this city. The cost will be about $150,000.

Demopolis, Ala.—The Southern, it is said, will put up a new freight house; also a new passenger station.

Havre de Grace, Md.—The Pennsylvania has received bids for building a two-story brick passenger station 70 ft. x 26 ft.; also a waiting room 23 ft. x 16 ft., and for shelter sheds 140 ft. long.

Horton, Kan.—The Chicago, Rock Island & Pacific will build a new roundhouse to cost about $75,000.

Lethbridge, B. C.—The Canadian Pacific and the Alberta Railway have jointly let a contract to Smith Bros. & Wilson for putting up a union passenger station here.

Lincoln Park, N. Y.—The Buffalo, Rochester & Pittsburg, it is said, will put up a new brick shop 140 ft. x 180 ft.

Milwaukee, Wis.—The Chicago, Milwaukee & St. Paul is improving ten of its warehouses on the river front at a cost of $60,000.

New Westminster, B. C.—The Vancouver, New Westminster & Yukon, it is said, will at once build wharves and freight sheds and make other water front improvements in this city.

Norton, Kan.—A contract has been given by the Chicago, Rock Island & Pacific to C. A. Feltons, of Topeka, Kan., for building a 27-stall roundhouse here to cost $75,000.

Parsons, Kan.—The Missouri, Kansas & Texas, it is said, will soon ask bids for putting up some of the larger buildings at its new locomotive works to be built here. The total cost of the improvements will be $1,000,000.

Pittsburg, Pa.—The Wabash Pittsburg Terminal, it is said, has plans ready for building large warehouses near its tracks, and bids are to be received shortly for the work.

San Marcos, Tex.—An officer writes that the International & Great Northern will put up a combination brick and wood passenger station one story high, 69 ft. x 191 ft., to cost $12,000. Work is to be commenced at once.

Woonsocket, R. I.—The Providence & Burrillville Street Railway Co. has given a contract to the Builders' Concrete Stone Co., of Pawtucket, for building new car barns here. The plans call for a structure 55 ft. x 110 ft., with two additions, one of 60 ft. x 130 ft., for offices and shops, and one of 20 ft. x 13 ft.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—Application has been made by this company to the courts of Muskogee, Ind. T., to appoint an appraising board to condemn a right of way from that point to Shawnee, Okla. T., a distance of 120 miles. The proposed line will con-

nect the branch between Independence, Kan., and Tulsa and the Oklahoma lines at Shawnee.

See Gulf, Colorado & Santa Fe below.

ATLANTIC & CAROLINA (ELECTRIC).—This company, which was chartered in April of last year to build an electric railroad from Atlanta, Ga., to Anderson, S. C., a distance of about 125 miles, has amended its charter so as to change its proposed route from Atlanta to Rockdale County through the town of Lithonia, in Dekalb County, to Colliers, in Rockdale County. (See Construction Record.)

BALTIMORE BELT LINE TERMINAL (P., B. & W.).—An officer writes respecting the proposed belt line to be built by this company around Baltimore, Md., that it has not as yet been finaly decided whether the line will be built partly through the city or further out. (November 3, p. 142.)

CANADIAN PACIFIC.—This company has opened the Lacombe branch of the Western division from Lacombe, Alberta, to Alix, 26.6 miles. The Wetaskiwin branch of the Western division has been opened for business from Wetaskiwin, Alberta, to Camrose, 25 miles, and the Pheasant Hills branch of the Central division has been extended from Lipton, Assiniboia, west to Strassburg, 54 miles. This branch will be extended to Saskatoon and eventually to a connection with the Wetaskiwin branch.

CHICAGO, ROCK ISLAND & PACIFIC.—See Rock Island, Arkansas & Louisiana below.

CUMBERLAND RIVER & NASHVILLE.—This company has filed a mortgage in Kentucky for $2,500,000 to build a railroad from Corbin, Ky., southwest down the Big Laurel river, through Laurel, Whitley, Pulaski, Wayne and Clinton Counties in Kentucky, to Nashville, Tenn., a total distance of about 200 miles. The road will pass through a rich coal and timber territory. L. F. Hubble, of Somerset, Ky., is a director. A contract is said to have been let for building the first 20 miles of the new line from a point on the Cincinnati, New Orleans & Texas Pacific south of Burnside to Monticello, the county seat of Wayne County, and work is to be commenced shortly.

DARIEN & WESTERN.—This company, which operates a line from tidewater at Darien, Ga., northwest to Weefannie, 46 miles, is building an extension from that point northwest to Glenville, where connection will be made with the new Reidsville & Southeastern, controlled by this company, from that point north to Collins, in Tattnall County, a distance of 23 miles. Part of the Reidsville & Southeastern from Reidsville north for a distance of seven miles to Collins was formerly the Collins & Reidsville Railroad.

DEEPWATER.—See Tidewater below.

DULUTH, VIRGINIA & RAINY LAKE.—President W. H. Cook announces that this road, 46 miles long in St. Louis County, Minn., will be extended from Pelican Lake, the present terminus, northwest to Fort Frances, Ont., about 50 miles.

GEORGIA NORTHERN.—This company has discontinued the use of its line from Oaklawn, Ga., south, six miles, to Pidcock, which was formerly the southern terminus of the road, and has opened a new line from Oaklawn southwest to Boston, in Thomas County, Ga., six miles, where connection will be made with the Atlantic Coast Line.

GRAND TRUNK PACIFIC.—This company is negotiating with the Canadian Northern for the double tracking of the C. N. line from Winnipeg west to Portage la Prairie, a distance of 59 miles, over which the Grand Trunk Pacific wishes to secure trackage rights. Unless an agreement is reached the G. T. P. will shortly commence the construction of this link of its line, making three lines between Winnipeg and Portage la Prairie. F. W. Morse, General Manager of the G. T. P., has announced that as soon as the main line is built far enough branches will be built to Regina, Prince Albert, Battleford and Calgary, and probably to Yorkton. It is the intention to have some of these western lines in a position to carry some of next year's wheat.

GREAT NORTHERN.—The extension of this company's line into British Columbia, has reached Keremeos, and the company's engineers say that the line will be at Princeton by the first of the year.

GREAT NORTHERN OF CANADA.—This company has opened a new branch to be known as the St. Jacques branch from St. Jacques Junction, Que., on the main line, southeast to St. Jacques, a distance of seven miles.

GULF, COLORADO & SANTA FE (A., T. & S. F.).—An officer writes regarding the report that this company would build a line from Davis, in the Chickasaw Nation, Ind. T., east to the coal fields, that the citizens of Sulphur, which is about eight miles east of Davis, have made a proposition to the company to build a branch from that point and that the company has made preliminary surveys for the line. (September 29, p. 103.)

HUDSON & MANHATTAN (ELECTRIC).—This company, incorporated to build a tunnel between Manhattan (Cortlandt street) and Jersey City (Montgomery street) has filed a revised certificate submitting surveys for a route from Jersey City to Newark. The purpose is said to be to provide a fast passenger line from Newark to New York, and the Pennsylvania Railroad is said to be friendly to the scheme. From the Jersey City terminus of the Pennsylvania Railroad, which is the western terminus of the river tunnel, the new route is by a subway west to Brunswick street; thence on the surface to a point in Harrison (about six miles), at which place it will again run underground and beneath the Passaic river, then continuing in a subway to a terminus in Market street, Newark. The certificate was signed by W. G. McAdoo as President of the company. (June 23, p. 207.)

ILLINOIS CENTRAL.—See Yazoo & Mississippi Valley below.

LAKE SUPERIOR & SOUTHEASTERN (WIS. CENT.).—A contract has been given by this company to H. F. Balch, of Minneapolis, Minn., for grading 11½ miles of its road from Duluth to Ladysmith, Wis. Part of this road, from Owen to Ladysmith, to be known as the Owen & Northern, is to be put in operation by the first of January. Grading work has been going on by McIntosh Bros., of Milwaukee, who have the contract, for the past six months. These two roads will form the extension of the Wisconsin Central to Duluth. (September 1, p. 72.)

LANCASTER, OXFORD & SOUTHERN.—This company, which operates 20 miles of road from Oxford, in Chester County, Pa., west to Susquehanna, has opened its new extension from Fairmount north to Quarryville, Lancaster County, 7 miles, where connection will be made with the Pennsylvania.

LAS VEGAS & TONOPAH.—An officer writes that this proposed road is to be built from Las Vegas, Nev., to Tonopah, a distance of 215 miles. There are no towns of importance on the route at present, except Bullfrog, Rhyolite and Beatty, about 115 miles from Las Vegas. The next town of importance is Goldfield, about 80 miles beyond Bullfrog. The line has been surveyed as far as Bullfrog and construction will commence early next month. Part of the grading is already completed, but no track has yet been laid. The company will do the track laying and grading, which will not be difficult, and will build its own bridges. The maximum grade westbound between Las Vegas and Bullfrog will be 1 per cent., eastbound 1.5 per cent., and the balance of the line 1 per cent. J. Ross Clark is President, and Arthur Maguire, Chief Engineer, Los Angeles, Cal. (November 3, p. 143.)

MANISTIQUE.—This road has been extended from Diller, Mich., its southern terminus, to Curtis, a distance of six miles.

MIDLAND & MANITOBA.—The first contract for grading this proposed road has been let to John Prout, of Portage la Prairie. Work will be rushed with a view to putting on trains early next spring. (November 3, p. 143.)

MILWAUKEE NORTHERN (ELECTRIC).—Incorporation has been granted to a company under this name in Wisconsin, with a capital of $100,000, to build an electric railroad from Sheboygan, Wis., south for a distance of about 60 miles to Milwaukee, passing through Fond du Lac, Port Washington and other points. John E. Uselding, of Port Washington; Peter D. Brueckbauer, of Elkhart, and John M. Saeman, of Sheboygan, are incorporators. Such a line would parallel the Chicago & North-Western between these two points.

NASHVILLE & HUNTSVILLE (ELECTRIC).—This company, which proposes to build a line from Memphis, Tenn., through Nashville, Tenn., and Birmingham and Montgomery, Ala., to Pensacola, Fla., announces that it will soon begin grading work on the first division, north of Nashville, and on the second division, south of Huntsville. J. H. Conner is President. (See Construction Record.)

OREGON & IDAHO.—A company has been incorporated in Idaho under this name to build a railroad from Emmett, Idaho, northwest through Payette Valley to Ontario, Ore., a distance of about 30 miles. The incorporators include: Nathan C. Richards and O. C. Wright, both of Sumpter, Ore.

OREGON WESTERN (So. Pac.).—Surveys are being made by the Southern Pacific for building this proposed road from Drain, Ore., west along Elk creek and the Upqua river to the Pacific coast at Gardiner, thence south to the head of Coos bay and around that water to Marshfield, a total distance of about 80 miles. The cost of the work will be approximately $3,500,000. (See Southern Pacific, August 25, p. 63.)

PENNSYLVANIA.—A contract is reported let to Menamin & Sims, of Philadelphia, at about $150,000 for double tracking on the Petersburg branch of this road from Coverdale to a point west to Clover Creek Junction, a distance of 2½ miles. A contract is also reported let to the Millard & McGraw Construction Co., of Philadelphia, for double track work from Clover Creek Junction to Franklin Forge, an additional 2½ miles. The contracts call for the beginning of the work at once and completion by May 1, 1906.

Philadelphia, Baltimore & Washington (Penna.).—See Baltimore Belt Line Terminal above.

Pueblo, Oklahoma City & New Orleans.—Incorporation has been granted this company in Oklahoma with a capital of $30,000,000 to build a railroad from Pueblo, Colo., southeast to New Orleans, 1,035 miles, air line. Preliminary surveys will be made and it is hoped to have financial arrangements completed by the first of next year. The initial work will be started between Oklahoma City and Woodward. The incorporators include: J. H. Wheeler, W. C. Burke, R. A. Wooldridge, George H. Dodson and J. H. Wright, all of Oklahoma City.

Rio Grande Western.—This company has track laid on its extension from Bingham, Utah, north to the mills of the Utah Copper Co., a distance of 13 miles. The road will be extended two miles further to Garfield.

Rock Island, Arkansas & Louisiana (C., R. I. & P.).—Certificates authorizing the consolidation of the Arkansas Southern with the Little Rock & Southern and the Arkansas Southern Extension Railroad Company under the above name have been filed in Arkansas. The capital stock of the consolidated company is $15,000,000, and headquarters will be at Little Rock. The directors include: E. P. Peirce, H. W. Morrison, W. S. Tinsman, T. S. Buzbee, of Little Rock, and A. E. Sweet, of Ruston, La. The company will operate the following lines of railroad: From Crossett to some point on or near the Mississippi river in Louisiana; from a point upon the Haskell-Eldorado line to Malvern, Ark.; from Haskell, Ark., to Little Rock; from a point at or near Junction City, La., to Shreveport, La.; from a point at or near the southern boundary of Winn Parish, Louisiana, to Alexandria, La.; from Alexandria southward to the Gulf of Mexico; from Alexandria westward or southwestward to the western boundary of Louisiana, and from Alexandria, La., to a point upon the Mississippi river at or near the city of Baton Rouge, La., or the city of New Orleans or upon the Mississippi river between Baton Rouge and New Orleans.

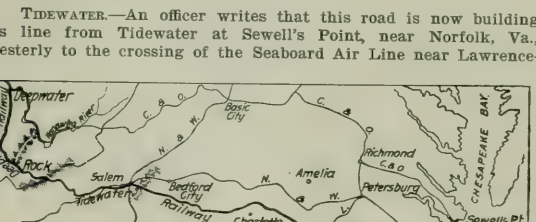
St. Louis Southwestern.—An officer writes respecting the proposed extension of this road from its southern terminus at Gatesville to Hamilton, Tex., that surveys were made some time ago for a distance of 33 miles, but that no definite action has as yet been taken towards beginning the work.

Shreveport & Northeastern.—An officer writes that this proposed road is to be built from Shreveport, La., via Homer to Memphis, Tenn. Surveys have been completed from Shreveport to Homer and nearly all the right of way secured. A contract has been let for building eight miles from Minden, La., southwest and in the 10 miles southwest from Homer, several miles of grading is nearing completion. Track laying will follow immediately and grading of the intervening section between Homer and Minden will be carried on during the winter. A. K. Clugman is President, Shreveport, La. (October 27, p. 139.)

Southern Pacific.—An officer writes that the Shattuck & Desmond Construction Co., of Los Angeles, is grading between Santa Cruz and Davenport, 12 miles, on the proposed extension from Santa Cruz, Cal., north via Davenport, San Gregoria, Pescadero and Half Moon Bay to a junction with the Southern Pacific near Colma approximately 68 miles. (October 27, p. 135.)

See Oregon Western above.

Tidewater.—An officer writes that this road is now building as line from Tidewater at Sewell's Point, near Norfolk, Va., westerly to the crossing of the Seaboard Air Line near Lawrence-



Tidewater and Deepwater Railways.

ille, 103 miles, and that bids are in for grading the balance of the line from this point west to Rock, W. Va., 259 miles, where connection will be made with the Deepwater Railroad. The latter is building 84 miles of railroad from that point north to Deepwater, on the Chesapeake & Ohio; and 24 miles of the line from Ivey north to Deepwater has been completed.

Wisconsin Central.—See Lake Superior & Southeastern above.

Yazoo & Mississippi Valley (Ill. Cent.).—This company, it is reported, has begun track laying on its new branch from Webb, Miss., east to Parchman, a distance of eight miles.

RAILROAD CORPORATION NEWS.

Allegheny Valley.—See Pennsylvania below.

Boston & Maine.—The results of operation during the three months ending September 30 are as follows (cents omitted):

	1905.	1904.
Gross earnings	$10,449,587	$9,908,851
Operating expenses	7,165,666	6,715,993
Net earnings	$3,283,921	$3,192,858
Net income	3,401,471	3,294,861
Surplus	1,362,632	1,262,192

Canadian Northern.—This company operated 1,876 miles of road during the year ending June 30, 1905, an increase of 290 over the previous year. There was an increase of about 250,000 tons in freight carried and 125,000 in the number of passengers. Statistics of operation for the year are:

Gross earnings:	1905.	1904.
Passenger	$663,936	$516,808
Freight	3,061,531	2,412,384
Mail, express, etc.	464,745	313,511
Total	$4,190,212	$3,242,703
Operating expenses:		
Maintenance of way	$557,261	$476,930
Maintenance of equipment	410,707	296,335
Conducting transportation	1,515,300	1,174,932
General	161,462	172,575
Total	$2,644,730	$2,120,772

Chicago & Eastern Illinois.—The New York Stock Exchange has listed $5,000,000 4 per cent. refunding and improvement mortgage bonds of 1955. (October 6, p. 112.)

Lake Shore & Michigan Southern.—The report for the quarter ended September 30 shows the following results:

	1905.	1904.
Gross earnings	$10,069,253	$8,776,979
Operating expenses	8,255,647	6,292,832
Net earnings	$1,813,606	$2,484,146
Surplus	1,053,606	1,434,146

New York Central & Hudson River.—It is reported as we go to press that at a meeting of the board of directors, to be held this week, an issue of $17,500,000 new stock will be offered at par to the shareholders. There is now $132,250,000 capital stock outstanding—$150,000,000 authorized.

New York, New Haven & Hartford.—The report of this company for the quarter ended September 30 reflects the generally prosperous condition of the manufacturing towns of New England. The results of operation during this period are as follows:

	1905.	1904.
Gross earnings	$13,849,515	$12,989,029
Operating expenses	8,993,930	8,721,795
Net earnings	$4,855,585	$4,267,234
Surplus	2,611,102	2,293,285

Pennsylvania.—This company proposes to exchange 1⅛ shares of its stock for two shares of Allegheny Valley preferred stock if 90 per cent. of the holders of the latter stock sign an agreement to that effect before December 1. The Pennsylvania now owns a majority of the stock of the Allegheny Valley, which consists of 263 miles of line between Pittsburg and Oil City, Pa., and Redbank, Pa., and Driftwood, and is operated as a part of the Buffalo & Allegheny Valley division of the Pennsylvania. There is $10,544,200 common stock of the Allegheny Valley outstanding; the Pennsylvania owns $9,653,800 of this and $11,876,655 of the $17,174,998 preferred stock. Thus, if an agreement is reached and the exchange is made, the Pennsylvania will turn about $6,000,000 of its own stock into its own treasury in exchange for the Allegheny Valley stock which it holds, and the minority Allegheny Valley stockholders will get a dividend paying stock in place of the securities which they now hold on which no dividends have ever been paid.

The New York Stock Exchange has listed $100,000,000 3½ per cent. ten-year convertible bonds of the Pennsylvania. (October 6, p. 112.)

Quebec Southern.—The Exchequer Court at Montreal has announced the acceptance of the bid of $1,051,000 made by the bank of St. Hyacinthe for the Quebec Southern. The decision was appealed. The Quebec Southern owns 89 miles of road between Sorel, Que., and Noyan, and 55 miles of road between St. Lambert and St. Francois, which was formerly the South Shore and which was consolidated with the Quebec Southern in 1902. The road went into the hands of a receiver in 1904.

Tennessee Central.—There is to be no further change, for the present, in the direct management of this company. After December 1 it will be operated under the joint direction of the Illinois Central and the Southern, who will, however, make no changes in any of the official positions. A meeting of the shareholders has been called for January 10, to act on a proposed sale of the entire property to the Illinois Central and the Southern. (October 27, p. 136; November 10, p. 147.)

GENERAL NEWS SECTION

NOTES.

The Rutland Transit Co. (Rutland Railroad) has ordered two additional steamers for service between Ogdensburg, N. Y., Milwaukee and Chicago.

The Supreme Court of South Carolina has sustained the decision of a Magistrate's Court imposing on a railroad the statutory penalty of $50 for failure to adjust a freight damage claim within 40 days.

The Atchison, Topeka & Santa Fe recently carried from California to points in Texas, Arkansas and Missouri, 9,450 sacks of potatoes. The potatoes were shipped from Stockton and filled 35 cars.

In the Supreme Court of the United States, twenty-seven railroads operating in the State of Michigan have made appeals in the suit brought to test the validity of the tax law of Michigan, passed in 1901.

An officer of the Pere Marquette road announces that his company and others in Michigan have given notice of withdrawal from the Central Passenger Association Mileage Ticket Bureau, and on February 1 will resume the sale of the "Northern" mileage ticket.

The railroad members of the joint committee of railroads and shippers recently established in Ohio, are G. W. Davis, General Freight Agent of the C., A. & C., Columbus; A. E. Billings, Division Freight Agent of the Lake Shore, Toledo, and J. H. Hackett, Division Freight Agent of the Erie, Galion.

A press despatch from Texas says that the ticket brokers of El Paso, having been asked by the Chamber of Commerce of that city to refrain from dealing in excursion tickets which are to be issued for a mining congress which is to meet there, have promised to comply with the request, and have given a bond for $10,000 as an assurance of good faith.

The planting of trees for timber by the Pennsylvania Railroad, which has been carried on now for several years, has reached a point where the total number planted is given as 477,299. An officer of the company is reported as estimating the number of sleepers needed for the road annually at 3,850,000, which would require the cutting of about 1,300,000 trees.

According to a Chicago press dispatch, the Chicago & Alton is to have "train auditors" on all passenger trains; men who will go through the train with the conductor and "check up" the collections. The train auditor is spoken of as an innovation. In the sense that the employment of two men to act jointly in collecting tickets and fares is old enough to have been forgotten, the idea may be called new, but it was in use on the Baltimore & Ohio something like thirty years ago.

The newspapers have recently revived the report, which has been circulated repeatedly within the last six or eight years, that the Pennsylvania Railroad was about to lay underground telegraph wires between New York and Philadelphia; and the report is now amplified to include the division west of Philadelphia; but an officer of the road informs us that the company is simply making investigations; that it is not at all likely that anything will be done within the next year.

General Passenger Agent Moody, of the Pennsylvania Lines West of Pittsburg, announces that, by an overwhelming vote, the passengers on the Pennsylvania 18-hour trains between New York and Chicago favor the present times of departure and arrival at the termini. For two weeks each passenger on the trains has been asked to vote on the question of changing the hours. The degree of overwhelmingness is not stated, but the number of votes of westbound passengers in favor of continuing the present arriving time at Chicago (8:55 a.m.) was 460, and of eastbound passengers in favor of continuing the present arriving time at New York (9:45 a.m.) was 420.

Bids for London City Council Improvements.

A contract has been let to J. G. White & Co., Ltd., the London connection of J. G. White & Co., electrical engineers of New York, for building a number of miles of track for the London City Council to cost a million dollars. Bids will shortly be invited by the London City Council for the reconstruction for electric traction of the first 22½ miles of the Northern system, which has just been bought from the North Metropolitan Company. The work will begin in April, 1906, and is to be finished by the end of the year. The track for the conduit system, it is estimated, will cost about $2,000,000, and the cars, electric cables and switchboards about $1,000,000. Four bridges over railroads will be built or widened at a cost of $120,000, and two new car barns, as well as three sub-stations built, calling for an outlay of $550,000, making a total estimated cost of $4,000,000. A contract has already been let for 4,210 tons of rails, at $35.70 per ton, to a Middlesboro concern. An American tender was lower but was thrown out because it did not comply with certain specifications. The contract calls for about $150,000 worth of material. In addition to the foregoing there are two sections of 46 miles and 36 miles of track on the Northern lines, which are shortly to be reconstructed. These new lines will also necessitate the purchase of large quantities of power generating machinery.

The Recent History of Federal Control of Railroads in the United States.*

BY W. M. ACWORTH.

(*Continued from page* 154.)

The history of Federal intervention in railroad regulation begins with the year 1866, in which year an Act to Facilitate Communication between the states was passed by Congress, providing that railroads in any one state might connect and exchange traffic with railroads in any other state. Presumably this statute was passed for merely legal reasons and only recognized and perhaps legalized what had already in very many instances been carried out in practice. Congress exercised its constitutional power to regulate—in the sense of making regular—commerce among the several states; but regulation, in the sense of control, it still left to the individual states. About the same time Congress also granted charters and gave subsidies to certain railroad companies, the Union Pacific more especially, so as to secure the closing up of the gap between the Atlantic and the Pacific States. But this power Congress exercised not so much as the supreme national authority as in its capacity of governing authority of those portions of the territory of the United States not yet included within the territory of any state. Another 20 years had to pass before the country as a whole was ripe for Federal legislation on the railroad question. The proportion of the whole volume of traffic that was merely intrastate was rapidly decreasing. All other traffic escaped state regulation. If Congress did nothing, it was uncontrolled. The railroad companies were a law to themselves, and their own law they often honored more in the breach than in the observance.

In 1887, after an exhaustive inquiry which elicited valuable evidence and resulted in a valuable report, the Act to Regulate Commerce, more commonly perhaps called the Interstate Commerce Act, was passed by Congress. Like most acts of the kind, it was a compromise measure, representing, not without some degree of success, an attempt to amalgamate into a single Act a very radical bill introduced by Judge Reagan, of Texas—afterwards for many years chairman of the Texan State Railroad Commissioners—and a much more conservative bill fathered by Mr. Cullom, then and still in 1905 Senator from Illinois.

The Act to regulate Commerce of 1887, which was amended in certain points of practical rather than theoretic importance in 1889 and again in 1893 and 1903, may be dealt with under three heads. [Let me once more repeat: "commerce" for Congress is "interstate commerce only." Intrastate commerce lies beyond its province.] All three heads are concerned with regulation of rates and that only. It was not till later that Congress dealt with matters falling under what I have described as the police power. The first portion of the Act lays down the law to bind railroads as carriers of passengers and merchandise, or rather—what is perhaps, with one exception, a more accurate statement—declares and particularizes the common law obligations which already bound them. The second portion requires the publicity of all rates and gives rules for publication. The third portion is wholly what Austin calls "adjective law." It creates an Interstate Commerce Commission, defines their duties, and provides machinery for the enforcement of the law and penalties for its violation.

The first portion of the Act, in language largely borrowed from our Railway and Canal Traffic Act, 1854, enacts in effect:

1. That all charges must be reasonable and just.

2. That no charge shall unjustly or unreasonably discriminate between (*a*) persons (*b*) places.

Two sections, however, as the Scotch say, "condescended upon details" Section 4, the famous "long and short haul" clause—next year incorporated, fortunately in a quite innocuous form, in our Railroad and Canal Traffic Act, 1888—requires that, under substantially similar circumstances, the rate for a short distance shall

*A lecture delivered on Oct. 25, at the School of Economics, University of London.

be at least not higher than the rate for the long distance of which it forms a part. The law-courts have, it may be here mentioned, of recent years drawn the teeth of this section by decisions that serious competition creates a state of circumstances substantially dissimilar. [Compare the decision of our own Courts of Appeal, and especially Lord Herschell's masterly judgment, in the case of Pickering Phipps vs. the London & North-Western Railway.] Section 5—which came from the Reagan bill—the equally famous "anti-pooling section," forbids either the diversion of competitive traffic from one route to another so as to make up agreed percentages of the total, or the division under a joint purse agreement of the total receipts from such traffic. But the pooling question is of such importance that I must deal with it at more length hereafter.

Section 6 requires that all rates for goods and passengers shall be published by being (*a*) printed and made available for public inspection, and (*b*)—which is a great improvement upon our English legislation, which provides for no one central point where all rates are accessible—filed with the commission. As showing the vast magnitude of the subject, it may be here stated that in the one year, 1903, over 165,000 tariffs were filed with the commission. And this, be it remembered, is interstate commerce only. Published tariffs may not be departed from upwards on less than ten, or downwards on less than three days' notice. Perhaps, as showing the temper in which some railroad magnates were at the outset prepared to receive new legislation—legislation which in the opinion of all competent and impartial observers was abundantly required—I may here mention an incident from my own recollection. Shortly after the Act came into force, a prehistoric boat was dug up somewhere on the shores of New England. It was acquired for the Boston Museum, and the railroad company was asked to carry it gratis. The company solemnly published and filed a tariff, "Boats constructed before the year 1600, cents per 100 lbs. 0"; waited three days, and then carried the boat.

The third portion of the Act provides for the appointment of a commission of five members to enforce the Act, and enacts that not more than three shall be members of the same political party. A recognition, based presumably on Gilbertian authority, of the fact that man is a political animal, but which, though doubtless well intentioned, has ever since afforded opponents of the Act an opportunity of saying that the Commissioners are by the law of their being political partisans. The Commissioners, a very hard worked body, are each paid £1,500 a year; whereas our Railroad Commissioners, whose duties are by no means equally arduous, are paid just double.

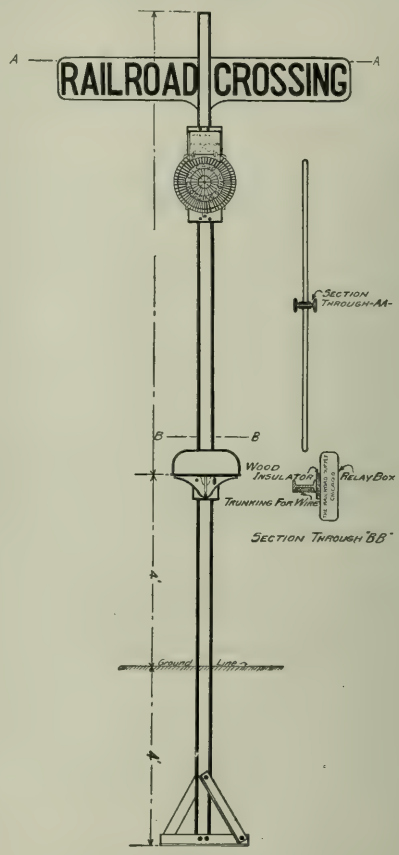
The commission is empowered to investigate any matter within the scope of its duties, either of its own motion, or on the application of any complainant, and for this purpose it has power to call for and to order the production of any necessary persons or papers. It may deal with any matter, either by an informal process of conciliation—a power given to our Railroad Commission in 1873, but withdrawn by the Act of 1888—or by a formal hearing. Should the commission decide against a railroad company, it cannot enforce its own decision, but must apply to the Attorney-General or one of his deputies to proceed in an ordinary Federal Law Court for its enforcement. In any such proceedings the findings of fact of the commission are to be regarded as "*prima facie* evidence." It will be observed that the commission is not a law court, like our Railroad Commission, enforcing its own orders. And, indeed, so long as it retains its present executive functions, it could not constitutionally, as I have already pointed out, be made a law court. Its members usually are, but are not required to be, lawyers. It combines, as has been pointed out, the incongruous functions of executive officer, detective, judge, and prosecutor, with a further function implied in the obligation to report to Congress what alterations, if any, of the law are required.

That the commission has not been entirely a success is admitted. Perhaps in the circumstances five archangels would not have succeeded either. That they have succeeded as well as they have, in spite of the fact that the salaries were wholly inadequate to command first-class men, that the post has often been made a mere political reward, that men with special railroad experience have been sedulously excluded, is surely high testimony both to the honesty, intelligence and diligence of the commissioners and to the reasonableness of the vast majority of the railroad managers. The following summary of the work of the commission has been published. In the five years 1900-5, there were made to the commission 2,296 informal complaints—complaints, we may suppose, similar to those made to our Board of Trade under the Conciliation Section of the Act of 1888—and 2,171 of these were satisfactorily disposed of. Formal complaints since the establishment of the commission in 1887 have numbered 770. The vast majority of those which have not been withdrawn have been settled either by the commission finding in favor of the railroad company or by the railroad company complying with the decision of the commission. Only in a very small fraction of the cases has the commission found it necessary to apply to a court to enforce its order. Where it has done so, its success has not been great. In the last five years it has made 22 final orders. Fourteen of these were obeyed by the companies without litigation, and of the rest five were upset on appeal, three were not obeyed, and in these cases (if I understand the figures rightly) the commission did not venture to attempt to obtain the enforcement of the order.

(*To be continued.*)

Crossing Sign and Bell Pole for Highways.

A new design of crossing sign and bell pole for highways is shown herewith. An upright I-beam has bolted to it two malleable iron signs, each of which has the words "railroad" and "crossing" on opposite sides in raised letters, thereby guarding both directions. These raised letters allow frequent painting, enabling a neat sign to be maintained at small cost. Strength and durability both were sought in the construction of the pole. The bottom has extra angle braces, which are buried in the ground and make unnecessary a concrete foundation, usually essential for a metal pole.



A New Highway Crossing Sign and Bell Pole.

The pole supports a relay box and crossing alarm bell, insulating material being used for mounting the box and bell. The trunking carrying the wires conforms to the web of the pole and is so arranged that no wires are exposed. Access to any wire or part is readily obtained by releasing one or two screws. A preservative paint covers the pole and trunking. The superiority of this design to a wooden pole in strength and durability is obvious. Lightning striking this pole would reach the ground without doing damage, whereas a wooden pole would probably be defaced or destroyed. The steel pole requires no attention or repairs, other than an occasional renewal of paint on the sign. The pole is also furnished without the wire trunking and insulated parts for use as a highway crossing sign. It is made by the Railroad Supply Co., Chicago.

Fifteen-Year Contract for Fuel Oil for the Mexican Central.

The Mexican Central Railroad has contracted with the Mexican Petroleum Co. to supply the road with fuel oil for all its locomotives for 15 years, an estimated quantity of 45,000,000 barrels of oil. The present production of the wells, which are near Ebano is about 2,000 gallons a day, while the average consumption on

the Mexican Central with all its locomotives burning oil would be about 8,000 barrels; but the petroleum company has considerable development work under way and expects to be able to supply the required amount. It has two reservoirs, one with a capacity of 500,000 barrels and the other of 225,000 barrels. Work is to be started at once on an additional reservoir that will hold 1,000,000 barrels. One condition of the contract is that there shall be a saving to the road of 20 per cent. on its cost of fuel.

A New Railroad Equipment Co.

The Baltimore & Ohio Equipment Co., of Wilmington, Del., filed a certificate of incorporation in Dover, Del., last week. The object of the company is to deal in rolling stock and railroad equipment. The incorporators are Andrew E. Sanborn, Henry A. Miller and Robert M. Burns, all of Wilmington, Del. Capital stock $1,000,000.

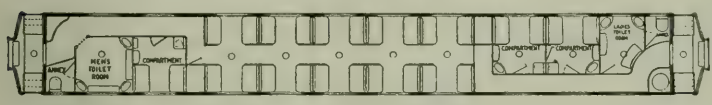
A Correction.

The Mr. Condict quoted in an editorial on "Motor Drive for Railroad Shop Tools," in our issue of November 17, was Mr. G. Herbert Condict, Vice-President of the Electro-Dynamic Company, Bayonne, N. J., and not Herbert T. Condict, as erroneously stated.

The New North-Western Limited.

The Chicago & North-Western placed in service last week new equipment for its "North-Western Limited" trains between Chicago, St. Paul and Minneapolis, built by the Pullman Company. The various roads between these cities have for years vied with one another in trying to excel in the quality of the equipment for their crack trains in this service. The North-Western's trains now being the newest, are naturally claimed to be the finest and embody some new features. Chief of these is a new arrangement for the sleeping cars. The straight compartment car has been dispensed with, and instead private compartments are provided in each section sleeping car. These cars have ten sections, a drawing room with annex and two private compartments, or ten sections and three compartments to the car. A diagram of the latter arrangement is shown. These compartments are slightly larger than the usual stateroom. Also the berths in these cars are several inches larger than the standard. An innovation in the toilet rooms is the use of porcelain washstands.

The interior decorations of the train are green and gold, the upholstery being olive green plush or green leather, with hangings and carpets to harmonize. A good feature in the day coaches, which include a reclining chair car, is wide decks, which give an air of roominess. The train is electrically lighted throughout from a dynamo in the baggage car, the illumination being exceptionally good. This is particularly noticeable in the chair car, where an extra row of incandescent lamps on the lower edge of the deck on each side makes the car as light as day and reading comfortable employment.



Floor Plan of New Sleeping Cars for the "North-Western Limited."

A Slur on the L. & S. W.

Mr. Binks.—"One of my ancestors fell at Waterloo." Lady Clare.—"Ah? Which platform?"—*Punch.*

Manufacturing and Business.

The Baldwin Locomotive Works, it is reported, is to erect a large building, which will be devoted exclusively to the making of electric trucks.

The Riverside Bridge Company's works at Martin's Ferry, Ohio, were damaged by fire Nov. 17; loss about $200,000. All of the iron and steel buildings were completely destroyed. The cause of the fire is unknown.

Frederick H. Stevens, formerly President of the Brooks Locomotive Works, has been elected Chairman of the executive committee of the American Locomotive Co. He will be, temporarily, the official head of the company.

It is expected that the Harlan & Hollingsworth Corporation will soon begin work on the new car shop at Wilmington, Del., which was planned some months ago. The new building is to be 500 ft. long and 90 ft. wide and will be of brick and steel.

The Helwig self-feeding tube expander with alarm attachment, made by the Helwig Manufacturing Company, St. Paul, Minn., is said to be meeting with much favor among its users, as it does away with a sectional expander its cost and labor to operate the same and indicates when the flue is sufficiently rolled.

The Crocker-Wheeler Company, Ampere, N. J., manufacturers and electrical engineers, announce the establishment of an Industrial Engineering Department, in which is concentrated all their work in the line of industrial engineering as applied to railway shops, machine shops and industrial plants of every description.

Work on the New York State barge canal has so far advanced that it is expected that additional contracts will be let next month. A delegation from the Utica Chamber of Commerce is urging the State Engineer to favor legislation to utilize the old Chenango Canal in giving that part of the state a more direct channel route to the soft coal regions. Such a bill was introduced at the last session of the Legislature.

The Independent Pneumatic Tool Company, of Chicago, has opened an office at 207 Germania Bank Building, Pittsburg, at which place it will carry a complete line of Thor piston air drills, reversible flue rolling, reaming, tapping and wood boring machines, and pneumatic riveting, chipping, calking and beading hammers. Richard D. Hurley has been appointed Manager of the office. James C. Dennis, well known in the pneumatic tool business, has also been appointed as salesman, and will travel out of the New York office.

The Lidgerwood Manufacturing Co., New York, has awarded the Miller-Collins Co., New York, the general contract for its new plant at Waverly, Newark, N. J. The buildings will cover upwards of 9 acres when the plant is completely finished, and will cost approximately $500,000, exclusive of machinery and land. The construction will consist of reinforced concrete, structural steel, and brickwork, with wood and slag roof over foundry. The Miller-Collins Co. are in the market for prices on piling, cement, sand, crushed stone, common brick, spruce and pine lumber, windows and sash, doors, skylights, sheet metal work, flooring, structural steel (about 500 tons), tin covered doors, painting, etc., etc.

The Baltimore & Ohio Equipment Co. has been incorporated in Delaware with a capital of $1,000,000 to buy, lease or otherwise acquire railroad rolling stock, and to buy, sell and deal in engines, cars, machinery, tools and general railroad equipment. The incorporators are: Andrew E. Sanborn, an attorney for the Baltimore & Ohio Railroad Company; Henry A. Miller, traveling passenger agent of the B. & O., Wilmington, Del., and Robert M. Burns of Wilmington.

Carl A. Strom has resigned as Superintendent of Motive Power and Machinery for the Isthmian Canal Commission at Panama and accepted the position of Works Manager of the Bucyrus Co., South Milwaukee, Wis., builders of steam shovels, dredges, etc. Mr. Strom is well known as the former Mechanical Engineer of the Illinois Central, with headquarters in Chicago, who resigned in May, 1904, to accept a similar position with the Isthmian Canal Commission. He was the first Engineer under the Commission to go to Panama, having preceded Mr. Wallace by a month. He found the shops of the old French company, after twenty years' idleness, practically buried in the jungle, in a generally dilapidated condition, and inside of a year's time Mr. Strom had four shops in complete commission, and had overhauled and put in service over 75 of the Belgian locomotives and hundreds of the French cars.

The continually increasing business of the American Blower Co., Detroit, Mich., has made necessary a three-story addition to the plant, which will be devoted entirely to the production of the Type A enclosed, vertical, self-oiling engine which has been on the market only two or three years and for which there is a growing demand. The building will be of steel and brick. The first floor will be used for erecting and testing engines, a very complete new outfit being put in for testing. The power from engines under test will be absorbed by generators and air compressors. An electric crane will form part of the equipment in this department. The second floor will be used for storing engine parts and painting the completed engines, and the third floor will be entirely for storage.

Iron and Steel.

The Boston & Maine has given an order for 25,000 tons of rails for delivery early in 1906.

Contracts for rails aggregating between 85,000 and 90,000 tons have been signed recently for 1906 delivery, as follows: Illinois Central, 39,000 tons; Chicago, St. Paul, Minneapolis & Omaha, 4,000 tons; an Indiana trolley road, 2,500 tons, and 10,000 tons supplementary orders for another railroad. All bids for steel for the Northwestern Elevated at Chicago have been rejected. Tenders were made on 8,000 tons of fabricated steel for the extension of this line from Chicago to Evanston, Ill. New bids will be asked for. The Duluth, Missabe & Northern has let contracts for 2,900 tons of bridge material in lots of 1,500 and 1,400 tons each to the American Bridge Co. A bridge contract was let by a road in Texas for 350 tons. Contracts are pending for structural shapes aggregating 50,000 tons. It is said that lake shipyards are figuring on contracts for 12 more lake vessels.

MEETINGS AND ANNOUNCEMENTS.

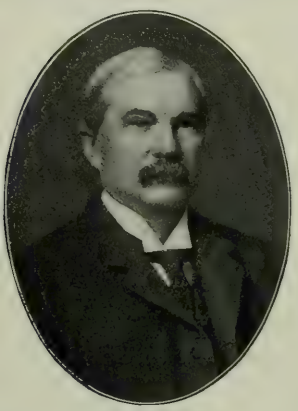
(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Master Car Builders' and Master Mechanics' Committee Meeting.

The Executive Committees of the Master Car Builders' and Master Mechanics' Associations will meet at the Manhattan Hotel, New York, December 11th, to listen to a report of the joint subcommittee on time and place for the 1906 conventions. The location will probably then and there be decided.

PERSONAL.

—Mr. Albert J. Pitkin, President of the American Locomotive Company, died at his home in New York City on November 16. He had been ill for several months, but his death was unexpected. Mr. Pitkin was born in Ohio in 1854, and at the age of 17 went, as an apprentice, into the stationary engine works of the Webster, Camp & Lane Machine Co., of Akron, Ohio. Having received his certificate, he spent a year in the locomotive repair shops of the Cleveland, Akron & Columbus, after which he entered the drawing office of the Baldwin Locomotive Works. Five years later, he became Chief Draftsman of the Rhode Island Locomotive Works, and in 1882 was appointed Mechanical Engineer of the Schenectady Locomotive Works. He became Superintendent of these works in 1884 and was later made Vice-President and General Manager. When the American Locomotive Company was organized, Mr. Pitkin was elected its First Vice-President, and on the death of S. R. Callaway, in June, 1904, became President.



A. J. Pitkin.

Mr. Pitkin was thorough and enthusiastic in the same measure that he was unassuming and approachable, and his personality inspired his associates and subordinates to their best efforts. He was an example of the unusual combination of high scientific talent with the executive ability necessary to the control of men and the management of a great corporation. To him is due a great deal of the credit for the development of the present high power locomotives, especially in the marked advance in the capacity of passenger locomotives, which began 12 years ago and reached its present high level in the large Prairie type locomotives recently built. More specifically, Mr. Pitkin's influence was shown in the introduction of wide fireboxes, and in the increase of steaming capacity through the use of larger boilers. The application of the Walschaerts valve gear received his careful attention, as did also the introduction into this country of the principle of the Mallet compound.

—Mr. J. M. Connell, who was recently appointed General Passenger Agent of the Atchison, Topeka & Santa Fé, began railroad work in 1879 as a clerk in the freight department of the Chicago, Burlington & Quincy. Two years later he went into the law department as a stenographer, where he staid about one year. He then was connected with the Northwestern Traffic Association and in 1883 returned to the Atchison as a freight and passenger clerk. The next year he became Traveling Freight and Passenger Agent for the Chicago, Milwaukee & St. Paul, and in 1889 was appointed City Passenger Agent of that road at Chicago. After about three years he went again to the Atchison, as General Agent of the passenger department at Chicago, where he remained until his recent appointment.

J. M. Connell.

—Mr. A. C. Dennis, recently appointed Division Engineer at Winnipeg of the Grand Trunk Pacific, has been on the Grand Trunk and the Grand Trunk Pacific for five years as Division Engineer of Construction, excepting one year, when he was in West Virginia as Chief Engineer of the Atlantic & Western. His railroad work has been in the engineering department of the Pennsylvania Lines West, the Southern, the Great Northern, and the Butte, Anaconda & Pacific. Before coming to the Grand Trunk Pacific he was Assistant Engineer of Construction of the Columbia & Western.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—R. G. Erwin, President, has resigned. T. M. Emerson, Third Vice-President, succeeds Mr. Erwin.

Central of New Jersey.—W. C. Smyth has been appointed Assistant Auditor of Passenger Traffic, with office at Philadelphia, Pa.

Chicago, Burlington & Quincy.—The title of W. F. Ackerman, Master Mechanic at Havelock, Neb., has been changed to Superintendent of Shops at that place.

Colorado & Southeastern.—C. H. Bevington, Superintendent has resigned. J. H. Abrams, formerly Superintendent of Terminals of the Missouri Pacific at Little Rock, Ark., succeeds Mr. Bevington, with office at Trinidad, Colo.

Denver, Enid & Gulf.—W. D. Gerber, Acting Chief Engineer, having been assigned to other duties, B. J. Dalton has been appointed Chief Engineer, with office at Enid, Okla. T.

Detroit, Toledo & Ironton.—The office of F. A. Durban, President, has been removed from Zanesville, Ohio, to New York.

Erie.—Russell Harding, Vice-President in charge of operation and maintenance, has resigned.

Gulf, Colorado & Santa Fe.—Y. Van den Berg, Assistant General Freight Agent at Galveston, Tex., has resigned.

Manitoba & Midland.—The officers of this new company are: President, James Fisher; Vice-President, H. Swinford, both with office at Winnipeg, Man., and Chief Engineer, P. E. Thian, with office at Portage la Prairie, Man.

Michigan Central.—S. P. Hutchinson, General Superintendent, has resigned. H. A. Worcester, Assistant General Superintendent, succeeds Mr. Hutchinson, with office at Detroit, Mich.

Pere Marquette.—P. F. Gaines, Assistant General Freight Agent, has been appointed General Freight Agent, with office at Detroit. The office of Assistant General Freight Agent has been abolished.

Rock Island, Arkansas & Louisiana.—The officers of this subsidary Rock Island company recently consolidated are: President, A. E. Sweet, with office at Ruston, La.; Vice-President, E. B. Pierce; Secretary and Treasurer, T. S. Buzbee, both with office at Little Rock, Ark.; and Assistant Secretary and Assistant Treasurer, G. H. Crosby, with office at Chicago, Ill.

Suffolk & Carolina.—The officers of this company are: J. T. Odell, President; F. E. Dewey, Vice-President; J. H. Force, Secretary and Treasurer; Joseph T. Odell, General Freight and Passenger Agent; A. N. Bullock, Chief Engineer. The office of the President is at New York; all other offices are at Norfolk, Va.

Tennessee Central.—W. C. Collier has been elected Vice-President.

Texas & New Orleans.—G. W. Vanderslice, Assistant Superintendent, has resigned. M. Sheehan, Superintendent of Maintenance and Water Service of the Fort Worth & Rio Grande, succeeds Mr. Vanderslice, with office at Houston, Tex.

Wabash.—R. F. Kelly has been appointed Assistant General Passenger Agent, with office at Chicago, succeeding F. A. Palmer. A. E. Robbins, Superintendent of the Buffalo division, has resigned, and the authority of C. S. Cunningham, joint Superintendent at St. Thomas, Ont., of this road and of the Grand Trunk, has been extended over the Buffalo Division.

LOCOMOTIVE BUILDING.

The Delaware & Hudson will build five D-3-B type locomotives at its own shops.

The Illinois Central is reported to be in the market for a number of locomotives.

The Pittsburg, Cincinnati, Chicago & St. Louis is reported to have ordered 50 locomotives.

The Chicago, Rock Island & Pacific has ordered 50 locomotives from the Baldwin Locomotive Works.

The Pennsylvania, as reported in our issue of November 17, has ordered 250 locomotives from the Baldwin Locomotive Works. Fifty of these locomotives will be H-6b consolidation freight locomotives, and the remaining 200 of a class or classes yet to be determined upon.

The Norfolk & Western, as reported in our issue of November

3, is in the market for 50 twelve-wheel locomotives. These engines are to weigh 200,000 lbs., with about 168,000 lbs. on the drivers; cylinders, 21 in. x 30 in.; diameter of drivers, 56 in.; radial stay wagon top boiler, with 200 lbs. working steam pressure; heating surface, about 2,943 sq. ft.; 258 charcoal iron tubes, 2¼ in. in diameter x 18 ft. 4⅞ in. long; firebox, 8 ft. 3⅞ in. x 5 ft. 4¼ in.; grate area, 44.5 sq. ft. The tender will have a capacity for 6,000 gallons of water and 10 tons of coal. The special equipment will include: Westinghouse air-brakes, hammered iron axles, except main wheel, which will be 3½ per cent. nickle steel; Keasby & Mattison boiler lagging, Perfecto brake-shoes, Norfolk & Western standard headlights, Monitor injectors, U. S. metallic piston and valve rod packings, Leach sanding devices, Nathan sight-feed lubricators, Railway Supply Co.'s springs, Crosby steam gages, Latrobe driving and truck wheels, cast-iron tender wheels and cast-steel wheel centers.

The Cincinnati, New Orleans & Texas Pacific has ordered three six-wheel switching engines from the Pittsburg Works of the American Locomotive Co. for February, 1906, delivery. These locomotives will weigh 145,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; radial stay wagon top boiler, with a working steam pressure of 185 lbs.; total heating surface, 2,486.5 sq. ft.; 300 tubes, 2 in. in diameter x 15 ft. 1½ in. long; firebox, 66 in. x 66 in.; grate area, 29 sq. ft.; tank capacity, 4,000 gallons of water and seven tons of coal. The special equipment will include: Westinghouse air-brakes, Otis steel axles, Simplicity bell ringers, Keasby & Mattison magnesia boiler lagging, Buffalo brake-beams, cast-iron brake-shoes, Climax and Hennesey couplers, Dressel headlights, Monitor injectors, Ajax journal bearings, Sullivan piston and valve rod packing, Hayden safety valves, Watters sanding device, Chicago sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashton steam gages, Latrobe driving wheel tires, cast-steel wheel centers, Homesteam's blow-off cock, Phillips boiler check, reflex water gages, Linstrom eccentrics and tank syphons.

CAR BUILDING.

The Southern is asking bids on 1,000 self-clearing hopper coal cars.

Morris & Company, Chicago, will build 100 fruit cars in its own shops.

The Buffalo & Susquehanna is reported in the market for passenger cars.

The Pittsburg & Lake Erie is reported in the market for passenger cars.

The Pittsburg, Cincinnati, Chicago & St. Louis has ordered 5,000 freight cars.

The New York Central & Hudson River is reported to be in the market for 300 passenger cars.

The Louisville & Nashville has ordered additional passenger equipment from Barney & Smith.

The Northern Pacific has ordered 500 steel underframe dump cars from the American Car & Foundry Co.

The Lake Shore & Michigan Southern has ordered 1,000 furniture cars from the American Car & Foundry Co.

The New York, Chicago & St. Louis, it is reported, is in the market for upwards of 5,000 box and stock cars.

The Chesapeake & Ohio has ordered 1,000 steel underframe gondola cars from the American Car & Foundry Co.

The Kelly's Creek & Northwestern has ordered 100 40-ton gondola cars from the American Car & Foundry Co.

The Lansing & Suburban Traction Co. is reported to have ordered four interurban cars from the St. Louis Car Co.

The Duluth, Missabe & Northern has ordered 250 steel ore cars of 100,000 lbs. capacity from the Standard Steel Car Co.

The Missouri Pacific is in the market for additional freight equipment, and, it is reported, is figuring on steam motor cars.

The Illinois Central is reported to have ordered a number of box and refrigerator cars from the American Car & Foundry Co.

The Great Northern is in the market for 1,000 box cars and has ordered 500 additional ore cars from the American Car & Foundry Co.

The Montreal Street Railway has set aside $1,000,000 for the purchase of new rolling stock and for the erection of new feeder lines next year.

The Colorado & Southern is reported to be figuring on 1,000 box cars; also a number of stock cars, flat cars, gondola cars and additional dump cars.

The Atlantic & Birmingham Construction Co. has ordered 13 passenger cars from the American Car & Foundry Co. and three passenger cars from F. M. Hicks & Co.

The Delaware, Lackawanna & Western is in the market for 18 milk cars, 15 passenger cars, 10 express cars, three combination passenger and baggage cars and two coaches.

The Minneapolis, St. Paul & Sault Ste. Marie, as reported in our issue of November 17, has ordered four twelve-section sleeping cars and six day coaches from Barney & Smith.

The Chicago, Burlington & Quincy has ordered 200 refrigerator cars and 250 ore cars from the American Car & Foundry Co., and 1,000 gondola cars from the Standard Steel Car Co.

The Pennsylvania has ordered 600 box cars and 2,500 hopper cars from the American Car & Foundry Co. These are in addition to the large orders placed by this company which have already been reported.

The Pittsburg Railways have ordered 100 closed vestibule passenger cars from the St. Louis Car Co. These cars will be 44 ft. 6 in. long x 7 ft. 10 in. wide over all, and 8 ft. 6 in. high from the under side of sill to the top of the roof.

The Ocean Shore has ordered 40 passenger and baggage combination cars from the W. L. Holman & Co., for April, 1906, delivery. The cars will be 50 ft. long and 9 ft. wide, over all. The special equipment includes Gould couplers.

The Atchison, Topeka & Santa Fé has ordered 75 passenger cars from the Pullman Co. Thirty of these are smoking cars, 20 are to be partitioned in the center, so as to form a separate compartment for negroes, and the remaining 25 are to be passenger coaches of the most modern type.

The Interstate has ordered five wooden hopper cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co. and not from the Pressed Steel Car Co., as reported in our issue of October 27. These cars will be 28 ft. long, 8 ft. 6 in. wide and 9 ft. $^{9}/_{16}$ in. high, over all. The special equipment includes Bettendorf bolsters.

The Pittsburg & Lake Erie has ordered 1,000 36-ft. box cars of 60,000 lbs. capacity from the American Car & Foundry Co., and 250 40-ft. gondola cars of 100,000 lbs. capacity from the Pressed Steel Car Co., all for February, 1906, delivery. The special equipment for all includes: Carnegie axles, Simplex bolsters and brake-beams, Westinghouse air-brakes, Camel brasses, Janney couplers, Security door fastenings, McCord journal boxes and Winslow roofs for box cars and Gould journal boxes for gondola cars, Railway Steel Spring Co.'s springs and Andrews trucks.

The Lehigh Valley, as reported in our issue of November 17, has ordered 1,000 hopper bottom steel gondola cars of 100,000 lbs. capacity and 1,500 box cars of 80,000 lbs. capacity from the Standard Steel Car Co., and 500 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. The gondola cars will weigh about 43,000 lbs., and measure 40 ft. long, 9 ft. 4 in. wide and 4 ft. 6½ in. high, all inside measurements. All box cars weigh about 44,000 lbs., and measure 36 ft. long, 8 ft. 6⅛ in. wide and 8 ft. 1¾ in. high, all inside measurements. The special equipment for all includes: American Brake-Shoe & Foundry Co.'s brake-shoes, Westinghouse air-brakes, Magnus Metal Co.'s brasses, Security doors for box cars, Miner draft rigging, Symington dust guards and journal boxes, Protectus paint for gondola cars, Winslow improved roofs for box cars, and Railway Steel Spring Co.'s springs.

BRIDGE BUILDING.

BEAUMONT, TEX.—The Southern Pacific is planning to build a viaduct over its tracks to cost $50,000. The company agrees to put up the structure if the city will build the approaches.

CHICAGO, ILL.—The engineering committee of the Drainage Board recommends that contracts be let for building the new bascule bridge at Dearborn street as follows: Substructure, to the Great Lakes Dredging & Dock Co. at $142,253, and superstructure, to the Jackson & Corbett Bridge & Iron Co. at $143,335; the work to be completed within 18 months.

LITTLE ROCK, ARK.—The St. Louis, Iron Mountain & Southern, it is said, proposes to build a steel viaduct 170 ft. long on two concrete piers 45 ft. high to cost $25,000 on West Third street to replace the present wooden structure. At Twelfth street, a viaduct 72 ft. long will replace the present structure over the tracks to cost $11,500, and at Thirteenth street the present bridge will be replaced by a steel structure 64 ft. long. Work on these improvements will be started at once.

MEXICO CITY, MEX.—The Mexican Central has decided to put up 12 steel bridges on its new line between Tuxpan, Colima and Manzanillo. The largest of the bridges will be 150 ft. long and 200 ft. high.

NEW WESTMINSTER, B. C.—The Pitt river bridge will be widened by the Canadian Pacific, but the cost of the work will be paid for

by the government. A. E. White, Secretary of the Board of Trade, New Westminster, can give information.

PORTLAND, ORE.—The Northern Pacific Terminal Co. has decided to build a system of elevated streets over the railroad tracks of the terminal yards at a cost of over $200,000. From Seventh street, near Kearney, a structure will be built gradually rising until it reaches Northrup, where it will intersect a similar structure extending over that street. At this point it will be 22 ft. above the tracks. One branch will follow Seventh street toward the river, descending gradually to the Albina ferry. The Northrup street structure will extend over the terminal company's tracks and gradually descend on Front street. The total length of the viaducts will be 1,600 ft.

RICHMOND, VA.—The joint committee of the City Councils of Richmond and Manchester have taken measures to have a site selected for the proposed bridge over the James river. The cost of the new bridge will be about $377,000.

SEGUIN, TEX.—An iron bridge will be built over the Guadalupe river at McQueeny.

STEPHEN, N. B.—Extensive repairs will be made to the international bridge between this place and Calais. Address C. H. LaBollois, Commissioner of Public Works, Fredericton, N. B.

TORONTO, ONT.—The City Engineer estimates the cost of the proposed subway under the railroad tracks on Bloor street at $200,000.

WILMINGTON, DEL.—Chief Engineer Theodore A. Leison, of the water department, has completed plans for building a concrete bridge 335 ft. long with a 16-ft. driveway and two 4-ft. sidewalks over the Brandywine river. The cost of the proposed structure will be $35,000.

Other Structures.

CHARLOTTETOWN, P. E. I.—The new station to be built by the Intercolonial will be of red sandstone 118 ft. x 140 ft., with a baggage room attached.

JOPLIN, MO.—The Missouri Pacific is planning to build a brick freight house 75 ft. x 200 ft. here.

LITTLE ROCK, ARK.—The Missouri Pacific is having plans made for a passenger station.

ST. LOUIS, MO.—The United Railways Co. is planning to build a repair shop here to cost $75,000.

SHARPSBURG, PA.—The Pennsylvania is said to have secured the land necessary for building car repair shops and as a site for large yards. The improvements are to include a dock 500 ft. long on the Allegheny river.

WILLMAR, MINN.—Improvements are to be made by the Great Northern on its shops at this place and the capacity of its yards doubled.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BANGOR TERMINAL.—An officer writes that the prospects of building this proposed road, from some point on the Northern Maine Seaport in the town of Herman, Penobscot County, Me., east to Bangor, a distance of about six miles, are very good. Contracts have not as yet been let. The officers recently elected are: Linwood C. Tyler, President; Arthur Chapin, Vice-President, and Charles D. Stanford, Treasurer. The Chief Engineer is P. H. Coombs, of Bangor. (November 3, p. 114.)

BRANDON, SASKATCHEWAN & HUDSON BAY.—The railway commission of the privy council has granted this road permission to cross the lines of the Canadian Pacific at Minto and Boissevain and the Canadian Northern at Kanoka. Surveys are now being finished and bids for construction will soon be asked. (Sept. 29, p. 102.)

BUFFALO & SUSQUEHANNA.—Preliminary work, it is said, has been commenced by this road to tunnel through Hogback Mountain near Galeton, Pa., to eliminate heavy grades. The work will cost $1,000,000 or more.

CALIFORNIA MIDLAND (ELECTRIC).—Incorporation has been granted a company under this name in California, with a capital of $3,000,000, to build an electric railroad from Marysville, in Yuba County northeast about 35 miles to Nevada City, with a branch south to Auburn, in Placer County, 30 miles. The incorporators include: John Morton, San Francisco; E. J. de Sable, Jr., San Mateo; L. H. Susman, L. W. Pryor and Walter J. McLean, all of San Francisco.

CANADIAN PACIFIC.—This company is said to have given a contract to Ironside, Rannie & Campbell, of Vancouver, B. C., for track laying, ballasting and bridging 45 miles on the Nicola branch between Spence's Bridge, on the main line, and Nicola Lake.

CATSKILL MOUNTAIN & MOHAWK VALLEY (ELECTRIC).—Incorporation has been granted this company in New York, with a capital of $2,000,000 to build a railroad from Cairo, in Greene County, N. Y., west to a point near Oneonta, with a branch from Jefferson, in Schoharie County, south to Stamford, in Delaware County, a total length of about 78 miles. The directors include: E. C. White, E. T. Holdridge, C. V. D. Peck, William B. Reed, Jr., and James W. McCabe, of New York; H. S. Lounsberry, of Portchester; N. Herschfield, of Rochester; G. W. Kendall, of Stamford, and E. E. Billings, of Gilboa.

CHICAGO, MILWAUKEE & ST. PAUL.—An extension of this road to the Pacific Coast at Tacoma and Seattle is, according to newspaper reports, now practically admitted by officers of the company. E. W. McKenna, second vice-president, has been quoted at some length in regard to the Pacific Railroad, a company which was incorporated in the State of Washington in October to build from Seattle southeast to Wallula on the Columbia river, just south of Pasco, Wash. The fact that after the numerous previous denials from many sources Mr. McKenna admits the possibility that the St. Paul might be interested in this Pacific Company looks as though the time was not far distant when plans would be definitely announced for a Pacific extension. Evarts, in the northern part of South Dakota, on the Missouri river and the westernmost terminus of any existing St. Paul line, is mentioned as the starting point of the new line to the Pacific, though a railroad—the White River Valley—is being built from Chamberlain west to Rapid City. From Evarts the proposed new line is to run west by northwest, probably to Butte and Helena, thence west across the Bitter Root mountains through Lolo Pass and the Clearwater country in Idaho to Lewiston; thence west through the southeastern corner of the State of Washington to the Columbia river near Wallula. According to this report, there is also to be a branch line from some point on this projected main line south to a connection with the Chamberlain-Rapid City line. It is also said that the middle part of the present gap between Evarts and the coast may be bridged by trackage rights over the Northern Pacific. The president of the Pacific Railroad is H. R. Williams, until recently general manager of the Chicago, Milwaukee & St. Paul, and the chief engineer is W. L. Darling, formerly of the Northern Pacific and the Rock Island.

COLORADO & SOUTHERN.—Contracts are reported let by this company for widening all of the embankments on its road between Cheyenne and Orin Junction, 154 miles. This work is to be carried out during the coming spring.

DELAWARE & SOUTHERN.—Incorporation has been granted this company in New York, with a capital of $170,000, to build a railroad from Deposit, N. Y., northeast to Trout Creek, in Delaware County, a distance of 17 miles. The directors include: Charles P. Knapp, of Deposit; William O. Dennis, of Trout Creek; G. H. Perigo, of Scranton, Pa., and others.

DENVER SOUTHEASTERN.—Incorporation has been granted this company in Colorado, with a capital of $1,000,000, to build a railroad from Denver, Col., south via Colorado Springs to Pueblo; thence south to Raton, N. Mex., 225 miles, with a branch from Pueblo east via Las Animas to Amity, about 150 miles additional. Walter H. Tunis, L. W. Herney, W. O. Temple, H. O. Tunis, W. C. K. Duhn and T. B. Doan, of Denver; I. C. Cockey, of Washington; F. A. Sherwood, of Philadelphia, and R. D. Whiting, of New York, are said to be interested.

EDDY & NORTHERN.—Incorporation has been granted a company under this name in South Carolina, with a capital of $100,000, to build a railroad from Marion south to Eddy Lake, about 35 miles. The incorporators are W. M. Burgan and Norman Jones, of Baltimore; George Officer and J. W. Little, of Eddy Lake, and R. B. Scarborough, of Conway.

GALVESTON-HOUSTON INTERURBAN.—This company has been organized to build a railroad between these two cities, with branch lines east to Laporte and Seabrook. Franchises have been granted both in Houston and Galveston, and rights of way are being secured. The officers include: J. O. Ross, President; Henry House, Vice-President; F. L. Dana, of Colorado Springs, Secretary, and J. S. Rice, Treasurer. W. J. Moore and Lyman Levy, of San Antonio, are directors.

GRAND TRUNK.—An officer writes that this company will depress its tracks at South Parkdale, Ont., to secure better entrance into Toronto. There will be practically no change of the present line, but additional tracks may be put in. The work, including land damage, is estimated to cost over $1,000,000.

GRAND TRUNK PACIFIC.—Overn & Olson have been given a subcontract for grading ten miles of the Lake Superior branch of this road. (Nov. 3, p. 143.)

GREEN BAY, OSHKOSH, MADISON & SOUTHWESTERN.—This company, which is building a line from Madison, Wis., north to Cran-

don, a distance of about 200 miles, has secured the right of way for nearly the entire distance. A grading contract has been let to McDonald & O'Connor, of Grand Rapids, for work on the portion of the road between Shawano and the village of Gresham, close to the Indian reservation. The proposed line will cross the Chicago & North-Western near Appleton Junction. (October 6, p. 11.)

HIGHPOINT-WINSTON-SALEM (ELECTRIC.)—A charter has been granted to a company under this name in North Carolina with a capital of $450,000 to build an electric railroad from Highpoint northwest with extensions 50 miles long. The incorporators include: C. C. Yeller, J. H. Mills, R. H. Wheeler and others of Highpoint.

HILLSBORO & NORTHEASTERN.—This company, which operates five miles of railroad in Wisconsin, is planning to build an extension south through Hub City and Rockbridge to Richland Center, a distance of about 30 miles. The line has been located and rights of way are being secured.

KNOXVILLE & MARYVILLE (ELECTRIC).—A company under this name will apply for incorporation in Tennessee, with a capital of $100,000, to build an electric railroad from Knoxville south to Maryville, about 20 miles. The franchise which the Knoxville Railway & Light Co. has over the bridge has been bought by the Knoxville Traction Co., of which the present company is to be the successor. J. Burger, President of the Maryville Bank; G. P. Gaut, Robert Vestal, Howard Cornick, J. C. Sterchi and others, of Knoxville, are interested.

KNOXVILLE, SEVIERVILLE & NEWPORT (ELECTRIC).—A charter has been granted this company in Tennessee with a capital of $50,000 to build an electric railroad from Knoxville, Tenn., southeast about 30 miles, to Sevierville. The incorporators include: S. P. Condon, J. B. Brabson and Jerome Templeton.

KOOTENAY CENTRAL (CAN. PAC.).—Announcement has been made that work on this road will be rushed between Golden and Cranbrook, B. C.

LOUISVILLE & NASHVILLE.—It is said that Eddington, Griffith & Co., of Knoxville, will soon begin work on an extension of this line from a point near Pineville, Ky., west 34 miles to Williamsburg, on the Knoxville division. The new line will make a shorter line from the Cumberland Valley division to the Knoxville division.

This company has begun operating trains through its tunnel under Baker's Hill, which is 16 miles west of Nashville. The tunnel is nearly a mile long and cost with approaches about $2,000,000. It is built entirely through solid rock.

MEXICAN CENTRAL.—This company, it is said, will build a branch line from Jimulco, in the state of Coahuila, Mexico, west to Velardena, a distance of about 30 miles.

MIDLAND & MANITOBA.—This company, chartered to build a railroad from the American boundary north to Fort Churchill on Hudson Bay, has let contracts to J. Stewart and Zimmerman Bros. to build an additional three miles south of Portage la Prairie. They will commence work immediately and hasten it to completion. Surveyors are now working north of Portage la Prairie, and a number of other contracts will soon be let. Work will be carried on all winter so that some of next year's crop may be taken out by the new route. (Nov. 17, p. 159.)

MIDWAY & VERNON.—This company, which proposes to build a railroad from Midway along the north side of Kettle river to a point near Westbridge, B. C., and thence north to Vernon, a distance of 150 miles, has recently sold bonds for $30,000 per mile to provide funds for building the line. Work is now in progress west from Midway; also between Rock Creek and Westbridge and from the latter place up West Fork towards Wilkinson creek, above Carmi Mills and north over the summit to a meeting with the force now working south from Vernon. This covers the entire route as located. The work will be light on the first 60 miles between Midway and Carmi. Between the latter place and Okanagan Mission, the proposed route passes through a mountainous country which will necessitate some heavy work. It is expected to have the first 20 miles between Midway and Westbridge finished during the present year. McLean Brothers, of Vancouver, are building the first 10 miles west of Midway. Contracts for building the balance of the road will be let this year. The original promoters of this road included Ralph Smailes, Robert Wood, Christopher Wood, Duncan McIntosh, James Kerr and Robert Kerr, all of Greenwood, and Charles Wilson, K. C., of Victoria.

NORTHERN PACIFIC.—This company, it is said, has finally decided to build a cut-off from Lind, in Adams County, Wash., west for a distance of about 100 miles to Ellensburg. The proposed road will shorten the distance between these two points over the present route by about 90 miles, the distance on the present line being 190 miles.

PACIFIC, OMINICA & NORTHERN.—Work will soon be commenced on this road. The charter has been bought by the Grand Trunk Pacific. Surveys are now being completed, so that bids may be called for soon. (See Pacific Northern & Ominica, Construction Record.)

PEA RIVER VALLEY & GULF.—Incorporation has been asked for by a company under this name in Alabama, with a capital of $25,000, and headquarters at Troy, to build a railroad from Opelika, Ala., southwest to Portland, Fla., on Choctawhatchee bay, a distance of about 200 miles. The offices of the company will be at Troy, Ala. W. H. Bootlo is President, and J. V. Huff, Vice-President.

PITTSBURG, INDEPENDENCE & OKLAHOMA.—A charter has been granted a company under this name in Kansas to build a railroad from Pittsburg, in Crawford County, Kan., southwest via Independence to Ponce City, in Kay County, Okla. T., a distance of about 150 miles. The incorporators include: A. C. Stitch, A. W. Shulthis, J. B. Zeigler and A. Steinmetz, of Independence, and Charles Mitchell, of Cherryville.

RICHMOND & CHESAPEAKE BAY (ELECTRIC).—This company, which was incorporated last year in Virginia to build an electric railroad from Richmond north to Ashland, a distance of about 17 miles, is asking bids for building the line. Eighty-pound rails will be used the entire distance, and there will be a double track from Broad street station to Lakeside, a distance of six miles. It is proposed to run express trains, making the trip from Broad street to Ashland in 18 minutes. (See Construction Record.)

RICHMOND, RAPPAHANNOCK & EASTERN.—This company, organized in Virginia by Philadelphia and New York capitalists, is negotiating for the sale of $1,250,000 bonds to build its railroad from Ellersons, near Richmond, Va., east to Urbana, near the mouth of the Rappahannock river, a distance of about 60 miles. R. V. Hilands, Jr., of Philadelphia, is President, and G. W. Carhart, of New York, Vice-President and General Manager. The promoters say that work is to be begun next month. (See Construction Record.)

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—This company is increasing the working force on the line which it is building from Raton west to Elizabethtown, in Colfax County, N. Mex., 76 miles. Work at present is only being done from Raton westward. The line will be 120 miles long. From Elizabethtown it will traverse the canyon of the Cimarron and cross the Red river to Raton, thence running east along Johnson's mesa to Folsom. The road is to be in operation by July of next year. The maximum grade is 1 per cent. The road will traverse a picturesque country. (Sept. 22, p. 95.)

SAN FRANCISCO, IDAHO & MONTANA.—This company, which was incorporated some time ago in Idaho to build a railroad from San Francisco to Butte, Mont., via Boise, Idaho, announces that financial arrangements have been made for building the first division of the line, which will be 210 miles long. It will run from the Snake river valley in Idaho southwest to the Oregon-Nevada line, thence south to Winnemucca, Nev., on the Southern Pacific. From the Oregon-Nevada line to Winnemucca this line will be a branch of the projected main line. The work will be done by the San Francisco, Idaho & Montana Railroad Construction Co., which was formed for this purpose. The proposed road will run through a district in which the United States Government and private individuals are spending about $15,000,000 for irrigation purposes. (See Construction Record.)

SEABOARD AIR LINE.—This company, it is said, is making surveys for a branch to be built from Odenville, in St. Clair County, Ala., northeast via Asheville to Gadsden, 32 miles.

SIOUX CITY, HOMER & SOUTHERN.—This company, which is building a line from Sioux City, Ia., south to Homer, Neb., a distance of 17 miles, has completed the line to Dakota City, a distance of seven miles, and this was to have been put in operation this month. Construction work will be pushed and it is hoped to have the road in operation this fall. Steam will be used as a motive power until the entire road is completed, after which it is planned to use gasolene electric motor cars. John H. Becker is President. (April 21, p. 131.)

SNOWBIRD VALLEY.—A charter has been granted this company in North Carolina to build a railroad from Andrews, in Cherokee County, on the Southern Railway, along Hickory creek and over Long Ridge mountains, thence down Bear and Snowbird creeks into Grand County, about 15 miles. The incorporators include: C. N. Hickerson, E. G. Hennermann, W. B. Hamrick and others, of Andrews, N. C., and W. A. Lewin, of Staunton, Va.

SPOKANE-COLUMBIA RIVER RAILROAD & NAVIGATION COMPANY.—A contract has been given by this company to M. P. Zindorf, of Seattle, for grading 63 miles of its road from the Columbia river to Fletcher, in Adams County. The road is to run from Spokane through Fletcher and Cornell to the Columbia river, connecting there with steamers to Portland. The entire cost will be about $4,000,000. (June 30, p. 216.)

TENNESSEE & GULF.—The Tennessee Industrial Railroad Company has changed its name to Tennessee & Gulf. The projected road was to run from a point on the Cumberland river near the mouth of Harpeth river to Clifton, Tenn., 70 miles. The new com-

pany has changed the proposed route from the Harpeth river to the south side of the Cumberland river about four miles below the former location. The company proposes also to build a branch from the main line at Lobelville, in Perry County, to Nashville. (See Construction Record.)

Union Pacific.—Announcement has been made by this company that its line in Wyoming, for a distance of 77 miles, will be double tracked. Bids will shortly be asked for grading on three sections, as follows: Between Hermosa and Hermosa Junction, two miles, completing the double track between Cheyenne and Laramie, with the exception of 25 miles between Hermosa and Buford; Lookout to Hanna, 50 miles. This portion of the work will be the most costly to be carried out by the company, the grading near Medicine Bow being unusually heavy. The third section is between Rock Springs and Point of Rocks, 25 miles.

Virginia & Southwestern.—A contract is reported let by this company to Walton, Wilson, Rhoads & Co., of Knoxville, Tenn., at between $5,000,000 and $6,000,000 for building 70 miles of its proposed road from Clinchport, Va. (September 8, p. 80.)

Washington Roads.—According to newspaper reports, Henry J. Pierce, President of the International Traction Co., of Buffalo, N. Y., in connection with Eastern capitalists, will build a railroad through the valley of the Cascade mountains in Washington, connecting Tacoma, Seattle and other cities in that state, the total length of road to be 162 miles. Surveys are being made through Cowlitz Pass. The officers of the company are: Frank A. Dudley, President; R. E. Strathorn, Vice-President and General Manager, and A. G. Smith, Secretary and Treasurer, of Buffalo, N. Y.; James A. Kerr, of Seattle; A. Fechter and John J. Rudkin, of Spokane, and others are directors.

West Texas & Northern.—A charter has been filed by this company in Texas, with a capital of $500,000, to build a railroad from Kerrville, Tex., in Kerr County, north through Kimble, Mason, Menard, Concho, Tom Green, Coke, Sterling, Glasscock, Howard, Martin, Dawson, Lynn, Lubbock, Hale, Swisher and Randall Counties to Amarillo, in Potter County, a distance of 450 miles. The incorporators include: E. P. Sears, J. T. Pinson, J. W. Pierson, John T. Witt, E. H. D. Gaston, J. A. Wilhite, all of Dallas; Will P. Edwards, W. R. Cole, G. L. Brown, S. H. Morrison, all of Big Springs. The offices of the company will also be at Big Springs.

RAILROAD CORPORATION NEWS.

Atlantic Coast Line.—The directors have declared a semi-annual dividend of 3 per cent. on the $42,980,000 common stock. Since 1900 the semi-annual dividend rate has been 2½ per cent.

Chicago, Milwaukee & St. Paul.—It is reported that this company has applied to the City Council of Seattle for the right to enter the city and establish terminals at that point. (See Railroad Construction.)

Chicago, Rock Island & Pacific.—A subsidiary company under the name Rock Island, Arkansas & Louisiana was incorporated on October 31 as a merger of the Little Rock & Southern, the Arkansas Southern and the Arkansas Southern Extension. The Little Rock & Southern is now building a line from Haskell, Ark., near Traskwood on the Little Rock-Hot Springs branch, south to Eldorado, 117 miles, and also a branch from Summerville, Ark., to Crossett, 36 miles. Its charter empowers it to build certain other lines in Arkansas. The Arkansas Southern operates a road from Eldorado, Ark., to Winnfield, La., 100 miles. The Arkansas Southern Extension owns a road from Winnfield, La., to the southern boundary of Winn Parish. Its charter authorizes it to build to Alexandria and elsewhere in Louisiana. For further information about projected extension see Railroad Construction column, November 17, page 160.

Delaware & Hudson.—Interests identified with this company have made an offer to purchase the $5,000,000 capital stock of the United Traction Company at Albany at about 150. Issues of not more than $5,000,000 4 per cent. preferred stock and $2,500,000 of 3¾ per cent debentures of the new holding company, the name of which is not yet announced, will be made in proportion to the amount of capital stock of the United Traction Company which is acquired. Principal and interest of these new securities will be guaranteed by the Delaware & Hudson Company. The United Traction Company operates 85 miles of electric road in Albany, Troy and neighboring towns. Gross earnings of the Delaware & Hudson for the quarter ended September 30 were $3,314,197, an increase of $268,446. The net earnings were $1,357,748, an increase of $27,390, and the surplus was $610,937, an increase of $17,964.

Detroit, Toledo & Ironton.—The combined gross earnings during the three months ending September 30 of this road and of the Ann Arbor were $939,625, and net earnings $303,362. The operating ratio of the Ann Arbor was 65¾ per cent. and of the Detroit, Toledo & Ironton 70¼ per cent.

Gainesville Midland.—This company has filed a mortgage, for an amount not to exceed $1,000,000, in favor of the Savannah Trust Co., of Savannah, trustee. This mortgage secures the recent bond issue of $625,000 and will also secure a further issue to be made if the company decides to build additional extensions. (November 10, p. 150.)

Grand Trunk.—The gross earnings of this company for the half-year ended June 30 were $13,235,689, an increase of $823,006 as compared with the corresponding period of 1904. Receipts from both freight traffic and passenger traffic increased about 7 per cent. The operating expenses were $9,328,669, an increase of $135,160, the operating ratio decreasing from 74 per cent. to 70 per cent. on account of the saving in the expense of conducting transportation, the winter and spring of 1904 having been a season of unusual severity. Maintenance of way cost $1,303,020, an increase of $107,132, and maintenance of equipment $2,064,732, an increase of $430,908. The surplus available for dividends was $1,414,512.

Helena Light & Railway.—This company, which was organized recently to take over the properties of the Helena Light & Traction Co., Helena, Mont., is offering in Europe $850,000 5 per cent. 20-year sinking fund gold bonds, which are part of an authorized issue of $1,500,000, two-thirds to be issued at once and the rest reserved for additional plants and betterments. The company owns 17 miles of road in Helena and also controls all of the gas and electric light plants in the city.

Interborough Rapid Transit (New York).—The report for the quarter ended September 30 shows a surplus after charges of $109,819. Gross earnings were $3,905,097, an increase of $672,148. Net earnings were $1,937,651, an increase of $73,796. The gross earnings of the Manhattan (elevated) division decreased about 13 per cent. and showed a deficit after charges of $117,741, as compared with a surplus of $411,311 during the same period of last year. The Subway division, therefore, earned a surplus of $227,560.

Metropolitan Street Railway (New York).—N. W. Harris & Co., New York, are offering $180,000 first mortgage 5 per cent. gold bonds of the South Ferry Railroad, which is a subsidary company of the Metropolitan, owning 1¼ miles of road.

New York Central & Hudson River.—The directors have decided to issue $17,192,500 capital stock to be offered at par to stockholders of record December 15, to the extent of 13 per cent. of their holdings. The right to subscribe terminates on January 20. This is part of an authorized issue of $150,000,000, of which $132,250,000 has been already issued. In 1902 the authorized amount of capital stock was $115,000,000, and an increase to the present amount was then authorized, an issue of $17,250,000 being taken by the stockholders at 125. As New York Central stock is at present selling at about ——, the "rights" of this latest issue are worth about $6.75 a share.

New York, New Haven & Hartford.—The stockholders of the Boston & New York Air Line (leased to the New York, New Haven & Hartford) have voted to issue $5,000,000 first mortgage bonds. It is said that the proceeds of the sale of these bonds will be used to repay the company's indebtedness to the New York, New Haven & Hartford, which paid up the $500,000 first mortgage 5 per cent. bonds which matured August 1, 1905, and for double tracking between New Haven and Willimantic.

Formal transfers of six lines of Sound steamers owned by the New York, New Haven & Hartford to the New England Navigation Co. was made at New Haven on Tuesday last. The lines are the Old Colony Steamboat, the Providence & New York, the Norwich & New York, the New London & New York, the New Haven & New York and the Bridgeport & New York companies.

New York City Railway Company.—This company, operating the Metropolitan and other lines in Manhattan, had gross earnings during the quarter ended September 30 of $4,509,610, an increase of $149,431 as compared with the same period in 1904. The net earnings were $2,217,352, a decrease of $69,466, and the total income was $2,556,768, a decrease of $61,999. The charges being $2,803,050, there was a deficit of $246,282, an increase of $66,807.

United Traction Company of Albany (Electric).—See Delaware & Hudson.

Western New York and Pennsylvania.—The gross earnings of this company during the quarter ended September 30 were $1,804,001, an increase over the figures for the same period last year of $419,579. Net earnings were $456,001, an increase of $302,979, the surplus being $150,291, as compared with a deficit last year of $132,034.

GENERAL NEWS SECTION

NOTES.

The train-staff system is to be put in use on the Duluth, South Shore & Atlantic between Negaunee and Eagle Mills, four miles.

The Southern Pacific, the Atchison, Topeka & Santa Fe, and the San Pedro, Los Angeles & Salt Lake have notified their eastern connections that after this year they will not carry a special tourist conductor with any tourist sleeping car.

In the United States Court at Cincinnati, November 22, Judge Thompson upheld an order of the Interstate Commerce Commission declaring unreasonable an advance in the rate on soap L. C. L., which had been made by four of the principal roads leading out of Cincinnati. The complainant was the firm of Proctor & Gamble.

Press dispatches report that, to appease the complaining drummers in the state of Michigan, the Michigan Central, the Lake Shore & Michigan Southern, the Wabash, and the Grand Rapids & Indiana are to issue individual thousand-mile tickets at a flat rate of $20. This ticket will be interchangeable within the state of Michigan over the roads named and will also be accepted between Grand Rapids and Chicago and between Michigan points and Toledo.

By an order recently issued, 108 U. S. mail clerks running between Cleveland and Syracuse over the Lake Shore and the New York Central are required to run through between Cleveland and Utica, about 53 miles farther. The New York and Chicago mail route over these roads is divided into three sections—New York to Syracuse, Syracuse to Cleveland, and Cleveland to Chicago—and the new order is designed to relieve the men on the New York end who, it seems, have had an undue share of the work. From the report in the *Utica Observer* it appears that the intention is to have the trips of the clerks overlap, so as to facilitate the transfer of the work from one crew to another. About 300 mail clerks now begin or end their runs at Syracuse.

Hackmen Defeated in U. S. Supreme Court.

At Washington, Nov. 27, Justice Harlan handed down the opinion of the Supreme Court of the United States in the case of Donavan, Callahan and others against the Pennsylvania Co., affirming the decision of the lower courts that cab drivers and hotel runners of Chicago who seek to secure access to the Pennsylvania station in that city for the purpose of soliciting business have no right to do so. The decision holds that if the railroad company is not fairly treating its patrons it is for the patrons and not the hack drivers to complain. The opinion also sustains the right of the railroad company to name the owners of carriages who may enter its premises; this privilege, instead of being a monopoly, is merely the exercise of a proper discretion for the protection of patrons; but the hackmen were within their rights in standing on the sidewalks adjacent to the station.

Great Northern's "Oriental Limited."

The Great Northern passenger train leaving St. Paul at 10:30 a. m. daily for the Pacific Coast will in future be known as the "Oriental Limited," and handsome new cars have been built for it. Eight trains of eight cars each are required to maintain this service. The new compartment observation cars are 82½ feet long and contain four staterooms, a card room and a drawing room. The sleepers are of the same length and have 16 sections. The coaches are 81 ft. long and seat 84 persons. The dining car is lighted by lamps incased in cathedral glass, those overhead being in square frames and those on the sides resembling ancient lanterns.

Opening of the Philadelphia Subway.

The first section of the Philadelphia Rapid Transit Subway under Market street from the Schuylkill river to Fifteenth street will be opened for traffic on December 15. Only surface cars will be run in the tunnel at first until the elevated road on West Market street is completed. Cars will be switched over at Fifteenth street for the return trip, pending the completion of the City Hall loop. Five lines of surface cars will be run in the tunnel, each alternate car on these lines continuing down town on the surface tracks. The opening of the new line is expected to greatly relieve the congestion on Market street, west of Fifteenth street.

The Washington State Railroad Commission.

The State Railroad Commission has made an excellent start toward justifying the expectations of those who successfully advocated the creation of such a body. A hearing at Colfax has revealed a number of serious abuses, and in its order directing the railroads to re-establish joint freight rates, the commission has done all that was within its power to correct these evils. The railroad officials were themselves surprised at the extent to which abuses had grown up in this state. The general counsel for the Great Northern candidly admits that the traffic men are not infallible; that "a rule or practice may grow up based on local conditions or emergency periods, and when the emergency has passed the practice is maintained; that railroads are liable to get into ruts in the conducting of their business, as are other business concerns." As a result of the Colfax hearing, many people in western Washington who have been opposed to the creation of a railroad commission, and a great many others who were apathetic because of a belief that there were no evils to right and a commission could not right them if there were, will now see the question in a new light. The business interests of Seattle, who always looked coolly upon the commission cause, are among the first to derive substantial benefits from the commission law.—*Spokane Spokesman.*

English Railway Amalgamation.

The Great Central, on Nov. 10, concluded arrangements for purchasing the Lancashire, Derbyshire & East Coast, a 55-mile section feeding important centers. The Great Northern negotiations for the purchase of this line failed.

System.

One of the railroads centering in Chicago is about to introduce an innovation in the collection of fares. Hereafter a "train auditor" will follow the conductor on his rounds. When the conductor collects a fare the auditor will examine it, enter the amount in a journal, and if change passes he will also make a note of that fact, so that every transaction may be complete.

It is thought that this is only the beginning of a revolution in the method of collecting train fares. In the not distant future the passenger who has settled himself in his seat, and spread out his newspaper, and is beginning to enjoy the real comforts of American railroad travel, will be approached by an avant courier, who will say:

"Kindly fill out this blank, giving your name, age, address, business or profession. State whether you carry any life or accident insurance; also whether you have ever been summoned to sit on a jury; also write in the proper place whether or not you are subject to any of the diseases referred to in this circular. Kindly have all this ready when the train statistician passes through."

The obliging patron does as directed, when the statistician approaches, takes up the filled forms, and asks:

"What is your gross and net income? Have you ever been divorced? Did you ever have a fire? Please name a few persons of prominence to whom we may address some confidential inquiries regarding your personal habits."

All of these requests having been complied with, the conductor appears:

"Do not move, if you please," he says, "while I am taking a snap shot for the company's files. Will you please empty all your pockets, so that I may know whether or not you have anything on your person by which you may be identified in case identification becomes necessary? You say this is your ticket. Is there anybody on the train who can identify you? No? Then please sign the following affidavit."

Then comes the auditor, who courteously remarks:

"I see that the conductor has interviewed you and passed on. Will you relate to me as nearly as possible everything that occurred between you, for the company's records?"

Having complied with this reasonable request, the corporation's notary public next appears:

"You swear," he asks, "that this is your signature and handwriting, and that all the statements made here are true to the best of your recollection and belief? Thank you, that is all."

Then the division superintendent appears:

"Will you do me the favor," he asks, "to tell me as briefly as possible everything that has happened to you since you entered this train; give me the number of your ticket, the amount of money you handed the conductor and the amount audited by the auditor, if you paid cash, and such other information as you think might be of value to the company."

All of this having been arranged, the general superintendent comes along:

"Will you do me the favor," he asks, in a gentlemanly manner, "to report any inattention on the part of any of our employes, and to tell me whether you ever do business with the scalpers? Thank you."

Then comes the treasurer of the corporation:

"Excuse me for troubling you," he says, "but I am picking up

a little information which may be valuable to us in the preparation of our quarterly, semi-annual and annual reports. Have you ever been addicted to the use of alcoholic liquors, to cigarettes, to railroad whist? Would you be willing to swear that you saw the conductor hand the ticket or money you gave him to the auditor? Did you observe anything peculiar in the manner of any of our employees, anything that might excite your suspicion? Thank you. Kindly keep your present position for a few moments longer. The directors are coming in and these will be followed by the preferred stockholders, who will be followed by the mortgage bondholders. We are determined to make this line popular."—*Chicago Inter-Ocean.*

The Recent History of Federal Control of Railroads in the United States.*

BY W. M. ACWORTH.

(*Continued from page 162.*)

I may pass very briefly over the exertion by Congress of the police power in the matter of interstate commerce, both because it is of less importance, and because it has less interest to us in England. I need only say that a series of Safety Appliances Acts passed in 1893, 1896 and 1901 require all railroads engaged in interstate commerce to equip their rolling-stock with automatic couplers and continuous brakes, and to report all accidents occurring, to the Commission.

The Act of 1887, with the amending Acts dated 1889, 1893 and 1903, forms the code under which Federal regulation of railroad rates has been in operation now for 18 years. How has the system worked? That the general situation has immeasurably improved is beyond question. Before 1887 the state of things was such as an Englishman, accustomed to the decorous, law-abiding methods of his own railroads, can hardly imagine. Tariffs were, indeed, nominally published, but the published rates were for the small fry only. A big trader obtained his rates by bargaining with the railroad, or, better still, by bargaining with the several competing companies. And the bigger the trader, and the better at driving a bargain, the lower were his rates. For a trader to obtain a specially low rate from Company A, by a false assertion that Company B had offered to give it, was apparently a recognized business transaction. Rebates off the nominal rates were given by all sorts of fraudulent devices; the weight of goods consigned was falsely understated; compensation was paid for the loss of goods that had never existed; the cashier of a merchant was appointed canvassing agent for the railroad company, and paid a handsome commission on all the business he introduced, and so forth. And bad as the position was, it seemed hopeless to improve it. In more than one instance railroad managers of high position, men of unchallenged integrity in their personal character, came forward at official inquiries and gave evidence that they had been forced to give secret preferences as otherwise their line would have been left with no traffice to carry.

Nor was this all. Small and non-competitive places were being handicapped out of existence. The rate for the 1,000 miles from Chicago to New York was perhaps half the rate charged from a point half way along the road. And it did not end here. For any day a rate war might break out, and, while the local non-competitive rate was maintained at the normal figures, the Chicago-New York rate might be cut within a week to half, a quarter, an eighth of its normal amount. Business was pretty much of a gamble, and a gamble with loaded dice.

The passing of the Act of 1887 was welcomed by everyone as putting an end to a situation that had become intolerable. In the phrase of President Hadley, "the railroad men stood up so straight that they were like to fall over backwards." But alas! Utopia is a long way off, and the way thither is steep and difficult, and with not a few turns where the road seems for a time to be leading in the opposite direction. Before long the inherent difficulties of the situation reasserted themselves. For one thing, the giving of a rebate was punishable by two years' imprisonment in the penitentiary. And no one, either trader or rival railroad manager, could be found to give evidence that might land a railroad freight agent, who in his private capacity was a respected and virtuous citizen, in jail. (The penalty of imprisonment has been repealed since 1903.) There was another difficulty. There were, for instance, between New York and Chicago ten or a dozen possible routes, differing widely in length and in general efficiency. If the rate was the same by all roads, the two or three strongest roads would take all the traffic. If the inferior roads published a lower rate, the strong roads immediately reduced theirs to the same figure. Before the Act this difficulty had been dealt with, not on the whole unsuccessfully, by agreements sometimes for pooling the traffic, sometimes for a division in specified proportions of the total receipts therefrom. But pooling agreements had never been enforcible at law. The Act of 1887 made them actually illegal.

The railroad men bitterly complained that the Act simultaneously required them to abolish discrimination, and deprived them of the only machinery which they had found efficacious for the purpose. For years an agitation was carried on for the repeal of the anti-pooling section of the law, and gradually almost all thinking men, including Judge Reagan, the author of the section, were brought round. Bills more than once all but got through Congress. But the mass of the American people are as little open to reason on the question of pooling as the English public on the question of "favoring the foreigner." And pooling still remains illegal.

Even this is not all. In 1890 Congress passed "an Act to protect trade and commerce against unlawful restraints and monopolies," commonly known as "the Sherman Act" or "the Anti-Trust Act," which declared every contract or combination in restraint of trade illegal. While this Act was passing through Congress, it was apparently agreed on all hands that it was not intended to, and in fact did not, apply to railroads. Unfortunately in two famous cases, the Trans-Missouri Freight Association case in 1897 and the Joint Traffic Association case in 1898, the Supreme Court of the United States—though only by a bare majority—decided (1) that the Act did apply and (2) that under it a traffic conference for the purpose of agreeing rates is illegal. The penalty under the Act for an illegal agreement is a fine of £1,000 and a year's imprisonment.

English railroad men will wonder how under these conditions rates can ever be fixed, still more maintained. Congress and the Supreme Court would seem to have combined to establish in perpetuity what one of the judges from the bench in a more recent case described as the *bellum omnium contra omnes.* But the American railroad mind is eminently resourceful. The Traffic Associations have been formally dissolved. What actually happens at present is, I imagine, something like this. The traffic officials of the various lines meet, discuss the situation, and express their views. Finally the representative of the line primarily interested announces as a fact that may be of interest to his colleagues that he proposes to make such and such a rate. And when, next day, the rival lines file new tariffs at the office of the Interstate Commerce Commission, it turns out that they are identical with the tariff which the leading railroad announced its intention of adopting.

Nor is this all. The inducement to cut rates has been largely removed by the introduction of what is known as "community of interests." The bulk of my hearers are probably not familiar with the geographical situation of all the American railroad companies. So let me paraphrase in terms of English railroad geography, and invite you to imagine the state of things with the North-Western owning the majority of the shares in the Great Central, the Midland owning the bulk of the Great Northern stock, the North-Western and the Midland each owning 20 or 25 per cent. of the Great Eastern stock, while finally the North-Western and the Midland had each two directors on the board of the Great Western. The six systems would all continue as separate companies; competition in facilities would still go on; but the probability of cut-throat competition, either by cutting rates, or by the building of superfluous new lines, would have receded indefinitely far into the background.

(*To be continued.*)

Some Interesting Dates.

The first teamster who ever turned a wheel in America—and, in fact, introduced not only wheels, but the driving of oxen—was Sebastian de Aparicio, of Spain. He drove ox carts from Vera Cruz to the City of Mexico in 1500.

The first wheels that ever trundled within the limits of what is now the United States were the ox carts which Juan de Anate brought up from Zacatecas in 1596 to colonize New Mexico. The first overland commerce in the United States was that on the Santa Fé trail, 1822 to 1843. This traffic across 800 miles was first by pack train.

The first wagons—25 of them, drawn by horses—made the journey in 1824. Oxen were first used in 1829 and the charge was $500 a wagon load. Oxen made the round trip between April and November. The great gold rush to California began in 1849. In the summer of that year 1,500 wagons, bound for "Californy," crossed the Missouri river at St. Joseph in six weeks.

The first mail route west of the Missouri river was a monthly stage line from Independence, Mo., to Salt Lake, 1,200 miles. The first great continental stage line was the "Butterfield Southern Overland Mail." Its route was 2,759 miles from St. Louis to San Francisco, via El Paso, Yuma and Los Angeles. The time was 25 days.

The first coaches started simultaneously from St. Louis and San Francisco, Sept. 15, 1858. Through fare $100 in gold; letters, 10 cents per half ounce. Seven hundred and fifty men were employed. Russell, Major & Waddell employed 6,250 wagons and 75,000 oxen in freighting across the plains in 1869. Fifteen thousand pounds was a wagon load, with six yokes of oxen to the wagon and 26 wagons to the train.

The pony express, which ran from Independence, Mo., to Frisco, 1,950 miles, made the trip in ten days. It carried mail for $5 per half ounce. It employed 500 men. The first starter was Harry

*A lecture delivered on Oct. 25, at the School of Economics, University of London.

Roff, who left Sacramento April 23, 1860. The mail was limited to 15 lbs. Ben Holladay's stage line started from Atchison in 1861. It cost $2,000,000 to build and equip the line. The Government paid Holladay $1,000,000 a year for carrying the mail.

From Atchison to Placerville, Cal., is 1,913 miles, and the shortest time was 12 days and 2 hours. The fare was $225. The era of the overland stage line from the river to the coast was eight years. Two thousand seven hundred horses and mules and 100 Concord coaches were used on the main line. At one time Holladay had 5,000 horses and mules and 1,000 coaches on his main line and branches.—*El Dorado* (*Kan.*) *Republican.*

Inspector's Report on the Hall Road Collision.

The British Board of Trade has issued its report, made by Lieutenant Colonel Druitt, on the collision of electric trains at Hall Road on the Lancashire & Yorkshire, July 27, when 20 passengers were killed and 47 passengers and the motorman injured. This collision was reported in the *Railroad Gazette* of August 18. The collision was due to a blunder on the part of the signalman, who left a facing point switch set for the side track in the face of an approaching train. When, on trying to clear his signal for the train, he found the lever immovable because of the wrong position of the switch, he assumed that the cause of his difficulty was a failure of the locking apparatus, and thereupon gave the motorman a clear signal by means of a flag. The inspector gives but few facts additional to those already published, but his report is of interest because of some of the comments which he makes. Following are extracts from the report:

"Signalman Boote no doubt made the initial mistake, and I endeavored to get him to say what passed through his mind and caused him to act as he did. He says that when the express was approaching the outer home signal and he could not get the inner home 'off,' the thought flashed in his mind that he would be fined if he stopped the express. He had never been fined himself for this reason, but had heard that another signalman had been, but he did not know why, beyond that he had stopped an express either through irregular working or some other cause. This thought, and also because he jumped to the conclusion that it was the electric lock on the inner home signal that was preventing it from coming 'off,' apparently induced him to neglect the rule he know should be carried out, and so he sent on the express without first having a man sent to the signal to give a proper hand signal after first seeing that the facing points were in the right position. Had he done so the express would have been delayed a few minutes, but no collision would have occurred. Motorman Rimmer should have stopped at the signal-box and ascertained what Boote meant by the green flag, and then have gone on slowly to the inner home signal and stopped until he received a proper hand signal to pass it while in the danger position.

"Signalman Boote works eight hours a day and has to attend highway crossing gates which have to be opened on an average less than once in every hour.

"The collision was due to inadvertence in leaving the switch wrong, to disregard of rules, and reckless running, and the only lesson to be learnt from the calamity is the very old one, of the necessity at all times of complying exactly with all rules and regulations, and that punctuality and fast running must always give way to safety requirements."

Discussing criticisms, Lieutenant Colonel Druitt says:

"1. The alleged greater danger of facing points as compared with trailing points on a line on which express trains run. . . . This danger does not exist with the safeguards especially introduced to prevent a signal being lowered to the safety position unless the points are first accurately in position for the line to which the signal refers. In this case both the signalman and the driver broke important rules regarding the manner in which trains are to pass signals which are defective or out of order, and in consequence a collision occurred, but a worse collision can be brought about at trailing points, on the supposition that signalmen and drivers may break rules, as then two trains running at speed could be brought into collision when converging on to a single line. . . . Given the conditions of traffic at Hall Road Station, the facing connections are in my opinion the simplest and quickest way of getting the turnback trains off the down road clear of following trains, and therefore the safest.

"2. The open corridor type of car. This type is coming into use on many railways where steam locomotives are used, and judging by the damage to the cars forming the express train behind the first motor car, which was very slight indeed, there would appear to be no extra danger with this type of car. This collision was a very violent one, the express running at a high speed into a train weighing 170 tons standing with the brakes hard on. The rear end of the first car of the standing train jumped up and so the heavy underframe of the leading car of the express slid along under that of the first car of the standing train, and the top woodwork was all torn away and the two cars completely telescoped one inside the other. The standing train was driven back a distance of 50 yards with the wheels not revoving but skidding, so that some telescoping was certain to occur whatever type of vehicle was in use.

"This collision also raises the old question of always having an empty carriage next the engine where no luggage compartment is so placed, especialy as there is no locomotive on these trains to act as a buffer. The motor cars at each end of these trains have first a motorman's compartment, then a luggage compartment, and then a vestibule with the entrance and exit doors at the sides, amounting in all to a space of 14 feet between the front, and the first portion of the car used for passenger accommodation. I do not consider it practicable to require the motor cars at each end of the train to be run empty. End-on (rear) collisions are as likely to occur as head-on (butting) collisions, so the same precaution would be necessary at the tail as at the head of the train. Much greater security can be obtained by strict observance of rules; and the fact that one driver has recklessly run past a stop signal in the danger position at a very high speed cannot be regarded as one requiring the very onerous conditions to be imposed which would result if no passengers were allowed in the motor cars. Such conditions would quite prevent the use of single steam motor cars, which are now being used in great numbers by several railway companies.

"3. Danger from fire. As soon as the collision occurred a short circuit was set up between the live rail and running rail, probably through a bar falling across them, and so a very large arc was formed at once, and this blew the section circuit breakers at the Formby sub-station. . . . On subsequent examination it was found that there were no signs of fire on any of the cars, except a slight charring of the woodwork underneath the first car of the standing train, and signs of short circuiting between the broken conductors and the ironwork under the car, which caused a certain amount of smoke, but there was no actual fire in any of the carriages, and no one in them could have received any electric shock. . . . Iron bars are supplied to stationmasters, and are also carried on the trains for setting up a short circuit and thereby blowing out the circuit-breakers at the sub-stations in case of emergency. On the occasion in question the stationmaster should have telephoned at once to have the current cut off, as he saw the large flame of the arc, instead of first going to the scene of the collision.

"So far as can be gathered from the results of this first bad collision on a railway worked by electric traction in this country, there would appear to be no more danger of fire occurring among derailed coaches than on a railway worked by steam.

"4. It may also be mentioned that though there is only one motorman on each electric train, the guards are instructed as to how to stop a train in case of emergency should the motorman be suddenly incapacitated. On electric *express* trains there is one guard with instructions as soon as the train starts to walk through the train from end to end, count the passengers, and then stand behind the motorman for the remainder of the journey. On electric stopping trains there are two guards, one of whom is always standing behind the motorman when the train is running.

"Looking at the facts connected with the collision, the two most striking results are, first, the absence of any fire among the derailed coaches, the danger from fire being one regarded as especially liable to occur on railways using electric traction and, secondly, the very small amount of damage done to the cars, with the exception of the leading one of each train, due no doubt to the very heavy and stiff underframes.

"Probably the collision would not have been so severe if steam locomotives had been in use, as under the same conditions the acceleration of the express would not have been so rapid; that on the electric trains is stated to be such that a speed of 30 miles an hour can be obtained from rest in a period of 30 seconds, but this, and the quick stopping due to the very powerful brakes in use, form the great advantages of electric traction for a fast and frequent passenger service of trains, and no danger need result therefrom if the ordinary rules for working trains are adhered to."

Big Salaries.

The Chicago *Record-Herald* quotes E. H. Gary as follows, in discussing big salaries:

It is not that the salaries paid to the heads of great business corporations to-day are too large; the real question is whether the right men are drawing the salaries. No man acquainted with the increased responsibilities arising out of modern business methods and conditions will say that $100,000 is too large a salary for the President of the New York Life Insurance Company or that $150,000 is an unreasonable salary for the President of the Mutual Life Insurance Company. These corporations handle hundreds of millions of dollars and slight errors of judgment might cost them sums so large as to make such salaries seem trifling by comparison.

The tendency of the business world just now is not to search for men who will take low salaries, but to find men who will deserve high salaries. That is the policy of the Steel Corporation

and it is the policy of all other flourishing business enterprises. The question of the size of the salary is a small matter compared to the question of the right man in the right place.

Take such a man as President Cassatt, of the Pennsylvania, who has had to determine the expenditure of $150,000,000 within a comparatively short time. Think of the knowledge, experience and good judgment required to deal with problems like that—not only the main policy, but the complex details upon which the main policy must rest. To get at a common sense view of Mr. Cassatt's salary try to imagine what it would cost his company if his policy in spending that $150,000,000 was unsound; if he overestimates or underestimates future markets, if he spent the money in the wrong direction, if he borrowed the money at the wrong time. Mr. Cassatt is the right man in the right place, and the size of his salary would never induce the owners of the Pennsylvania Railroad to consent to his retirement.

Take a man like Marvin Hughitt, President of the Chicago & Northwestern road. Do you think that the stockholders of that enterprise would hesitate to double his salary rather than lose his services?

I meet a good many business men, and this question of salaries is naturally a common subject of discussion. But I do not find that business men, that capitalists, that property owners, complain of salaries. Their one idea is to get hold of the right men.

I know that in my own case money could not tempt me to leave the service of the Steel Corporation. Of course, I am glad to get a salary of $100,000 a year, but when that salary was first named it pleased me most because it was the largest salary paid to anyone in New York, so far as I knew. To come here I had to give up my life connections, a law practice that was agreeable to me and an income of something like $75,000 a year.

M. C. B. Association Circular of Inquiry.

The Committee on Height of Brake Staffs has sent out a circular of inquiry to members of the Association asking for information regarding present practice in height of brake staff on box cars. Four questions are asked: (1) What is the maximum height of brake staff (measured from top of rail) permissible on your road? (2) If this limit is fixed by one or two points only, are they sufficiently important to fix the limit for the whole system? (3) What is the height of peak of roof of your standard box car from top of rail? (4) What is your standard diameter of brake wheel? Replies should be sent to the Chairman, J. H. Pennington, S.M.P., Delaware, Susquehanna & Schuylkill, Drifton, Pa.

The committee appointed to prepare specifications and tests for brake-beams for cars of 60,000 lbs., 80,000 lbs. and 100,000 lbs. capacity has sent out a circular containing 15 questions relating to present practice in the design and application of brake-beams. Replies should be sent to R. B. Kendig, Mech. Eng. L. S. & M. S., Cleveland, Ohio.

Manufacturing and Business.

The East Carolina is offering for sale a 35-ton locomotive with 14 in. x 22 in. cylinders and 5,000 lbs. of heavy copper.

William H. Edgar, President of the Dearborn Drug and Chemical Works of Chicago, died on Sunday night last at Hot Springs, Ark.

Mr. Thomas J. Long, Vice-President of the Atlantic, Gulf & Pacific Co., died in New York of pneumonia on November 20, after a short illness. Mr. Long was born in New York City in 1852 and graduated from the Rensselaer Polytechnic Institute of Troy, N. Y., in 1873. He was first employed as an engineer on the Atlantic & Great Western Railroad, and afterward, from 1874 to 1885, he occupied various grades in the Department of Docks in New York City, rising to Assistant to the Engineer in Chief. In 1885 he went to the Morse Bridge Co. of Youngstown, Ohio, and remained with them until the destruction of the works by fire and the dissolution of the company in 1887. He then became general agent of the Union Bridge Co. of New York City and had charge of the construction of several of the largest bridges in the West, notably that across the Ohio river at Cairo, Ill., and the Merchants' Bridge at St. Louis, Mo. From 1896 to 1898 he was engaged in general practice as civil engineer and contractor, and was interested in the enlargement of the Erie Canal. During the next two years he was Vice-President of the firm of R. P. & J. H. Staats, doing a general engineering and contracting business, with a specialty of dock and harbor work. In 1900 he became Vice-President of the Atlantic, Gulf & Pacific Co.

Thomas J. Long.

The St. Louis office of the Sullivan Machinery Co., Chicago, P. F. Jarvis, Manager, has moved into larger quarters in rooms 1125-A to 1127 Missouri Trust Building.

Bowring & Co., 17 State street, New York, export and import commission agents, have made arrangements through a representative now in the Orient for Cornes & Co., Yokohama, Japan, to act as their agents in Japan. Cornes & Co. have large and fully equipped electrical and engineering departments and are prepared to handle contracts for any kind of machinery and equipment in Japan and the Far East.

The Draper Manufacturing Co., Port Huron, Mich., reports sales of McGrath pneumatic turntable motors and McGrath pneumatic flue welding hammers, described respectively in the *Railroad Gazette* March 24 and May 5, 1905, to the Canadian Pacific, which took a motor for Winnipeg and a hammer for Montreal; Toronto, Hamilton & Buffalo, motor and hammer for Hamilton; Intercolonial of Canada, two hammers for Moncton; Baltimore & Ohio, four additional motors; New York Central, hammer; Erie, hammer for Cleveland; Pennsylvania, motors for Sunbury and Emporium; Richmond, Fredericksburg & Potomac, motor for Richmond; Missouri Pacific, hammer for Ft. Scott.

Iron and Steel.

The United States Steel Corporation is reported to have sold rails in London at about $31 a ton.

The Lehigh Valley has ordered 18,000 tons of rails from the Carnegie Steel Co. and the Lackawanna Steel Co.

The rolling mills which the Union Pacific is building at Laramie, Wyo., it is said, will start up by the first of next year. Most of the smaller iron required for the Harriman roads will be rolled at the new works.

MEETINGS AND ANNOUNCEMENTS.

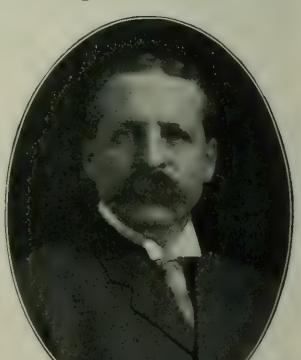
(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Engineering Association of the South.

The annual meeting of this Association will be held at Birmingham, Ala., Dec. 15 and 16. The business session will be held on the evening of the 15th. Saturday will be devoted to visiting points of interest in the vicinity of Birmingham, and in the evening there will be the usual banquet.

PERSONAL.

—Mr. R. H. Bowron, who was recently appointed General Superintendent of the Erie, was born in England in 1858. He came to this country at the age of 17 and began railroad work as a telegraph operator on the Tennessee Coal, Iron & Railroad Company's line in 1876. From 1881 to 1884 he was in a railroad supply business; and at the end of that period went to the Alabama Great Southern, and from there to the Mobile & Ohio. In 1887 he was appointed Superintendent of the Chattanooga Union. Thence he went to the Montana Central, and in 1896 was made Superintendent of the Montana division of the Great Northern. In 1897 he was appointed Superintendent of the Willmar and Breckinbridge divisions, and in 1898 was transferred to the Cascade division. He went to the St. Louis Southwestern the next year as Superintendent, being promoted to General Superintendent in 1900. In 1903 he was on the Denver & Rio Grande, and in 1904 on the Cincinnati, Hamilton & Dayton. He was promoted to be General Manager of the C. H. & D. in June, 1905, where he remained until his recent appointment.



R. H. Bowron.

—Mr. W. H. Wilson, who was recently appointed Superintendent of Motive Power of the Buffalo, Rochester & Pittsburg, began railroad work, in 1881, as an apprentice in the shops of the Lehigh Valley. In 1886, he went to the Dunmore Iron & Steel Company's locomotive shops, and in 1888 was made foreman of the locomotive de-

partment. Six years later he was made general foreman, and Master Mechanic in 1900. In 1904, he was appointed Master Mechanic of the Susquehanna, Jefferson, Delaware and Tioga divisions of the Erie, where he remained until he took his present position.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—Edward D. Kenna, First Vice-President, has resigned.

Detroit, Toledo & Ironton.—Eugene Zimmerman has been elected President, succeeding F. A. Durban, resigned, and has been also elected a Director, succeeding Samuel Hunt, deceased. John Scoville has been elected a Director, succeeding D. M. Dickinson.

Illinois Central.—H. J. Scheuing, Assistant Superintendent at Evansville, Ind., has been appointed Superintendent of the Nashville division.

Isthmian Canal Commission.—W. G. Tubby, General Store Keeper of the Great Northern, has been appointed Chief of the Division of Materials and Supplies of the Panama Canal, not Superintendent of Construction, as was reported.

Lake Shore & Michigan Southern.—J. J. Bernet, Superintendent of the Eastern Division, has been appointed Assistant General Superintendent, with office at Cleveland, succeeding D. C. Moon, promoted. S. W. Brown, Superintendent of the Western Division, succeeds Mr. Bernet, with office at Buffalo, N. Y. F. H. Wilson, Assistant Superintendent of the Western Division, succeeds Mr. Brown, with office at Chicago. F. M. Smith, Trainmaster of the Michigan Division, succeeds Mr. Wilson.

Missouri Pacific.—B. M. Flippen, Assistant to Vice-President, has been appointed Assistant Freight Traffic Manager, with office at St. Louis. J. C. Lincoln, General Freight Agent of the St. Louis, Iron Mountain & Southern, has been appointed Assistant Freight Traffic Manager of the Missouri Pacific, with office at Kansas City. W. N. Knight has been appointed General Freight Agent, and J. B. Burnett has been appointed Assistant General Freight Agent, both with offices at St. Louis, Mo.

Mobile, Jackson & Kansas City.—C. Henderson, Assistant Secretary and Treasurer, has resigned. D. W. Davis succeeds Mr. Henderson temporarily.

Nashville Terminal.—W. E. Knox, heretofore General Freight Agent of the Atlanta & West Point, has been appointed General Manager of the Nashville Terminal Co.

New York Central & Hudson River.—George H. Daniels, General Passenger Agent, has been appointed to the new position of Manager of the General Advertising department for all the New York Central lines. C. F. Daly, Passenger Traffic Manager of the lines west of Buffalo, has been appointed Passenger Traffic Manager of the lines east of Buffalo, with office at New York. W. J. Lynch, General Passenger Agent of the Cleveland, Cincinnati, Chicago & St. Louis, succeeds Mr. Daly, with office at Chicago.

New York, New Haven & Hartford.—The position of Assistant General Superintendent at New Haven has been abolished.

Southern.—R. B. Pegram has been appointed Assistant General Freight Agent, with office at Nashville, Tenn.

Tidewater.—George Reith, formerly Superintendent of Terminals of the Chicago Great Western at Oelwein, Iowa, has been appointed Superintendent of the Tidewater, with office at Suffolk, Va.

Western Maryland.—H. G. Clark, Manager, has resigned. S. Ennes, Superintendent, has resigned, and is succeeded by J. A. Shepherd, formerly Superintendent of Transportation.

LOCOMOTIVE BUILDING.

The Canadian Northern, it is reported, has ordered 40 locomotives.

The Illinois Central is reported to be in the market for a number of locomotives.

The Minneapolis & St. Louis has ordered eight mogul locomotives from the American Locomotive Co.

The Darien & Western has ordered several locomotives from the Baldwin Works for December delivery.

The Southern, it is reported, has placed an additional order for locomotives with the American Locomotive Co.

The Delaware, Lackawanna & Western, as reported in our issue of November 17, has ordered 50 locomotives from the American Locomotive Co.

The Duluth & Iron Range states that the order for two locomotives from the American Locomotive Co. reported in our issue of November 17 is incorrect. The only locomotives ordered so far are the 10 which were reported in our issue of October 27 ordered from the Baldwin Works.

The Great Northern, it is reported, is figuring with the American Locomotive Co. for 100 locomotives for delivery in the early spring of 1906.

The Atlantic & Birmingham Construction Company, Waycross, Ga., has ordered 16 ten-wheel locomotives from the Baldwin Works. These locomotives have cylinders 21 in. x 28 in.

The Louisville & Nashville has ordered 30 simple consolidation locomotives from the Rogers Locomotive Works for June, 1906, delivery. These locomotives will weigh 179,000 lbs., with 158,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of driving wheels, 57 in.; straight boiler, with a working steam pressure of 180 lbs.; heating surface, 2,550 sq. ft. The tender will have a tank capacity of 7,000 gallons of water and a coal capacity of 14 tons. The special equipment includes: Westinghouse air-brakes, Gollmar bell ringers, Climax couplers and Leach sanding devices. The above company has also purchased six eight-wheel locomotives from the Northern Pacific with cylinders 17 in. x 24 in.

The Chicago, Rock Island & Pacific, as reported in our issue of November 24, has ordered 50 simple consolidation locomotives from the Baldwin Works. These engines will weigh 201,000 lbs., with 180,000 lbs. on drivers; cylinders, 23 in. x 30 in.; diameter of drivers, 63 in.; wagon top boiler, with a working steam pressure of 185 lbs.; total heating surface, 2,923 sq. ft.; 340 charcoal iron tubes, 2 in. in diameter x 15 ft. 6 in. long; firebox, 107 in. x 67¼ in.; grate area, 50 sq. ft. The tender will have a capacity of 7,000 gallons of water and 15 tons of coal. The special equipment includes: Walschaert valve motion, Richardson balanced slide valves, Gollmar bell ringers, Keasby & Mattison boiler lagging, Vanderbilt brake-beams, Major couplers, Hancock injectors, Magnus journal bearings, U. S. piston and valve packings, Hancock safety valve, Leach sanding devices, Nathan bull's-eye sight-feed lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Standard solid rolled truck and tender wheels, and cast-steel wheel centers.

The Atlantic Coast Line, as reported in our issue of November 17, has ordered 20 simple ten-wheel locomotives from the Baldwin Works. These engines will weigh 155,000 lbs., with 115,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 63 in.; straight top wide firebox boiler, with a working steam pressure of 200 lbs.; total heating surface, 2,675 sq. ft.; 236 Shelby steel tubes, 2 in. in diameter x 14 ft. 5 in. long; firebox, 96¼ in. x 66 in.; grate area, 44.1 sq. ft. The tender will have a capacity of 6,000 gallons of water and 11 tons of coal. The special equipment includes: Westinghouse friction draft gear, Lobdell chilled cast-iron wheels, I-beam truck bolsters, Lindstrom eccentrics, Westinghouse air-brakes, Keasbey & Mattison sectional magnesia boiler lagging, Diamond special brake-beams, Perfecto brake-shoes, Tower couplers, Dressel headlights, Hancock injectors, Damascus bronze journal bearings, U. S. metallic piston and valve packings, Star safety valves, Watters sanding devices, new Nathan bull's-eye No. 9 sight-feed lubricators, Atlantic Coast Line standard springs, cast-steel wheel centers, Hancock steam valves, Newton fire brick and Richardson balanced slide valves.

CAR BUILDING.

The Chicago City Railway is reported in the market for 200 cars.

The Southern, it is reported, is figuring on about 8,500 freight cars.

The Eureka & Palisade is in the market for 30 ore cars of 30,000 lbs. capacity.

The New York Central & Hudson River is reported to be in the market for 300 passenger cars.

The Fort Worth & Denver City, it is reported, is in the market for additional freight equipment.

The Mobile & Ohio has ordered 1,000 box cars and 200 coal cars from the American Car & Foundry Co.

The Canadian Northern has ordered 1,000 box, stock and baggage cars; 400 flat cars, and 400 passenger cars.

The Chicago, Rock Island & Pacific, it is reported, has under consideration the purchase of additional box cars.

The Louisville Railway Company, Louisville, Ky., has ordered thirty 32-ft. closed cars from the St. Louis Car Co.

The International Railway Company (Electric), Buffalo, it is reported, has just ordered 100 new street cars from the J. G. Brill Co.

The Lake Shore & Michigan Southern, as reported in our issue of November 17, has ordered 1,000 furniture cars from the American Car & Foundry Co.

The St. Louis, Rocky Mountain & Pacific, it is reported, will shortly be in the market for upwards of 1,000 coal cars. Henry Koehler, Jr., St. Louis, Mo., is President.

The Illinois Central, as reported in our issue of November 24, has ordered 1,500 box and refrigerator cars from the American Car & Foundry Co., and 500 box cars from Haskell & Barker.

The New Orleans Railway & Light Company has ordered 30 standard semi-convertible vestibule type cars from the St. Louis Car Co. These cars will be mounted on the St. Louis Car Co.'s trucks.

The Chicago & Eastern Illinois has ordered 2,000 coal cars of 100,000 lbs. capacity, 1,250 National dump cars of 100,000 lbs. capacity from the American Car & Foundry Co., and 25 cabooses from the Mt. Vernon Car Manufacturing Co.

The Atlantic & Birmingham Construction Company, Waycross, Ga., has ordered 1,100 box cars and 300 flat cars from the Atlantic Car & Manufacturing Co., and 16 passenger coaches and six combination baggage, mail and express cars from the American Car & Foundry Co.

The St. Louis & San Francisco has ordered 1,000 coal cars of 100,000 lbs. capacity, 1,700 box cars of 60,000 lbs. capacity, and 300 furniture cars of 60,000 lbs. capacity from the American Car & Foundry Co. The furniture cars will be 40 ft. long x 9 ft. wide x 10 ft. 9 in. high.

The Delaware, Lackawanna & Western, as reported in our issue of November 24, has ordered two passenger cars, 11 express cars, 18 milk cars, 500 steel hopper bottom coal cars and 500 steel gondola cars from Barney & Smith, and 15 passenger cars and three combination cars from the American Car & Foundry Co.

The O. F. Jordan Company, Chicago, has ordered five flat cars of 60,000 lbs. capacity from F. M. Hicks & Co. These cars will be 36 ft. long over all, 7 ft. wide and 4 ft. 2½ in. high; inside measurements. The special equipment will include: Westinghouse air-brakes, National or Tower couplers, Hinson draft rigging and Diamond arch-bar trucks.

The Elgin, Joliet & Eastern, as reported in our issue of November 17, has ordered 500 gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co. These cars will weigh about 37,000 lbs., and will measure 35 ft. long x 8 ft. 6 in. wide x 8 ft. 3 in. high. The special equipment will include: Simplex bolsters and brake-beams, Westinghouse air-brakes, Harrigan brasses, Janney couplers, Miner draft rigging, Ryan dust guards and Griffin wheels.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 400 coke cars of 80,000 lbs. capacity from the American Car & Foundry Co. These cars will be 40 ft. long by 8 ft. 8 in. wide by 8 ft. high, all inside measurements. The special equipment will include American Steel Foundries bolsters, Westinghouse air-brakes, Hewitt Mfg. Co.'s brasses, Miner draft rigging, C., C., C. & St. L. standard paint; Railway Steel Spring Co.'s springs, Diamond and C., C., C. & St. L. trucks, and American Car & Foundry Co.'s wheels.

The Minneapolis & St. Louis has ordered two cafe cars and is reported as having ordered one office car from the St. Louis Car Co. It has also ordered six day coaches from the American Car & Foundry Co. for May, 1906, delivery. These cars will be 62 ft. 6 in. long x 9 ft. 8 in. wide over sills and 6 ft. 3 in. high between sills and plate. The special equipment includes: Simplex brake-beams, Fulton brasses, Tower couplers, Hartshorn curtain fixtures, Pantasote curtain material, Pullman standard door fastenings and Railway Steel Spring Co.'s springs.

The Duluth, Missabe & Northern, as reported in our issue of November 24, has ordered 260 steel ore cars of 100,000 lbs. capacity from the Standard Steel Car Co. for May, 1906, delivery. These cars will weigh 32,000 lbs., and will be 24 ft. long over all, 8 ft. 6 in. wide and 9 ft. high, inside measurements. The special equipment will include: Carnegie axles, Simplex bolsters, pressed steel brake-beams, Streeter brake-shoes, Westinghouse air-brakes, Duluth Brass Works brasses, Westinghouse friction draft rigging, Franklin asbestos dust guards, McCord journal boxes, Illinois Steel Co.'s graphite paint, Railway Steel Spring Co.'s springs, Barber trucks and Griffin wheels.

The Lehigh Valley, as reported in our issue of November 17, has ordered 1,000 steel gondola cars and 1,500 box cars from the Standard Steel Car Co., and 500 box cars from the American Car & Foundry Co. The gondolas will be of 100,000 lbs. capacity and will be 40 ft. long x 9 ft. 4 in. wide x 4 ft. 6½ in. high inside. The box cars will be of 80,000 lbs. capacity and will measure 36 ft. long x 8 ft. 6⅛ in. wide x 8 ft. 1¾ in. high inside. The special equipment for the above cars includes: Lehigh Valley standard arch-bar trucks, cast-steel truck bolsters, Westinghouse air-brakes, Miner draft rigging, Railway Steel Spring Co.'s springs, Symington journal boxes and dust guards, Magnus Metal Co.'s journal bearings, Winslow's improved roofs and Security doors and door fastenings.

BRIDGE BUILDING.

Atlanta, Ga.—Residents are agitating the question of replacing the present Bell street bridge with a new structure.

Calgary, Alberta.—Work will be commenced at once by the government on a bridge over Bow Marsh to cost $50,000. W. H. Cushing can give information.

Calumet, Mich.—The Board of Commissioners of Iron County has authorized the building of a bridge over Brule river on the Crystal Falls-Florence road, to be paid for jointly by Iron and Florence Counties.

Carlisle, Pa.—Bids are wanted by the County Commissioners December 22 for building a bridge over Conodoguinet creek.

Donora, Pa.—A contract has been let to the American Bridge Co. at $250,000 for building a toll bridge to carry two tracks for electric cars over the Monongahela river at North Charleroi. The structure must be completed by December 1 of next year.

Georgetown, Ont.—The Grand Trunk, it is said, will build a new bridge over the Credit River a quarter of a mile long, to cost about $200,000.

Kansas City, Mo.—Plans for building a reinforced concrete bridge on Gilham road are under consideration by the Park Commissioners. The estimated cost of the structure will be $40,000.

Lexington, Ky.—The voters have authorized the issuance of $27,000 in bonds for building a viaduct. T. P. O'Neill is City Engineer.

Manitowoc, Wis.—Bids are wanted December 18 by John S. Unger, City Clerk, for building a steel bridge over the Manitowoc river at Tenth street. The proposed structure is to be 378 ft. between abutments with an 80-ft. draw and 21-ft. roadway with 7-ft. sidewalks.

Milwaukee, Wis.—Bids are wanted by the Board of Public Works December 15 for building a section of the superstructure of the Washington avenue viaduct. C. J. Poetsch is Chairman.

Muscatine, Iowa.—Bids will be asked early next year by the Commissioners of Drury and Eliza Townships for building three iron bridges. Address Joseph Nussbaum, Muscatine.

Muscogee, Fla.—Bids are wanted January 10 by A. M. McMillan, Clerk of the Board of County Commissioners, Pensacola, Fla., for building a steel bridge over the Perdido river near this place.

New York, N. Y.—President Rhodes, of the City and County Contract Co., which is building the New York, Westchester & Boston, is reported as saying that he will let contracts for 16 steel bridges on the line of the proposed road between West Farms and the northern boundary of the city of New York.

Portage, Wis.—The Pan-American Bridge Co., of Newcastle, Ind., has been given a contract at about $29,291 to build the steel superstructure of the bridge over the Wisconsin river at this place. The work must be completed by May 10 of next year.

The proposed steel bridge to be built over the Wisconsin river at this place will cost between $50,000 and $52,000.

Salem, Mass.—Plans are being made for building an iron bridge, with a draw, to cost $100,000. Bids may be asked for early next month. W. A. Bates is Chairman of the County Commissioners.

Sioux Falls, S. Dak.—Bids are wanted by C. E. Hill, County Auditor, Dec. 8, for building all the bridges that may be needed in Minnehaha County for one year.

Toronto, Ont.—The City Engineer recommends the building of a swing or rolling lift bridge over the western channel at Queen's Wharf to cost $200,000.

Other Structures.

Cheyenne, Wyo.—The Union Pacific, it is said, is planning to build a new 20-stall roundhouse here.

Cumberland, Md.—The Baltimore & Ohio, it is said, will put up a new station, with sheds, to cost $50,000.

Gassaway, W. Va.—The West Virginia Bridge & Construction Co. is putting up a new roundhouse, machine shops and other buildings for the Coal & Coke Railroad. The Mt. Vernon Bridge Co. is furnishing the structural iron for the roundhouse and the West Virginia Bridge Co. the iron for the machine shop building.

JACKSON, TENN.—The Mobile & Ohio has bought a large plot of ground in this city as a site for new yards and for the enlargement of its present shops.

OTTAWA, ONT.—The Grand Trunk Pacific, it is said, will put up a combined station and hotel to cost about $2,000,000.

SPOKANE, WASH.—The Oregon Railroad & Navigation Co., it is said, will shortly begin work on a new passenger station on the north side of the Spokane river, between Howard and Washington streets, to cost $50,000.

TEXAS CITY, TEX.—The Gulf, Colorado & Santa Fe, it is said, will build a large refrigerating plant at this place, which is opposite Galveston. The cost of the proposed improvements will be about $500,000.

TOLEDO, OHIO.—The Lake Shore & Michigan Southern has decided to build large freight house and a union passenger station to replace the present structure. Plans, it is said, have been completed for this work; also for a new roundhouse, new coal docks and a new transfer station.

TOPEKA, KAN.—The Atchison, Topeka & Santa Fe, it is said, is planning to build a large annex to its present building at a cost of about $40,000.

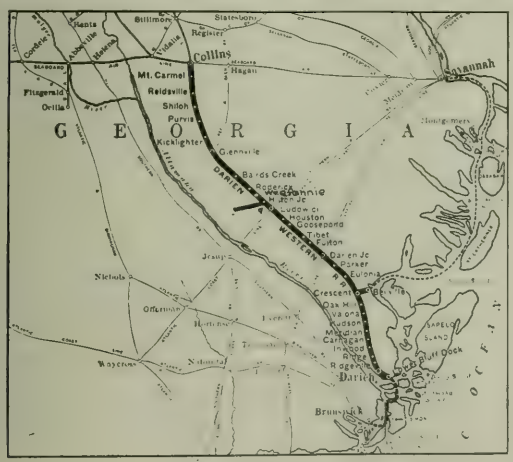
RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—See Eastern Oklahoma below.

BROOKVILLE & MAHONING (PITTSBURG, SHAWMUT & NORTHERN).—This company, which is building a road from Hyde, in Elk County, Pa., where connection will be made with the Pittsburg, Shawmut & Northern, southwest for a distance of 103 miles, is asking bids December 10 for building about 21 miles of its proposed road. The work includes the excavation of about 500,000 cu. yds., 200,000 cu. yds. of borrowed embankment, 20,000 cu. yds. of bridge and culvert masonry, and 700,000 lbs. of 12-in., 18-in. and 24-in. culvert pipe; also 1,900 tons of steel bridges and viaducts. W. W. Hershey is Chief Engineer, Brookville, Pa. (July 7, p. 7.)

DARIEN & WESTERN.—An officer writes that this road, which runs from tidewater at Lower Bluff dock (Darien), in McIntosh County, Ga., northwest to Weefannie, in Liberty County, a distance of 46 miles, has now under construction a line from Weefannie northwest to Glenville, 15 miles. The Reidsville & Southeastern, running from Glenville north to Reidsville, 16 miles, which leases the Collins & Reidsville, seven miles long, will form a part of this company's line, giving a total mileage of 84 miles main line and about six miles of branches. Grading between Weefannie and Glenville is nearly completed and track laying is now in progress. It is expected to have the line in operation early next year. The work is easy, being through a level and sandy section. There will be three trestles from 800 ft. to 1,500 ft. long. The maximum curvature, from Lodowici to Glenville, is 3 deg. The company has docks at Darien (Lower Bluff) and expects to increase its terminal facilities as traffic demands.



Darien & Western.

CALIFORNIA INLAND EMPIRE.—A number of St. Louis capitalists have organized this company to build a railroad from Boise City, Idaho, into California, with branches touching the principal mineral, agricultural and grain belts of Washington and Oregon, with a terminus at Sausalito and ferry connection thence to San Francisco. The St. Louis Trust Co. is said to be interested.

CANADIAN NORTHERN.—This company has completed track laying as far as Edmonton, and the main line now extends from Port Arthur, Ont., on Lake Superior, west to Edmonton, Alberta, 1,245 miles.

CHICAGO, BURLINGTON & QUINCY.—This company, it is said, is securing rights of way for building its proposed line from Sterling, Ill., northwest to Savanna, a distance of about 35 miles.

CHICAGO, ROCK ISLAND & PACIFIC.—Vice-President Mudge is reported as saying that the company's Colorado line is to be double tracked for about 291 miles from McFarland, Kan., northwest to Belleville, 105 miles, and from Goodland, Kan., west to Colorado Springs, Colo., 186 miles. This work will complete the laying of heavy rails (85 lbs.) on the Colorado division.

CINCINNATI BELT (ELECTRIC).—Incorporation papers have been filed by a company under this name, to build a railroad from Brighton and Winton place east through the suburbs of Cincinnati and terminating at Redbank. The proposed road is to be a belt line connecting several steam and electric roads which it will intersect. The incorporators include: J. G. Jacobs, J. W. Peurrung, O. C. Evans, K. F. Beckhardt and V. Q. Price. The road was originally planned by Peter Eichels and others, of Redbank.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC (QUEEN & CRESCENT).—Announcement has been made by General Manager W. A. Garrett that this company proposes to double track its road from Oakdale, Tenn., north to Somerset, Ky., a distance of about 93 miles. This is on the mountain section. About one-third of this work will be carried out during next year, after which the remainder will be double-tracked as soon as practicable. A contract has been given to W. J. Oliver & Co., of Knoxville, for building 12 miles from Pine Knot north to Flat Rock. An additional contract will be let shortly to build the balance of the first 30 miles. The cost of the entire work from Oakdale to Somerset will be about $1,000,000.

COOK COUNTY & SOUTHERN.—Incorporation has been granted a company under this name, in Illinois, with a capital of $50,000, to build a railroad from Franklin Park south to Cary, in Cook county. The office of the company will be at Chicago. The incorporators include: James S. Hopkins, Royal Wright and E. M. McKinney, all of Chicago; John M. Peffers of Aurora, and George W. Child of Hinsdale, Ill.

CRESTON & WESTERN.—Articles of incorporation have been filed by this company in Iowa, with a capital of $250,000, to build a railroad from a point on the Chicago Great Western near Carroll, Iowa, south to Creston, a distance of about 80 miles. The officers are: T. Dufer, President, of Des Moines; Thomas A. Way and Irving W. Keerl, Vice-President and Treasurer, of Mason City, and E. E. Sampson, Treasurer, of Des Moines.

DES MOINES, WINTERSET & CRESTON (ELECTRIC).—This company has just been organized in Iowa to build an electric railroad from a connection with the Des Moines City Railway Co. and the interurban railway lines at Valley Junction southwest via Winterset and Macksburg to Creston, Iowa, 44 miles. The officers are: W. D. Skinner, President, and Milo Ward, Secretary, both of Des Moines; S. S. Alexander, of Winterset, Treasurer; A. E. Park, General Manager, and N. E. Coffin, General Counsel, both of Des Moines. (See Construction Record.)

EASTERN OKLAHOMA (A., T. & S. F.).—This company has filed an amendment to its charter in Oklahoma, providing for the building of a railroad from Pauls Valley, Ind. T., southeast for a distance of 20 miles to Sulphur Springs. The company, which is capitalized at $10,000,000, has among its directors Charles Steele, of New York; E. P. Ripley, W. B. Jansen, of Chicago; F. H. Greer, H. E. Asp, U. C. Guss and W. H. Merten, of Guthrie.

GRAND TRUNK.—Plans, it is said, have been completed by this company for elevating its tracks in London, Ont., at a cost of about $1,000,000.

GREAT NORTHERN.—This company, it is said, will build an extension from Armington to Billings, Mont., a distance of 200 miles, connecting Billings with Great Falls and forming a link between the Northern Pacific and the Burlington on the south and the Great Northern on the north.

JOLIET & SOUTHERN TRACTION.—Incorporation has been granted to this company in Illinois, with a capital of $10,000, to build a railroad from Joliet, Will County, Ill., southwest through Will, Grundy and Livingston Counties to a point in Dwight County. The office of the company will be at Joliet. The first board of directors includes: H. A. Fisher, F. E. Fisher, L. D. Fisher, F. E. Stoddard and J. A. Jarvis, all of Joliet.

Kansas City Southern.—An officer writes that a contract has been let to W. O. Wilbourne, of Edgerly, La., for building the line from Lockport Junction, on the Lake Charles branch, southwest to Union Sulphur Mine, a distance of about six miles. Grading has not yet been commenced. The maximum grades will be ½ per cent. and maximum curvature 7.3 deg. (November 10, p. 149.)

Kentucky Roads (Electric).—Application has been made to the Montgomery Fiscal Court by John T. Collins, W. A. Thomason, of North Middletown, and others to build an electric railroad from Paris, Ky., to Mt. Sterling, 30 miles. Work is to be commenced at once, it is said.

Klondike Mines Railroad.—This company, which was granted a charter in 1899 to build a railroad from Dawson to Stewart river crossing, 84 miles, built five miles and graded 10 additional miles, but was unable to continue the work for lack of funds; but it is said that the project is now revived. T. W. O'Brien, of Dawson City, is negotiating to secure the necessary financial backing to complete the road.

Louisiana East & West.—A contract is reported let by this company to J. W. Dickinson for grading the first 10 miles of its proposed extension from its northern terminus at Bunkie, La. (October 20, p. 127.)

Manila & Southwestern.—An officer writes that grading work is now under way by D. A. Smith & Sons, of Manila, Ark., for a distance of 65 miles. The line is from Wynne, Cross County, Ark., northeast to Manila, Mississippi County. The proposed road will run through a level and heavily timbered district. About two miles of trestle will be required at the St. Francis river, also a drawbridge. R. L. Williford, of Manila, is President, and William Kerr is Chief Engineer, Jonesboro, Ark. (November 3, p. 143.)

Marion, Matthews & Muncie (Electric.)—Articles of incorporation have been filed by a company under this name in Indianapolis to build an electric railroad from Marion southeast to Matthews, Ind., 16 miles, and from the latter place to Muncie, Ind., an additional 16 miles. Such a road would parallel the Chicago, Indiana & Eastern from Matthews to Muncie. The incorporation includes: Samuel Ecker, Jr., of Matthews, and George G. King, William W. Adams, W. T. Nelson and W. S. Whitney.

Missouri, Kansas & Texas.—Surveys, it is said, are being made by this company for building an extension from Mineral, Kan., to Pittsburg, connecting at Mineral with the Parsons-Joplin branch. The extension will give the M., K. & T. connection with the coal fields around Pittsburg and an entrance into the city.

Morehead & North Fork.—Incorporation has been granted to a company under this name in New Jersey with a capital of $500,000 to build a railroad in Kentucky. The incorporators include: William McCormick, of Philadelphia; John W. Wrigley, of Clearfield, Pa., and Lewis Starr, of Woodbury, N. J.

New York, Susquehanna & Western (Erie).—A contract has been given to Lesher & Wagner, of Jersey City, to build an extension of the Edgewater & Fort Lee branch. It runs from the western portal of the Bergen Hill tunnel north for a distance of one mile. A contract for a further extension of two miles will be let next spring.

Northern Pacific.—This company is to build a new short line from Washburn, Wis., to connect with the main line at Omaha Junction, about nine miles from Washburn. The company already has a line to that city, having bought the old "Battle Axe" road some years ago; but the grades are so steep that this line is to be built over a more favorable route.

Oklahoma City, Lexington & Sulphur Springs (Electric.)—This company, it is said, proposes to build an electric railroad from Davis, Ind. Ter., northward, crossing the South Canadian river at Redbank Crossing, five miles south of Lexington, thence north through Lexington to Oklahoma City, Ind. Ter., about 80 miles. A contract is reported let to the Lovejoy Construction Co. for building the first 11 miles, to be completed during the present year. Chief Engineer Guy McGuire is quoted as saying that work will be under way next month on the entire line. The work includes the building of a steel bridge over the South Canadian river about 3,000 ft. (See Oklahoma Interurban, July 7, p. 7.)

Oregon Roads.—The City Council of Portland, Ore., is considering an application for a franchise by a company which proposes to build an electric railroad from Portland south through the Willamette valley and to the Coos Bay region.

A project is under way to build a railroad from Portland northwest via Nehalem to Tillamook, on the coast, about 80 miles. This project, which has been talked of for several months, is awaiting financial backing. It is said that new interests have now taken hold of it and that grading on the proposed route will be begun soon.

Pennsylvania Lines.—The Pennsylvania, it is said, is planning to double track the Cleveland & Pittsburg from Martins Ferry to Bellaire, seven miles.

Port Angeles & Olympia.—A charter has been granted a company under this name in Washington with a capital of $4,000,000 to build a railroad from Victoria, B. C., to the northwest corner of Vancouver Island, a distance of about 270 miles. Connection is to be made on the south end with the American shore at Port Angeles by ferry. Lester Turner, Jacob Furth, W. D. Hopkins, A. A. Arthur, all of New York, and M. J. Carrigan, of Port Angeles, are interested.

San Pedro, Los Angeles & Salt Lake.—A contract has been given by this company to the Utah Construction Co. for building 3 or 4 miles of tracks to the smelters at Garfield, Utah.

Yellowstone Park Railroad.—Incorporation has been granted to a company in Montana with a capital of $3,000,000 to build a railroad from Bridger, Mont., on the Northern Pacific, southwest to Cooke, in the northwest corner of the National Park. Frank A. Hall is President of the company. This project has no connection with the company incorporated under the same name by Union Pacific interests.

RAILROAD CORPORATION NEWS.

Chicago, Milwaukee & St. Paul.—At a special meeting of the directors held in New York City on Tuesday, an extension from Evarts, South Dakota, the farthest western point reached by the St. Paul, to the Pacific coast at Tacoma and Seattle was authorized. The route will probably be substantially that reported last week in the Railroad Construction columns of the *Railroad Gazette*—from Evarts to Butte, Montana, thence through the Clearwater country to Lewiston, Idaho, and across the southeastern corner of the state of Washington to Wallula on the Columbia river just south of Pasco. Wallula is to be the eastern terminus of the recently incorporated Pacific Railroad, whose President is the late General Manager of the St. Paul. The air-line distance from Evarts to Puget Sound is something over 1,000 miles; the new line should be from 1,200 to 1,400 miles long. There is $25,000,000 C. M. & St. P. common stock, authorized on October 4, 1902, unissued.

Intercolonial.—The gross earnings of this company for the three months ended September 30 were $1,995,630 and the operating expenses were $2,072,447. In the month of September, however, the earnings were greater than the operating expenses, the figures being $686,271 and $661,612 respectively.

Northern Pacific.—The report for the year ended June 30, 1905, shows that the average mileage operated during the year was 5,315, an increase of 103 miles. The gross earnings were $50,722,886, an increase of $4,198,311, the average per mile being $9,543, an increase of $702. The operating ratio was 53 per cent., an increase of 1 per cent., the operating expenses being $26,808,759, an increase of $2,574,216. The surplus after dividends was $6,276,242, an increase of $1,896,920, making the total balance to the credit of profit and loss $14,381,219.

Panama.—The New York Stock Exchange has listed $607,000 additional first-mortgage 4½ per cent. bonds, making the total amount listed $2,879,000.

Philadelphia Company.—It is reported that a new holding company will be formed to purchase control of this company by exchanging $37.50 in collateral trust bonds secured on the Philadelphia Co. and $20 in common stock of the new company for each $50 share of the $28,953,029 common stock of the Philadelphia Co. The Philadelphia Co. owns 365 miles of street railways in Allegheny County, Pa.; it also controls the greater part of the natural gas in that county and owns many oil wells in that region. It is stated that the United Railways Investment Co., of San Francisco, which owns stock of the United Railroads of San Francisco, is behind the new company. Ladenburg, Thalmann & Co., of New York, are interested in the United Railways Investment Co., which has a capital stock of $25,000,000 outstanding.

St. Louis & San Francisco.—In the quarter ended September 30, the gross earnings of this company were $10,251,659 and the net earnings $3,717,876. The surplus after charges was $530,637.

Southern Indiana.—During the year ended June 30, there were 197 miles of road operated, an increase of 31 miles. The gross earnings were $1,380,955, an increase of $87,374. The operating expenses were $798,273, an increase of $59,455, leaving net earnings of $582,682, an increase of $27,919. The surplus after charges was $206,118.

Western Maryland.—The New York Stock Exchange has listed $10,000,000 general lien and convertible 4 per cent. bonds, $15,685,400 capital stock and an additional $1,270,000 first-mortgage 4 per cent. bonds, making the total amount of the latter bonds outstanding $33,194,000. Of these bonds, $900,000 were used to pay for the extension from Cherry Run to Cumberland.

GENERAL NEWS SECTION

NOTES.

According to a western reporter, Traffic Director J. C. Stubbs, of the Union and Southern Pacific lines, travels 65,000 miles a year.

The Government has begun a suit in the Federal Court at Portland, Ore., against the Southern Pacific for violation of the Safety Appliance Act.

The Pennsylvania has created the office of Statistician of the Freight Department. The duties of the office will be to collect and compile industrial and commercial statistics and to handle subjects relating to the development of freight traffic.

During the month of November the eastbound traffic through the Soo canals amounted to 4,074,030 tons, and the westbound traffic was 932,513 tons. The number of vessels passing through the canal was 2,357, their total registered tonnage being $4,208,325.

The transcontinental railroads in conjunction with other lines east of Chicago, and with Atlantic steamship lines, have made a rate on oranges of $1 per 100 lbs. from California points to London and other European cities, which is 25 cents less than the rate to New York.

The Southern Pacific has finally resumed full passenger train service between Houston, Tex., and New Orleans, after the suspensions due to the yellow fever; the new time table went into effect November 21. There are still two or three points at which quarantines are continued.

According to a Washington (D. C.) newspaper the Pennsylvania road has ordered 20,000 honeysuckle vines, which are to be planted on the sides of the embankment on which is being built the company's new line from near the capitol westward to the Potomac river. This line runs through a public park.

The new or amended suit of the Government against the Terminal Railroad Association of St. Louis, asking the dissolution of the Association because of its maintenance of a monopoly in the use of the two bridges across the Mississippi river, was filed in the Circuit Court at St. Louis, November 29.

It is announced in Wheeling, W. Va., that the Baltimore & Ohio has abrogated its order forbidding the use of B. & O. cars for shipments going to foreign roads; though in the case of box cars shippers are asked to notify the agent in advance so that he can secure foreign cars for shipments going to foreign points.

The Grand Trunk Pacific has secured extensive coal fields near the Pacific Coast, and has lately paid the first installment of $5,000,000 for the Cassiar fields. These are 60 miles east of Laurier, the Pacific terminus of the road. It is said that the property includes 42 square miles of coal lands containing coal of high quality.

The Chicago *Record-Herald* says that the Atchison, Topeka & Santa Fe, on whose line occurred the disastrous wreck of October 30 (Sheffield, Mo.), has given an order to discontinue the use of old and comparatively weak passenger cars in the front ends of trains, and has ordered 55 new smoking cars to take the place of these old ones.

The railroads carrying grain from points in Illinois to the Ohio river have announced an increase of two cents per 100 lbs. to Louisville and to Cincinnati. This is the result of the conferences over the complaints of shippers that the rates to the cities named were too low as compared with those on grain which goes through Cairo and other points west of Louisville.

At Pittsburg last week Judge Buffington, in the United States District Court, granted writs of alternative mandamus on officers of the Pennsylvania Railroad to compel a fair distribution of cars to coal shippers. The Hillside Coal & Coke Company had charged that the railroad company furnished it only a small portion of the cars needed and had shown favoritism to other shippers.

Press despatches from Chicago say that the Chicago, Milwaukee & St. Paul has taken contracts to carry several thousand cars of corn from the Missouri river to the Atlantic seaboard at rates of 30 cents from Omaha to Liverpool, and 28.5 cents from Kansas City to Liverpool. The report says that these through rates are 3 cents less than those prevailing from Missouri river points to Liverpool by way of the Gulf of Mexico.

A Pittsburg paper reports that there is extensive lamentation in the City Hall of that city because of a notice received by the Mayor from Mr. Pitcairn, of the Pennsylvania, that the fountain from which have issued railroad passes for city officials and their friends has been frozen up. So many passes have been issued that "the free passengers have crowded out those who had paid their fare"; the company was obliged either to lengthen its trains or cut off the passes.

"The New Line" steamers between New York and Fall River, the line managed by Mr. George W. Brady, now carries passengers from New York to Fall River for $1 (round trip, $1.50); to Providence, $1.15, and to Boston, $2. The boats of this line are the "Palatial steamers Kennebec and Frank Jones." The fare by the Joy Line to Providence is $1, and to Boston $2. The regular Fall River Line has reduced its fare to $1.50 to Fall River and $2 to Boston—the latter a reduction of 50 per cent. from the full summer rate.

"A Big Conference About Signals" is the title given by a Philadelphia paper to an item about a meeting of officers of the Pennsylvania Railroad which was held in that city last week. This means, presumably, the conference between the General Manager and the superintendents and other division officers whom he has invited, to discuss the recommendations made in the elaborate report on signaling of Messrs. A. H. Rudd and Frank Rhea, recently presented to the General Manager. Messrs. Rudd and Rhea have made an exhaustive study of the whole subject of railroad signals, and, it is said, have presented numerous radical recommendations.

On December 2 the Wabash Railroad put in effect throughout its main lines a symbol time-freight system for insuring the prompt report by telegraph to the chief office of the movements of all cars of time freight. General Traffic Manager D. O. Ives announces that the fast freight lines running over the Wabash are to be consolidated. On January 1 Mr. Signer, Manager of the Lehigh & Wabash Dispatch at Chicago, will be made Assistant General Freight Agent of the Wabash, with office at St. Louis, and will have charge of all of the Wabash fast freight line business. The Hoosac Tunnel Line, the Lehigh & Wabash and the Ontario Dispatch will be practically abolished.

Readers who have been annoyed by the "delays of the law" may find a little refreshment in a news item from Summit, N. J., where, according to the *New York Times*, the Mayor has cut down the poles of a telephone company because the company attempted to do business in the city without first obtaining a franchise; where the Common Council has torn down the bridges of the Rahway Valley Railway Company because they had been built without permission; and where passengers, displeased at the action of the Lackawanna Railroad in putting up a barrier between the eastbound and the westbound stations, made a "rush" and broke down a door. This was to facilitate their access to the 6.35 a.m. train for New York.

The suit of the Government against the Atchison, Topeka & Santa Fe and other roads, for giving rebates, which embraces both the Colorado coal cases, wherein Mr. Paul Morton was so prominent, and the Kansas salt cases, has been dismissed by Judge Phillips in the District Court at Kansas City for want of jurisdiction. Judge Phillips says also that the present suit would have no standing whatever except for the Elkins law, passed in 1903; but the suit was begun in 1902, and therefore cannot enjoy the benefit of the Elkins law. He says that the question should be decided by the United States Circuit Courts of Kansas and Colorado; he also says that in cases of this kind the greatest offender is the shipper; but in spite of this "the Government, instead of going directly after the shipper under the law, seeks alone by a contempt proceeding to punish the railroad company which has been held up by the shipper. The Government will never strike at the root of the rebate evil until it goes after the shipper as well as the railroads. It is not fair play and a square deal that the railroads should first be held up by the shipper and then punished by the Government for being held up while the shipper gets the rake-off."

Master Car Builders' Association Circular of Inquiry.

The standing committee on brake-shoe tests calls attention to the existence of specifications governing the frictional qualities of brake-shoes. At a meeting of the committee, held at Indianapolis October 10, it was agreed that some inquiry should be made to ascertain the quality of shoes now being supplied railroad companies with reference to these specifications. To this end the committee has made preparations to test shoes submitted by railroad companies. Any railroad company may submit any number of shoes, but in case duplicates are received in large numbers the committee reserves the right to select for test a portion only of the whole

number. If the number is not large, all shoes submitted will be tested. Shoes should be taken from service and should be about one-third worn. They should be marked as follows: Name of the manufacturer; name of the road; whether taken from freight or passenger service. They must be shipped prepaid, either by freight or express, to M. C. B. Association, care of W. F. M. Goss, Purdue University, Lafayette, Indiana. They should be shipped as soon as practicable, and in no case should shipment be delayed beyond January 10. Contributing companies will be under no expense for testing beyond that incident to the shipment of the shoes. They will receive the results of the tests in the report of the committee.

The Recent History of Federal Control of Railroads in the United States.*

BY W. M. ACWORTH.

(*Continued from page 170.*)

The development of the idea of community of interests brings the railroad history practically down to our own day. In spite of all obstacles and temporary checks, there can be no doubt that the situation to-day is immeasurably better than it was eighteen years ago. Railroad companies have become on the whole law-abiding bodies. Complaints of rates, extortionate and unreasonable in themselves, are, on the evidence of the chairman of the Interstate Commerce Commission, "practically obsolete." Secret rebates are now—so I have been personally assured by men who speak with authority—no longer given, though undoubtedly they have been given till very recently. Where discriminations exist, between localities or between different classes of traffic, they are justified—or at least *bona fide* claimed to be justified—by the attendant circumstances. But there are still admittedly abuses in need of reform. In certain trades, more especially in live stock and perishable freight, the special cars required are furnished not by the railroad companies but by private persons, and some of the railroad companies appear to have paid a quite indefensible amount of mileage to these private firms, so as to induce them to operate their cars over the one road only. Another abuse which still exists is in connection with private sidings. A manufacturing company, with a mile of private siding, registers itself as a railroad company, and then obtains from the railroad company with which its siding is connected possibly 20 per cent. of the total rates for all the traffic passing over the siding. Nominally this is an agreed division of the through rates; in effect it is a bribe to induce the manufacturing company not to consign by a rival route. A friend of mine at the head of a great manufacturing concern said to me in New York last spring that competitors were in this manner getting such advantages over his concern that he thought he would be obliged to get a charter as a railroad company. "Don't do that," I said, "remedial legislation must come next session, and then you will have had all your expenditure for nothing." "Oh," replied my friend, "the cost would be infinitesimal; we have a shunting engine already. All we should need to do would be to paint the name of the new company on the tender."

But these are small matters. If, however, on the whole the abuses of American railroad management are less than they ever have been, it seems strange that just at this moment the situation should have become acute. The cause, however, is of a more general nature. The American public have been startled at the rapid development of the consolidation of separate properties—both manufacturing and railroad properties—into single aggregates of enormous size. The United States Steel Corporation has a capital of £200,000,000. The Pennsylvania Railroad, with an annual revenue of £44,000,000, can treat with the Government of the great State of Pennsylvania as an equal—a superior—rather than as a subject. One man, Mr. J. J. Hill, President of the Great Northern Railroad—a genius, it is true, and a most wise and public-spirited citizen—dominates the economic situation of the entire Northwest. And Anglo-Saxons don't take kindly to despotism, however able and benevolent the despot. American public opinion doesn't know quite what is wrong, but is pretty sure that something is wrong, and that something—it doesn't know what—ought to be done to put it right. Railroads are, in American legal phrase, "public service corporations." It is natural therefore to begin with them rather than with purely private concerns like the steel trust.

To this general cause may be added two other more specific ones. Railroad rates in America are extraordinarily low. It is admitted, as a general proposition, that they are low enough. In the eighteen years from 1882-1900 the average ton-mile rate fell steadily from 1.236 cents to .724 cent. But then the descent was abruptly arrested. Unreasonably low published rates were raised, partly by change in rates, partly by reclassification, and, further, published charges were exacted in full. By 1903 the figure had got back to .768, and since then the movement is still upwards. A 4 or 5 per cent. increase may be admitted to be reasonable in view of the enormous increase in working expenses of recent years. But if the railroads can raise their rates 4 per cent. or 5 per cent. of their own mere motion, why should they not raise them 40 per cent. or 50 per cent.? Should not the public have some tribunal to which they can appeal?

The second cause was this. The Interstate Commerce Commission had, like our own Railway Commission of 1873, imagined itself to possess various powers, and in particular the power to fix a rate, which the Supreme Court decided that the law had not conferred upon it. The Commission—so the Court in effect said—might say what rate ought to be charged in a given case, after all the circumstances of the case had been brought before it. And that decision the Court would, if satisfied of its justice, enforce. But neither the Commission nor the Court could say—and indeed it was doubtful whether a law empowering and requiring them to do so would be constitutional—what would be a reasonable rate under the hypothetical circumstances of the future. The Commission has constantly claimed that this power was intended to be given them in 1887, and that, if it had not been given, it could and ought to be given. And bills to effect this purpose have on several occasions been introduced into Congress.

In the early spring of this year President Roosevelt intervened in his usual dramatic manner. In a message to Congress he wrote: "Above all else we must strive to keep the highways of commerce open to all upon equal terms; and to do this it is necessary to put a complete stop to all rebates. The abuses of the private car and private sidetrack systems must be stopped. While at present it would be undesirable, if it were not impracticable, finally to clothe the Commission with general authority to fix railroad rates, I do believe that the Commission should be vested with the power, where a given rate has been challenged, and after full hearing found to be unreasonable, to decide, subject to judicial review, what shall be a reasonable rate to take its place; the ruling of the Commission to take effect immediately and to obtain unless and until it is reversed by the Court of Review." The President added that the Government must in increased degree supervise and regulate the working of railways, and that in his judgment the new law which he suggested was the most important legislative act now needed.

The effect of the President's intervention was immediately apparent. The House of Representatives passed by an overwhelming majority a bill, known as the Esch-Townsend bill, conferring on the Commission power to fix rates subject to judicial review, and sent it up to the Senate. But the Senate is a very conservative body, not easily moved by gusts of popular feeling. It refused to discuss the bill, and appointed a committee to investigate the whole question. This committee has been sitting almost constantly ever since, and had taken a large mass of valuable evidence. Its report is expected to be published almost immediately. Meanwhile the railroads have been carrying on a campaign of education.

That neither the Senate committee nor the Senate as a body will approve of the Esch-Townsend bill is tolerably certain. It is, however, almost equally certain that something will be done. The only question is whether a bill, conservative enough for the Senate to pass, will be drastic enough for the President and the House to care to accept. One thing is quite clear. The President has declared that rebates are the crying evil. But in the first place it is admitted that rebates have ceased, and in the second place the Esch-Townsend bill would do no more to stop them than a re-enactment of Magna Charta. A rebate is illegal to-day. It will neither be more illegal nor more preventible if the published rate is fixed by a Commission instead of by a railroad freight agent. The railroad men further complain, and I think with just cause, that the Commission is not trying to exercise the ample power which it already possesses to put a stop to unjust discriminations. Like the dog in the fable, grasping at the shadow of rate making, it lets drop the substance of rate enforcement. However, a big firm has been fined £5,000 recently for attempting to obtain an illegal and secret preference.

(*To be continued.*)

*A lecture delivered on Oct. 25, at the School of Economics, University of London.

More American Rails for Australia.

Another contract for rails to be shipped to Australia has been let in this market, the New South Wales Government railway commissioners having ordered 6,000-odd tons through their representatives in New York, the Australasian merchant house of R. W. Cameron & Company. The contract has been allotted to the United States Steel Products Export Company, the foreign end of the United States Steel Corporation. Deliveries are to begin inside of thirty days. The entire shipments will be completed within three months.

The Lackawanna Steel Company recently obtained a contract for some 6,000 tons of rails for the Victorian State Railways. The price quoted delivered in Melbourne was a shade above $27.50 a ton. This low figure was arrived at because of the then existing ocean freight rate being only 15 shillings a ton. The rails will cost $2.80 a ton to carry from the Buffalo mills to seaboard. The combined cost of transportation, including lighterage at this end, is only about $6 a ton. The ocean freight on the New South Wales order will, however, be 27s. 6d., as the American and British shipping lines engaged in the Australian trade last week consummated a working agreement after a rate war of many years' stand-

ing, with the result that freight charges have shot up in some instances nearly 100 per cent. The rails just ordered will be subject to a total freight rate, including lighterage, of upwards of $10 per ton.

The New South Wales Government railroad system, which is more than 3,000 miles in length, is constructed and operated on American lines to a greater extent, probably, than any other foreign road. The major portion of the rails, locomotives, cars and bridge material is of American manufacture.

Montana in the Senate.

The *Record* has waited with what it deems to be a commendable degree of patience for Senator W. A. Clark to define his position on the matter of railroad rate legislation. Interviews with Mr. Clark have appeared in almost endless number. He discusses art, his private car, and the distribution of seeds, but the nearest, and, indeed, the only point of contact between Senator Clark's views and the railroad rate legislation plan is this paragraph:

"In the matter of the proposed Federal control of railroads, I can say I favor the idea, as it appears primarily. Of course, there are so many different interpretations of that expression that one's decision must be qualified."

Mr. Clark gives us a stone when we ask for bread. His manner of dodging the issue is not even clever. It has not the merit of being cunningly evasive. Either Mr. Clark must say that he will uphold the President's hands and thus, in some degree at least, earn the name of Senator, which the people of Montana have bestowed upon him, or he must further give confirmation to the belief, long and universally prevalent, that the interests of Montana are of little concern to him. Will he direct his newspapers and political friends to help Montana in a time of dire need, or will he merrily whisk down Pennsylvania avenue in his automobile and let the people fight their own battle?—*Helena Record.*

Isthmian Canal Appropriation.

A bill has been introduced in the Lower House of Congress to provide for an immediate appropriation of $16,500,000 to be used to carry on the work of building the Panama Canal. The bill provides that the Treasury shall ultimately be reimbursed out of the proceeds of the sale of bonds authorized to be issued to secure funds for this work, and requires a detailed statement of the expenditures from this and subsequent appropriations to be made annually to Congress.

Data Wanted Regarding Fire Tests.

At a recent meeting of Committee P on Fireproofing of the American Society for Testing Materials, it was decided to consider, for the present, the establishing of a standard fire test for fireproof floors only. For this purpose, the committee will endeavor to collect all available data on fire tests of fireproof floors and information resulting from the study of fires and conflagrations, more particularly as to the temperatures reached and the duration of the same. It is proposed to analyze and study this information, then publish the same with the hope of drawing forth suggestions and criticism from all who may be interested.

It is the earnest desire of the committee to make the record of past tests as complete as possible, and it will greatly appreciate the kindness of those who may possess such information if they will forward the same to the committee. Such information may be sent to Professor Ira H. Woolson, Chairman of the committee, at Columbia University, or to R. P. Miller, Secretary, 141 East 40th street, New York City, N. Y. If copies of reports cannot be forwarded, reference to the journals in which the reports have appeared may be given.

Discrimination in Favor of Railroad Company's Mines.

The Interstate Commerce Commission, in an opinion by Commissioner Fifer, has announced its decision in favor of the complainant in the case of the Red Rock Fuel Company against the Baltimore & Ohio Railroad. The road declined to permit a side-track connection between its line and a side-track to complainant's coal mine in the Fairmount district of West Virginia for the purpose of receiving interstate shipments of coal from such mine, although it has provided and maintains side-track connections for other mines in that district from which large quantities of coal are shipped to interstate destinations. It is also found by the Commission that the railroad company controls, through ownership of capital stock, large coal mining enterprises in the Fairmount district, which, during the year 1904, shipped more than one-half of the tonnage from that district. The complainant purchased the right of way for a side-track and the physical conditions pertaining to the proposed connection are found to be at least as favorable as those pertaining to connections already made for other mines in that coal field. It also appears that as between complainant's and the favored mines similarity of situation exists in essential respects; that under such discrimination the complainant is unable to make interstate shipments of coal from its mine, and the defendant, by continuing its policy of denying these facilities to applying owners of coal lands, may practically control in its own interest all of the undeveloped coal in this field as well as derive greater profits from its own holdings in mines already developed in that section.

The jurisdiction of the Commission was questioned by the carrier, but the Commission holds that this is a case of discrimination in facilities or instrumentalities of shipment or carriage, and that its jurisdiction extends to any case of wrongful prejudice resulting from discrimination in the provision of such facilities or instrumentalities, including side-track connections. The decision is that the discrimination is not only wrongful as between complainant and other more favored shippers, but amounts to undue and unreasonable preference by the carrier of itself, and that an order forbidding further violation of section three of the statute should issue accordingly.

Railroads Inquiring for European Cars.

Owing to the fact that the unprecedented contracts recently placed with the various car-building plants throughout the country precludes the filling of big new orders for some months to come, it is reported that one of the Eastern roads is inquiring in Europe—both in England and on the Continent—with a view of placing a substantial contract for cars to be imported should better terms of delivery be secured than can be obtained on this side under present conditions.

It is estimated that the various railroad equipment companies comprising the American Car & Foundry Company, the Pressed Steel Car Company, the Pullman Company, the American Locomotive Company, the Baldwin Locomotive Works, etc., have on their books unfilled contracts representing in the aggregate no less a sum than a quarter of a billion dollars. The American Car & Foundry Company's different shops are reported to be taxed to the utmost capacity for a period extending well into the spring of 1907.

M. M. Association Circular of Inquiry.

The Committee on Classification of Locomotive Repairs of the Master Mechanics' Association has sent out the following circular of inquiry to members of the Association:

1. How do you distinguish between engines in service and those undergoing or waiting repairs, whether in roundhouse or shop?
2. If you have a limit, how is it defined?
3. If defined by considering an engine out of service if held for repairs for a certain time such as 24 or 48 hours, does that time commence when an engine is called for and not ready, or does it commence when an engine arrives at the roundhouse?
4. Do you make any distinction between running and shop repairs?
5. If so, how is the distinction defined?
6. Have you any classification of shop repairs?
7. Please send with your reply five copies of your classification of shop repairs.
8. Do you advocate any system of classification distinguishing between engines in service and those under repairs, between running and shop repairs, and any system of classifying shop repairs other than that you are now using. If so, describe the system you would recommend and give reasons for its use.

Members are requested to forward their replies promptly to H. H. Vaughan (Chairman), Superintendent Motive Power, Can. Pac. Ry., Montreal, Canada.

Manufacturing and Business.

The Goodwin Car Company has moved its offices from 96 Fifth avenue to the Whitehall Building, 17 Battery Place, New York.

Joel Bernice Ettinger has been appointed western manager of the S. A. Woods Machine Co., Boston, Mass., with offices in the Railway Exchange Building, Chicago.

The Guayaquil & Quito has let a contract to the American Bridge Company for nearly 100 small bridges to span the chasms and ravines along its line in the Andes.

W. W. Young, formerly General Agent, and recently Acting Purchasing Agent, has been appointed Purchasing Agent of The Union Switch & Signal Co., Swissvale, Pa.

E. B. Leary has been appointed as department manager of the Pittsburg department of the U. S. Metal & Mfg. Co., New York, former Department Manager Eugene L. Caton having resigned.

H. W. Edwards, Mem. Am. Soc. C. E., who resigned as Chief Engineer of the Chihuahua & Pacific last August, upon the completion of its construction, has opened an office as consulting engineer at 80 Broadway, New York.

The St. Louis Car Company has secured an order for 700 of its standard reversible car seats, covered in rattan with top rail and nickel-plated trimmings, from the Anglo-Argentine Tramway Company, of Buenos Ayres, South America.

The American Railway Equipment Co., of San Antonio, Tex., has been organized with a capital of $100,000 to make railroad equipment. The incorporators include: John Hendricks and C. W. Gill, of Galveston, and D. F. Youngblood, of San Antonio.

The Coale Muffler & Safety Valve Co., Baltimore, Md., announces

that the Nathan Manufacturing Company, New York, has taken over its business, and all orders or inquiries concerning the same in the future should be addressed to the last named company.

The Anglo-American Varnish Company, of Newark, N. J., has just been granted a charter by the Dominion Government. It will manufacture japans, lacquers, varnishes, oil and pigments. The capital stock is $20,000, and the headquarters will be in Montreal. Mr. Marshall will be President.

Charles A. Olson, who for several years has been superintendent of the flanged fitting department of Crane Co., Chicago, has been promoted to the newly created position of general superintendent of that company. Mr. Olson was formerly superintendent of the St. Petersburg, Russia, plant of the Societe Anonyme Westinghouse.

Residents of Lynchburg, Va., have organized the Old Dominion Bridge & Construction Co. with a capital of about $300,000. The company has bought about 25 acres of land adjacent to the Southern Railway in the suburbs of the city, on which it will build shops next spring. The directors are: Walker Pettyjohn, President; William Hurt, Vice-President; A. R. Long, Secretary; W. L. Moorman, Treasurer, and others.

The Belle City Malleable Iron Co., Racine, Wis., which has a present capacity of 7,000 tons a year, is adding buildings to increase this by January 1st to 10,000 tons. There are two new buildings, one being 100 ft. x 200 ft., containing two new furnaces, and the other 80 ft. x 100 ft., containing four new annealing ovens. The output of this plant is largely railroad and agricultural work, the former being in the line of specialties.

Mr. David R. McKee, Jr., who has been connected with the Chicago office of the Western Steel Car & Foundry Co., now holds a position in the sales organization of the T. H. Symington Co., of Baltimore, with headquarters in the western sales office of the company, Railway Exchange Building, Chicago. Previous to his connection with the Western Steel Car & Foundry Co., Mr. McKee was in the engineering department of the Delaware, Lackawanna & Western (coal department).

The various stations and shops of the Philadelphia Rapid Transit Company furnish an interesting exhibit of the variety in products manufactured by the B. F. Sturtevant Co., of Boston, Mass., for the equipment of plants of this class. In the various sub-stations are no less than ten steel plate fans especially designed for cooling transformers. In one of its shops is a complete heating and ventilating system consisting of fan, heater and distributing pipe. In another is a forge shop equipment, together with an exhauster for removing smoke, while a large cupola furnace is supplied with a Sturtevant pressure blower.

The Hayes Track Appliance Co., Geneva, N. Y., in advertising the Hayes lifting and pivot derails, goes into particulars in a way that leaves nothing to be desired. It has issued a circular informing the reader that 430 of these appliances are in use on the Pennsylvania railroad system (naming 13 of the roads in the system), and gives a list of the 60 or more towns on these lines in which the derails have been applied during the past 18 months; and circulars in similar detail have been issued about the 1,022 derails in use on New York Central lines, 351 on the Baltimore & Ohio and 590 on the Atchison, Topeka & Santa Fe.

The Standard Paint Co., New York, is distributing broadcast to the trade throughout the United States a circular letter in which it states that it is the only maker of "Ruberoid Roofing." The company was prompted in distributing this letter for the reason that it has received numerous complaints from dealers in and consumers of Ruberoid Roofing that inferior imitations of it, many of them having similarly sounding names, had been sold under the deliberate misrepresentation that these imitations were actually Ruberoid Roofing or that they were made by the Standard Paint Company or some concern which was or has been affiliated with the Standard Paint Company.

The interests controlling the Bedford Quarries Co., Bedford, Ind., and the Ohio Quarries Co., North Amherst, Ohio, with head offices at Chicago, are planning a large increase in the output of their limestone and sandstone properties at these points. New equipment for next year will include 18 Sullivan stone channeling machines, which have been ordered through Geo. D. Hunter, representing the Sullivan Machinery Co., Chicago, at Bloomington, Ind. These machines are of the Class Y rigid head type, with boiler. This channeler has been developed especially for the needs of the building stone districts and is a standard machine for this service. The Bedford Quarries Co. already has 10 machines of this type in use and the Ohio Quarries Co. has eight similar machines, especially adapted for cutting sandstone at its North Amherst quarries. The Consolidated Stone Co. has ordered four of the new Class Y Sullivan oolitic type channelers with 8-in. cylinders, for use at its quarries at Bloomington and Bedford. This company will then have 21 Sullivan machines at these two properties. The New York office of the Sullivan Machinery Co. has secured from F. A. Manelli & Co. an order for two Class Y-8 channelers and several rock drills, for use at Rochester, N. Y., on the Erie Canal improvements.

Iron and Steel.

The American Bridge Co. has lately received orders for about 50,000 tons of structural and fabricated material, principally from railroads.

The Republic Iron & Steel Co. has increased the price of bar iron $4 a ton on a basis of $2 per 100 lbs. in Youngstown, Ohio, instead of $1.80, as formerly.

The City & County Contract Co., New York, which is building the New York, Westchester & Boston Railroad, is asking bids December 19 for 16 bridges requiring about 4,000 tons of steel.

Orders have recently been let for rails for 1906 delivery as follows: Duluth, Virginia & Rainy Lake, 8,000 tons; St. Louis, Troy & Eastern, 5,000 tons. The proposed extension of the Chicago, Milwaukee & St. Paul will necessitate the laying of from 1,200 to 1,500 miles of new line, which will call for about 175,000 tons of rails. The Baltimore & Ohio has let a contract for 16,000 tons of rails with an eastern mill for 1906 delivery.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Franklin Institute.

At a meeting of the Sections in Philadelphia December 17, the program included a paper on "New Laboratory Methods and Appliances," by S. S. Sadtler; also one on "Analytical Notes," by Dr. Henry Leffmann.

American Society of Civil Engineers.

At the regular business meeting of this society in New York December 6, a vote was taken on the admission of new members and a paper presented on "A New Graving Dock at Nagasaki, Japan," by Naoji Shiraishi. This paper was printed in the October "Proceedings."

The Northern Railway Club.

A new railroad club was organized on Nov. 28th in Duluth, Minn., under the above name. The charter membership is about 140. The officers are: President, W. A. McGonagle, Vice-President and General Manager, D. M. & N.; First Vice-President, E. C. Blanchard, Superintendent, Nor. Pac.; Second Vice-President, H. S. Bryan, Supt., M. P., D. & I. R.; Secretary, C. L. Kennedy, Coml. Agt., C., M. & St. P.; Treasurer, J. I. Thomas, Joint Local Frt. Agt. A committee on constitution and by-laws was appointed. The next meeting will be held Dec. 29th in the Spalding Hotel, at which time papers on the following subjects will be presented: "Railroad Organization," by F. E. House, President Duluth & Iron Range; "Variation in Heights of Couplers," by J. E. Goodman, Master Mechanic, Northern Pacific.

PERSONAL.

—Mr. J. B. Flaherty, who is now Superintendent of the Colorado Springs & Cripple Creek District Railway, was, in 1895, train despatcher of the Midland Terminal. He was promoted the next year to be chief despatcher of the same road, holding that office until 1901, when he was made trainmaster. In 1903, he went to the Grand Trunk as train despatcher at Island Pond, Vt. The next year he went to California, but in April of this year left and was appointed trainmaster of the Florence & Cripple Creek and the Midland Terminal. Here he remained until appointed Superintendent of the Colorado Springs & Cripple Creek. He is also Superintendent of the Midland Terminal and the Florence & Cripple Creek.

J. B. Flaherty.

—Mr. John Baird Morford, Assistant to the General Manager of the Michigan Central, died at his home in St. Thomas, Ont., on November 28, of pneumonia. Mr. Morford was widely known. He

was born in 1840 and entered railroad service in 1852 as water boy on the New York & Erie. He remained on that road until 1866 as brakeman and later conductor on the different divisions. In that year he went to the Morris & Essex, where he was chief train despatcher. Five years later he went to the New York Central & Hudson River as General Agent at New York, becoming later station master at the Grand Central Station. In 1873 he was appointed General Superintendent of the Long Island, and from 1875 to 1882 was Superintendent of the Sandy Hook Steamboat Co. and later Superintendent of Ferries of the Central of New Jersey. Leaving New York, he went to Texas and was Superintendent of Construction of the Sabine & East Texas, but the next year he went to the Michigan Central as Assistant Superintendent of the Eastern & Toledo division, and has been on that road ever since. He was soon made Superintendent of the Canadian division (the Canada Southern), and held the place many years. About two years ago he was promoted to the position which he held at his death.

B. B. Mitchell.

—Mr. Barrett B. Mitchell, recently appointed Freight Traffic Manager of the New York Central Lines west of Buffalo, was born in 1846. His first railroad service was in 1867 as a clerk of the Blue Line, at Detroit. He remained in the Detroit offices of this company until 1878, having been appointed chief clerk in 1871. He was then promoted to the office of General Manager, where he remained until 1895. During the last ten years of this period he also acted as General Manager of the Canada Southern Fast Freight Line. He became General Freight Agent of the Michigan Central in 1895, and in 1896 was made General Freight Traffic Manager, which he has been until his latest appointment. The photograph of Mr. Mitchell, reproduced herewith, was, by an unfortunate mistake, published in the *Railroad Gazette* of November 24 as that of Mr. J. M. Connell, General Passenger Agent of the Atchison, Topeka & Santa Fe.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—J. R. Kenly, Fourth Vice-President, has been elected Third Vice-President, succeeding T. M. Emerson, promoted.

Bessemer & Lake Erie.—F. R. Layng has been appointed Engineer of Bridges, with office at Greenville, Pa.

Canadian Pacific.—W. A. Cooper, Assistant Superintendent of Sleeping, Dining and Parlor Cars, has been appointed Superintendent of that department, with office at Montreal, succeeding George McL. Brown, promoted.

Chicago, Burlington & Quincy.—C. S. Bricker has been appointed Master Mechanic of the Sheridan Division, with office at Sheridan, Wyo., succeeding C. J. Saberhagen, resigned.

Chicago, Milwaukee & St. Paul.—W. J. Underwood, Assistant General Manager, has been appointed General Manager, succeeding H. R. Williams, resigned.

Cincinnati, Hamilton & Dayton.—G. W. Perkins has been elected Chairman of the Board of this road and of the Pere Marquette.

Copper Range.—E. H. Wright, Auditor and General Freight and Passenger Agent, has resigned. F. R. Bolles has been appointed General Freight and Passenger Agent, and Wallace Tedford, Auditor, both succeeding Mr. Wright.

Grand Trunk.—R. G. Butler has been appointed Manager of the Grand Trunk Milwaukee Car Ferry, with office at Milwaukee, Wis.

Gulf, Colorado & Santa Fe.—A. C. Fonda and J. R. Dillon have been appointed Assistant General Freight Agents, both with offices at Galveston, Tex., succeeding Y. Van den Berg, resigned.

Halifax & Southwestern.—L. H. Wheaton has been appointed Chief Engineer, with office at Bridgewater, N. S., succeeding T. H. White, assigned to other duties.

Interstate Commerce Commission.—Franklin Lane of California has been nominated by the President to succeed Commissioner J. W. Fifer, whose resignation takes effect January 1, 1906.

Mexican Central.—H. W. Ridgeway, Superintendent of Shops at Aguascalientes, has resigned. George Tilton succeeds Mr. Ridgeway.

Missouri Pacific.—W. T. Tyler, General Superintendent of the Southern district, at Little Rock, has resigned, and is succeeded by Horace Baker, heretofore Assistant General Superintendent of the Southern at Greensboro, N. C. J. M. Walsh, Superintendent of the Joplin division, has been appointed Superintendent of the Northern Kansas division, with office at Atchison, Kan. G. H. Stapp succeeds Mr. Walsh, with office at Nevada, Mo.

New York Central & Hudson River.—The jurisdiction of I. A. McCormack, Manager of the "Harlem Line" (Grand Central Station to Mott Haven, New York City), has been extended from Mott Haven to High Bridge, about 2 miles, on the Hudson division, and to Wakefield, 7 miles, on the Harlem division. His title is General Superintendent of the Electric Division, High Bridge and Wakefield being the temporary northern termini of the lines which are to be electrified. Mr. McCormack will have charge of passenger train operation, but the direction of freight train and station operation, freight-car distribution and the despatching and recording of train movement north of Mott Haven will remain, until further notice, under direction of the respective division superintendents. The territories of R. E. Slater, Superintendent, and H. S. Balliet, Engineer of Maintenance of Way, have been similarly extended.

New York State Railroad Commission.—H. N. Rockwell has been appointed Commissioner. The other members are: Geo. W. Dunn, J. M. Dickey, M. Baker and G. W. Aldridge.

Norfolk & Southern.—J. Whetstone, Superintendent of Motive Power, has been appointed Marine Superintendent. J. E. Gould succeeds Mr. Whetstone.

Oregon Railroad & Navigation.—See Union Pacific.

Oregon Short Line.—See Union Pacific.

Pere Marquette.—See Cincinnati, Hamilton & Dayton.

Southern.—Horace Baker, Assistant General Superintendent, has resigned. E. H. Coapman, Superintendent of the Danville division, succeeds Mr. Baker, with office at Greensboro, N. C. H. A. Williams, Superintendent of the Savannah division, succeeds Mr. Coapman, with office at Greensboro. (See Missouri Pacific.)

The jurisdiction of J. B. Michael, Master Mechanic of the Knoxville division, has been extended over the Nashville division.

Southern Pacific.—G. L. King has been appointed Right of Way Agent, succeeding T. J. Wilson, assigned to other duties.

See Union Pacific.

Union Pacific.—J. D. Isaacs has been appointed Consulting Engineer for the completed lines of this road and of the Oregon Short Line, the Oregon Railroad & Navigation and the Southern Pacific, with office at San Francisco.

Wheeling & Lake Erie.—R. L. Porter has been appointed Auditor of this road and of the Wabash-Pittsburg Terminal, succeeding W. M. Bonar.

LOCOMOTIVE BUILDING.

The Guayaquil & Quito has ordered six Mallet locomotives from the Baldwin Works.

The Canadian Northern has ordered 10 locomotives from the Canadian Locomotive Co.

The Atchison, Topeka & Santa Fe has ordered 20 locomotives from the Baldwin Works.

The Chicago & Eastern Illinois, it is reported, has ordered 55 locomotives from the Baldwin Works.

The Vandalia, it is reported, has ordered eight or ten locomotives from the American Locomotive Co.

The St. Louis & San Francisco has ordered 20 locomotives from the Baldwin Works and 25 from the American Locomotive Co.

The Norfolk & Western, it is reported, has ordered 25 locomotives from the Baldwin Works and 25 from the American Locomotive Co. Specifications for these engines were printed in our issue of November 24.

The Lehigh Valley, it is reported, has ordered 40 locomotives as follows: Twenty freight locomotives from the American Locomotive Co. and five freight and 15 passenger locomotives from the Baldwin Works. Deliveries are to begin in February and April, 1906.

The Chicago, Rock Island & Pacific, as reported in our issue of November 24, has ordered 50 simple consolidation locomotives from the Baldwin Works. These engines will weigh 201,000 lbs., and will have 180,000 lbs. on drivers; cylinders, 23 in. x 30 in.; diameter of drivers, 65 in.; wagon top boiler, with a working steam pressure of 185 lbs.; total heating surface, 2,923 sq. ft.; 340 National charcoal iron tubes, 2 in. in diameter x 15 ft. 6 in. long; firebox, 107 in. x 67¼ in.; grate area, 50 sq. ft. The tender will have a capacity of 7,000 gallons of water and 15 tons of coal. The special equipment includes: Walschaert valve motion, Richardson balanced slide valves, Gollmar bell ringers, Keasbey & Mattison boiler lagging,

Vanderbilt brake-beams, Major couplers, Hancock injectors, Magnus journal bearings, U. S. piston and valve rod packings, Hancock safety valves, Leach sanding devices, Nathan bull's-eye lubricators, Railway Steel Spring Co.'s springs, Ashcroft steam gages, Standard solid rolled truck and tender wheels and cast-steel wheel centers.

CAR BUILDING.

The Wisconsin & Michigan is in the market for 200 ore cars.

The Wabash, it is reported, is figuring on ordering upwards of 5,000 freight cars.

The Cleveland Electric, it is reported, has ordered 50 cars from the J. G. Brill Co.

The Green Bay & Western has ordered 20 new flat cars from F. M. Hicks & Co.

The Colorado & Southern is in the market for 1,500 freight cars and 20 passenger cars.

The Mexican Central has ordered 50 tank cars from the American Car & Foundry Co.

The Lehigh Valley has ordered 70 mining cars from the American Car & Foundry Co.

The Grand Trunk has ordered 25 standard first-class coaches from the Canada Car Co.

The Wilkesbarre & Hazleton has ordered 10 passenger coaches from the Jewett Car Co.

The Chicago & Eastern Illinois has ordered 6,250 freight cars from the American Car & Foundry Co.

The Duluth, Missabe & Northern has ordered 25 refrigerator cars from the American Car & Foundry Co.

The Suffolk & Carolina has ordered 25 box cars and 40 flat cars from the American Car & Foundry Co.

The Aurora, Elgin & Chicago (*Electric*) will shortly be in the market for additional passenger equipment.

The Virginia & Carolina Coast has ordered 40 flat cars and 25 box cars from the American Car & Foundry Co.

The East Carolina is in the market for one passenger car and one combination passenger and baggage car, either new or second-hand.

The Maine Central, as reported in our issue of October 20, has ordered 60 passenger coaches and two baggage cars from the Pullman Co.

The Buffalo, Rochester & Pittsburg has ordered 100 box cars, 500 hopper cars and 200 gondola cars from the American Car & Foundry Co.

The Great Northern is in the market for a large amount of additional freight equipment, and is reported as figuring on a number of new passenger cars.

The St. Louis, Rocky Mountain & Pacific has ordered 20 gondola cars and 12 box cars from the American Car & Foundry Co. and 20 gondola cars from F. M. Hicks & Co.

The Chicago, Rock Island & Pacific has ordered 1,000 box cars, 500 stock cars, 10 cabooses, two passenger cars and two combination cars from the American Car & Foundry Co.

The El Paso & Southwestern has ordered 50 Hart convertible cars of 100,000 lbs. capacity from the Rodger Ballast Car Co., for March, 1906, delivery. The special equipment includes: Simplex bolsters, More-Jones brasses and Miner draft rigging.

The New York Central Lines, it is reported, have ordered for the Big Four and Lake Shore 27 smoking cars, 14 combination passenger and observation cars, two postal cars, two combination baggage and mail cars, two café cars and three dining cars from Barney & Smith.

The Central of New Jersey, as reported in a previous issue, has ordered 50 covered ore cars from the Pressed Steel Car Co. These cars will have a capacity of 80,000 lbs. and will be 20 ft. ¼ in. long x 7 ft. 6 in. wide, inside dimensions, and will be fitted with steel underframes. The special equipment will include: Kewanee brake-beams, Tower all-steel couplers and twin spring draft rigging.

The Eureka & Palisade, as reported in our issue of December 1, is in the market for 30 ore cars of 30,000 lbs. capacity. The company writes that it is trying, if possible, to get second-hand narrow-gage gondolas or coal cars with bottom openings. The cars should conform to the following general specifications: Length, 22 to 24 ft.; width, 7 ft.; diameter of wheels, 24 in. The special equipment should include Westinghouse air-brakes.

The Illinois Central has ordered 1,500 box cars of 80,000 lbs. capacity and 500 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co., for February, April and May, 1906, delivery. The box cars will weigh 37,500 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The refrigerator cars will weigh 36,400 lbs., and measure 37 ft. 11⅜ in. long, 8 ft. 2⅜ in. wide and 7 ft. 6⅛ in. high, inside measurements.

The Nelson Morris Company, Chicago, as reported in our issue of November 24, is building 100 refrigerator cars of 60,000 lbs. capacity at its own shops. These cars are for March, 1906, delivery, and will weigh 40,000 lbs. They will measure 28 ft. 6 in. long, 8 ft. wide and 7 ft. 4½ in. high, inside measurements. The special equipment will include: Simplex bolsters and brake-beams, Westinghouse air-brakes, Laflare doors, Miner draft rigging and Griffin car wheels.

The Lake Shore & Michigan Southern, as reported in our issue of November 24, has ordered 1,000 furniture cars from the American Car & Foundry Co., for April, 1906, delivery. These cars will have a capacity of 60,000 lbs. and will be 40 ft. long. The special equipment will include: Diamond trucks, Simplex bolsters, Westinghouse brakes, Buffalo brake-beams, Gould couplers, Railway Steel Spring Co.'s springs, Magnus metal journal bearings, Susenmihl side bearings and Camel doors and door fastenings.

The Pittsburg & Lake Erie, as reported in our issue of November 24, has ordered four combination passenger and baggage cars, five 70-ft. coaches and five 50-ft. coaches from the American Car & Foundry Co. The special equipment for the above cars will include: Paige wheels, Commonwealth bolsters, Westinghouse brakes, Diamond special brake-beams, Gould couplers, drawbar attachments, journal boxes and vestibules, Railway Steel Spring Co.'s springs, Pintsch lighting system and Chicago Car Heating Co.'s heating system.

The Tehuantepec National, as reported in our issue of November 10, has ordered 300 steel frame box cars from the American Car & Foundry Co. These cars are of 60,000 lbs. capacity and weigh about 34,000 lbs. They will be 36 ft. long x 8 ft. 6 in. wide x 8 ft. high, all inside dimensions. The special equipment will include: American Steel Co.'s axles, American Steel Foundries' bolsters, National-Hollow brake-beams, M. C. B. standard brake-shoes, Westinghouse brakes, Tower couplers, Wagoner door fastenings, American Car & Foundry Co.'s draft rigging, dust guards and journal boxes, corrugated galvanized iron roofs, American Car & Foundry Co.'s springs and Diamond arch-bar trucks.

The Boston & Maine, as reported in our issue of November 17, has ordered 20 passenger cars from the Pullman Co. for January, 1906, delivery. These cars will have a seating capacity for 72 persons and will weigh 75,300 lbs. each. They will be 59 ft. 2⅜ in. long x 8 ft. 10⅜ in. wide x 9 ft. 4 in. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment includes: Hammond axles, double iron bolsters, National-Hollow brake-beams, Christie brake-shoes, Westinghouse brakes, Gould couplers, Vinton's patent curtain bottom irons, Pantasote curtain material, Pintsch gas, Gould standard platforms, tin roofs, Crucible Steel Co.'s springs, four-wheel B. & M. standard trucks, and 36-in. wheels fitted with Allen No. 9 Krupp tires.

BRIDGE BUILDING.

Cheyenne, Okla. T.—Bids are wanted January 3 by John H. Osborn, County Clerk, for building an iron bridge 85 ft. long over the Washita river in Roger Mills County.

Long Island City, N. Y.—Out of the city bond issues, money amounting to $175,000 will be used to build a retractile bridge over Dutch Kills creek. The plans have been completed by Engineer Edward A. Byrne and bids may be asked for during the present month.

Monessen, Pa.—Contracts have been given to the Friday Contracting Co. for the substructure and to the American Bridge Co. for the superstructure of the bridge to be built for the Mercantile Bridge Co. over the Monogahela river at this place. The contracts which have just been let call for the completion of the work by Dec. 1, 1906. The proposed structure will be a combined highway and street railroad bridge to carry two tracks. It will consist of two spans each 400 ft. long, with a 500-ft. approach on the west side.

Norristown, Pa.—Separate bids are wanted December 27 by the Commissioners of Montgomery and Chester Counties for building the substructure and superstructure of an inter-county highway bridge over the Schuylkill river near Sanatoga, on the Philadelphia & Reading.

Portland, Ore.—Plans are being made for building a steel bridge about 400 ft. long over Montgomery slough and lower Albina.

Other Structures.

Angelica, N. Y.—The Pittsburg, Shawmut & Northern has started work putting up shops here.

ATHENS, GA.—The Central of Georgia will improve its yards and build a large freight house here at a cost of about $100,000.

CHARLESTON, S. C.—A contract has been given to Grant Wilkins, of Atlanta, Ga., at $152,000 for building the union passenger station here. There were ten bids submitted ranging from $152,000 to $182,000.

LETHBRIDGE, ALBERTA.—The Canadian Pacific will build terminals here and put up a 10-stall roundhouse and repair shops; also a freight shed 500 ft. long.

OMAHA, NEB.—The Union Pacific is planning to make large additions and improvements to its property at this place. The company will put up large locomotive and car shops.

SHAWNEE, OKLA. T.—The Atchison, Topeka & Santa Fe is putting up a $25,000 electric lighting plant for lighting its roundhouses, buildings and yards. New machinery at a cost of about $100,000 will also be put in at its shops here.

TORONTO, ONT.—The Grand Trunk roundhouse at this place was destroyed by fire November 26, and several locomotives were burned.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BAY CITY & PORT HURON.—An officer writes that this company, which was incorporated some time ago to build a railroad from Bay City, Mich., to Port Huron, a distance of 105 miles, has 20 miles of grade completed from Port Huron to Lexington. The work is not difficult. It will include the building of two steel bridges and a number of small bridges. W. C. Penoyar is President. The project will be financed by George B. Jenkinson, 35 Nassau street, New York, who will have the final surveys completed at once and who will give the contract for the balance of the work to a construction company of which he will be President. (May 12, p. 158.)

BROOKLYN RAPID TRANSIT (BROOKLYN, N. Y.).—This company will at once begin extending its Myrtle avenue elevated line from Ridgewood to Middle Village, a distance of two miles. The company has bought about 30 acres of land known as St. James park, which will be filled in and used for a large yard to have a capacity of 300 cars.

CENTRAL OF NEW JERSEY.—A contract has been let by this company to C. R. Kingsley, of Scranton, for extending its tracks from Truesdale City in Luzerne County, Penn., to the West End Coal Co.'s colliery at Mocanaqua, and to connect with its own tracks over its River branch to Shickshinny, a distance of about four miles. The work includes several deep cuts through solid rock.

CHICAGO, BURLINGTON & QUINCY.—See Denver & Beaver Valley below.

CHICAGO, MILWAUKEE & ST. PAUL.—A contract is reported let by this company to McIntosh Bros., Milwaukee, for building about 800 miles of the extension from Evarts, S. Dak., on the Missouri river, west toward the Pacific Coast. Contracts for the rails are said to have been given to the United States Steel Corporation.

Announcement has been made by this company that it is operating 40 miles of its extension now under construction from Chamberlain, S. Dak., west to Rapid City, 200 miles. This new line parallels the Chicago & North-Western extension now building from Pierre to Rapid City.

COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—An officer writes that this road is being built by the Kenefick, Quigley & Hammond Construction Co., of Beaumont, Tex., and that work is under way. (November 10, p. 149.)

CUMBERLAND RIVER & NASHVILLE.—This company, which was incorporated to build a railroad from Corbin, Ky., west to Burnside, thence southwest via Monticello and Albany to the Tennessee state line, and which surveyed the proposed line from Corbin to Monticello, 63 miles, last spring, has let a contract for building the road from Burnside, on the Cincinnati Southern, to Monticello, 20 miles. Under the name of the Nashville & Northeastern, the road will be built from the Tennessee line to Nashville. The road will traverse a rich district in timber, coal and oil. Connection will be made with the Chesapeake & Nashville at Westmoreland, Tenn. (November 17, p. 159.)

DEERING SOUTHWESTERN.—This company, which operates a freight line from Deering, Mo., to Camp, a distance of six miles, connecting at the former place with the Frisco system, has filed an amendment to its charter providing for an extension from its western terminus south in Dunklin County to the state line, about 10 miles.

DELAWARE & EASTERN.—Construction work is being pushed on this proposed road by the John R. Lee Construction Co., of Paterson, N. J., which has the contract. The work was begun in August of this year and 18 miles have already been completed. The proposed route is from the east branch of the Delaware river in New York State, touching the Ontario & Western at Eastbranch, west to the Ulster & Delaware at Arkville, through a rich timber and quarry section, a distance of 45 miles. The company, which is capitalized at $1,000,000, is being promoted by Searing & Co., 7 Wall street, New York City. (Oct. 6, p. 111.)

DELAWARE & HUDSON.—An officer writes that this company has under consideration the building of a road from South Wilkesbarre to Yatesville, Pa., to form a connection with the Pennsylvania road. It has not yet been definitely decided whether work will be let by contract; it may be done by the company's forces.

DENVER & BEAVER VALLEY (C., B. & Q.).—This company has recently been incorporated as a subsidiary line of the Chicago, Burlington & Quincy to build 100 miles of line from Oberlin, Kan., to Uray, Colo.

INDIANA ROADS (ELECTRIC).—Contracts have been let to A. M. Weedon, of Alexandria, and P. T. O'Brien, of Elkwood, Ind., for building an interurban road from Fort Wayne, Ind., northwest to South Bend, 70 miles air line. There will have to be 25 bridges. A. J. Behymer, of Elkwood, is one of the incorporators.

JALISCO RAILWAY.—Incorporation has been granted a company under this name in Maine with a capital of $7,500,000. Frederick Seward, of New York, is Treasurer and one of the directors. The purposes of the company are to buy and use the contract and concessions granted by the government of Jalisco, Mexico, to Melvin C. Miller to build a railroad from Guadalajara to a point on the coast of the Pacific near Chamelainjalisco, with a branch line from Guadalajara to LaSoledad.

JUNCTION RAILROAD.—This company's tunnel under Neville street, Pittsburg, is to be abandoned and a new tunnel will be pierced at a cost of about $2,000,000. This change is made necessary in connection with the removal of the company's tracks from their present location at Junction Hollow to Boundary street. In the cut from the Monongahela river to the mouth of Neville street tunnel the line will have a grade of 32 ft. less than the present line.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Announcement has been made that this company opened for traffic on December 3 its extension from Thief River Falls, Minn., to Kenmare, N. Dak., a distance of about 300 miles. The new road passes through the center of territory covered by the Great Northern and crosses 12 branch lines of the latter which were built through the Red River district. It is expected to secure a large share of the grain traffic.

MORGAN'S LOUISIANA & TEXAS (SOUTHERN PACIFIC).—An officer writes that surveys are being made to build a line from Baton Rouge, La., southwest to Lafayette, a distance of 53 miles; also that surveys have been completed for an extension from Arnaudville north for a distance of 12 miles to Port Barre. Rights of way are being secured.

MUNISING.—This company has applied for an amendment to its charter giving authority to build branches from a point on its line at Little Lake station, in Marquette County, Mich., to Austin and Princeton mines, a distance of 7.3 miles; from the northern terminus on Munising bay northeasterly, paralleling the shore of Lake Superior, to a point in Alger County, 25 miles; and for a line from its main line south to a connection with the Delta Lumber Co.'s road in Schoolcraft County, 24 miles.

NASHVILLE & NORTHEASTERN.—See Cumberland River & Nashville above.

OREGON & IDAHO.—An officer writes that this company, recently organized to build a railroad from Ontario, Ore., to Emmett, about 30 miles, will be built at once. Bids are being asked for the work but no contracts have as yet been let. The work will be light and includes the building of one bridge over the Snake river. The maximum grade will be 1.5 per cent. and the maximum curvature 5 deg. O. V. Allen, of Boise City, Idaho, and O. C. Wright, of Sumpter, Ore., are the engineers in charge. Information will be furnished by the latter. (Nov. 17, p. 159.)

PEA RIVER VALLEY & GULF.—An officer writes that this road will be built from Opelika, Ala., southwest through Union Springs, Brundige, Enterprise, Chancellor and Geneva, Ala., and Darlington and DeFuniak Springs, Ala., to Portland, Fla., on Choctawhatchee Bay, on the Gulf of Mexico, a total distance of about 190 miles. No track has been laid. The company intends to buy a short existing line running north from DeFuniak Springs about 12 miles. The time for asking bids for the work has not yet been fixed. The work will be light; maximum grade 1.1 per cent., and light curvature. The work includes the building of three small bridges. Surveys have been completed for a part of the proposed line. Connection will be made at Opelika, the northern terminus, with lines running northwest to Birmingham, Ala., and northeast to Atlanta, Ga. From the southern terminus at Portland there is a favorable water route through the East Pass crossing the gulf to Cuba and South American countries. (November 24, p. 167.)

Pennsylvania.—An officer writes that the program of the Engineering department for improvements to be carried out during the next year includes: A new low-grade, double-track freight line from Glenlock to West Philadelphia to cost $7,000,000; two additional tracks from Trenton, N. J., to Waverly, as a continuation of the low-grade freight line to New York, $5,500,000, and third and fourth tracks on the Middle division for about 12 miles to cost $2,500,000.

Pennsylvania Lines West.—The Pennsylvania Company's new cut-off from Ravenna eastward to Niles, Ohio, where connection is made with the Pittsburg, Youngstown & Ashtabula division, has been opened for business. The Cleveland & Pittsburg, between Cleveland and Ravenna, has also been rebuilt. The company now has lines between Cleveland and Pittsburg over three routes: One via Ravenna and Youngstown, 138 miles; one via Alliance through Homewood, 140 miles, and the other via Alliance and Wellsville, 150 miles.

Richmond & Chesapeake Bay (Electric).—An officer writes that this company, which proposes to build an electric railroad from Richmond, Va., north to Ashland, and thence to tidewater by a route not yet determined, has surveys under way and that contracts for grading were to be let about the first of this month. A contract has already been given to Charles Gasser for masonry. The maximum grades will be 1 per cent., but most of them will be ½ per cent. There will be one overhead viaduct at Richmond about 2,700 ft. long. Frank J. Gould, of New York, is President, and C. P. E. Burgwyn, Chief Engineer, of Richmond, Va. (November 24, p. 167.)

Seaboard Air Line.—See Tallahassee Southeastern below.

South & Western.—A contract has been let by this company to S. Walton & Co., of Falls Mills, Va., for building 12 miles of its proposed road in Hawkins County, Tenn., and in Scott County, Va. The surveys, which are being made for this company by the George L. Carter Syndicate, will shortly be completed and bids for building about 200 miles of the proposed road will be asked for. (October 20, p. 128.)

Southern.—Announcement has been made by this company that it has opened for passenger traffic its Danville extension from Harrodsburg, Ky., south to Danville, a distance of nine miles.

Southern Pacific.—See Morgan's Louisiana & Texas above.

Tallahassee Southeastern (S. A. L.).—This company, which operates a line from Tallahasee, Fla., to Wacissa, on the Wacissa river, in Jefferson County, has let a contract to Blair Burwell, of Jacksonville, for building part of its proposed extension from Perry to Wacissa, on which work is under way. The road will be extended through Jefferson County into Taylor County and to Perry, connecting there with the Suwanee & San Pedro, now controlled by the Florida Railway Co., of Live Oak. The proposed road will cross the Aucilla river, Enconfina river and Long creek before reaching Perry, and will traverse a rich timber section.

Texas Roads.—The Kenefick-Hammond-Quigley Construction Co., Beaumont, Tex., is asking bids for 300 miles of grading work between Baton Rouge, La., and Houston, Tex.

Tidewater.—This company, it is said, has let a contract to MacArthur Bros. Company for building 100 miles of its proposed road from a point near Lawrenceville, Va., west towards Rock, W. Va. The contract includes 21 tunnels from 350 to 3,500 ft. long, and the entire contract must be completed in two years. (November 17, p. 160.)

Toledo, Marshall & Northern.—At a recent meeting of the stockholders of this company in Marshall, Ohio, the capital stock was increased from $800,000 to $2,000,000. The company will soon begin work on its proposed line from Bay City, Mich., southwest through Olivet, Marshall and Coldwater to Montpelier, Ohio. (April 14, p. 122.)

Virginia & Carolina Coast.—This company, which will build a railroad from Norfolk, Va., to Beaufort, N. C., about 130 miles, has given a contract to J. G. White & Co., of New York, and work is now under way. The company will develop about 500,000 acres of timber lands in Virginia and North Carolina.

RAILROAD CORPORATION NEWS.

Cincinnati, Hamilton & Dayton.—On December 4, Judson Harmon was appointed receiver of the Cincinnati, Hamilton & Dayton and the Pere Marquette on the petition of W. B. Horn, of New York. He stated that he was a creditor of the C., H. & D. to the amount of $62,986. The petition also alleges that, while the defendant company was solvent prior to July 7, 1904, it has since that time assumed such obligations as to cripple it, particularly the purchase of the Pere Marquette stock for $12,500,000, the agreement between the C., H. & D. and Pere Marquette and the Toledo Railway & Terminal Co. which involved large obligations for terminals in Toledo, and an agreement to carry $3,500,000 bonds issued by the Pere Marquette to cover that company's purchase of the Chicago, Cincinnati & Louisville. It is further asserted that the cash assets of the C., H. & D. and Pere Marquette on December 2, 1905, were less than $100,000, although the interest on the Pere Marquette bonds mentioned above is due on January 1, 1906.

President Underwood of the Erie issued the following statement on November 29:

"It having appeared to the board of directors of the Erie that under existing conditions the purchase of the common stock of the Cincinnati, Hamilton & Dayton might involve obligations on the part of the Erie company interfering with the future development of its own railroad, the board of directors to-day voted unanimously to accept the offer of J. P. Morgan, himself to assume and complete that purchase on his own account, thus relieving the Erie Railroad from all costs, charges and contracts in the matter.

"The Erie board voted further to proceed with the sale of its $12,000,000 convertible bonds as heretofore authorized, the proceeds to be used as authorized under the general mortgage of 1903 in the improvement of and extensions to its road. Of course, all stockholders who have subscribed to these bonds on the faith of the C., H. & D. stock being pledged thereunder will be released from their subscriptions if they so desire."

Delaware & Hudson.—This company has purchased the Quebec Southern, which was recently sold at receiver's sale. (November 17, p. 160.)

Delaware, Lackawanna & Western.—The directors have declared an extra dividend of 10 per cent. This makes 20 per cent. in dividends which have been paid this year, as compared with 17 per cent. last year and 7 per cent. during each of the two preceding years.

Erie.—See Cincinnati, Hamilton & Dayton.

Kanawha & Michigan (Toledo & Ohio Central).—A committee has been formed to represent the minority stockholders of the Kanawha & Michigan in an effort to influence the directors of the road to distribute a portion of the net profits in a dividend to the stockholders. The committee makes the following statement: "The Kanawha & Michigan has enjoyed five years of great prosperity, in which the gross earnings have increased from $759,069 to $1,764,173, and by a favorable disposition on the part of the directors can easily begin to pay dividends on its $9,000,000 of stock issued. The earnings for the next fiscal year indicate a gross of over $2,000,000. Heretofore the management has been hindered from considering the claims of the stock because the increasing business has demanded every resource of the road to furnish facilities to handle it. Because of the clause binding the road not to increase its bonded debt ($2,469,000) beyond $15,000 per mile, increases of rolling stock and every addition and improvement to plant has had to be paid for out of earnings and temporary loans. In addition to such expenditure from earnings, which is estimated to have amounted to $2,000,000 in five years, there has been added to its interest-bearing obligations $2,705,330 debts for improvements, which have increased the charges per year from $109,591 in 1900 to $239,173 in 1905. The present charge of $239,173, which includes payments to reduce equipment obligations, is not burdensome when the large earnings are considered, and by ordinary economy the road could show a satisfactory percentage earned on its stock in the last fiscal year." The committee, which is made up of George D. Mackay, of Mackay & Co., Chairman; W. H. Goadby, of W. H. Goadby & Co., of New York, and I. L. Ellwood, of Dekalb, Ill., is said to represent about one-half of the minority shareholders. H. D. Emerson, of Mackay & Co., is Secretary of the committee.

Kansas City Southern.—Blair & Co. have bought $1,440,000 4½ per cent. equipment notes of 1915 of this company. The equipment which secures these bonds is to be delivered within the next two months, and consists of 20 locomotives and 1,414 cars.

Philadelphia Company.—The Pittsburg Railways Co. will issue $400,000 5 per cent. car trust bonds, maturing within ten years and guaranteed by the Philadelphia Co.

Toledo, St. Louis & Western.—The gross earnings for the year ended June 30 were $3,785,165, an increase over the figures for last year of $443,517. Operating expenses were $2,851,099, an increase of $424,925, making an increase in net earnings of $8,332. The surplus after charges was $172,613.

Union Pacific.—The report for the year ending June 30 shows gross earnings of $59,324,949, an increase of $4,045,713. The operating expenses were $30,370,702, an increase of $1,344,095, reducing the operating ratio from 51 per cent. to 48 per cent. The surplus available for dividends was $22,785,507, which is equal to 4 per cent. on the $99,558,900 preferred stock outstanding and 11⅛ per cent. on the $164,841,900 common stock outstanding. The surplus after all charges was $7,219,282.

Western Maryland.—The income account for the year ended June 30 shows gross earnings of $3,900,249, an increase of $143,057. Operating expenses and taxes amounted to $2,512,421, an increase of $189,206, making a decrease in net earnings of $46,149. The surplus after charges was $206,097, a decrease of $194,345.

GENERAL NEWS SECTION

NOTES.

The State Railroad Commission of Illinois has directed its secretary to revise the freight rates on the railroads of that state, to go into effect January 1; and on roads in Class A the order makes a horizontal reduction of 20 per cent. Roads in Class B may charge 10 per cent. more than the rates on roads in Class A.

In a local court at El Paso, Tex., the railroads have been declared violators of the Anti-trust Law, and the ticket scalpers, by presenting this argument, have escaped prosecution. As in the case which came up in the Federal Court at Buffalo a year or two since, the railroads which attacked scalpers were charged with maintaining associations for regulating fares and thus in some degree suppressing competition in fares; and the court, necessarily finding this charge valid, under the Sherman Law, had to throw the railroads out of court.

On Tuesday, December 5, the elevated and subway lines of the Interborough Rapid Transit Company, New York City (Boroughs of Manhattan and the Bronx) carried 1,380,000 passengers, the largest number ever carried in a single day. The number on the elevated lines was 865,000 and on the subway lines 515,000. An officer of the Interborough tells a reporter that the population is rapidly increasing in those parts of the city which are convenient to the subway, and that large numbers of business men now go home to lunch in the middle of the day who could not do so before the rapid transit of the subway was available.

The Southern Pacific has modified its decision refusing to take "personally conducted" tourist car parties from its eastern connections. It appears that the chief reason for the original decision was the fact that the rival lines bringing passengers into Ogden from the East have frequently delivered tourist sleeping cars only partially loaded, thus throwing upon the Southern Pacific the burden of many hundreds of miles of unnecessary haul. It is now proposed to consolidate such loads at Ogden. It is said that on Thursday and Friday, November 2 and 3, the Denver & Rio Grande delivered to the Southern Pacific at Ogden 87 tourist cars all "personally conducted." These cars, which are run two days in a week, take more passengers than those, without special conductors, which are run on the other five days in the week.

According to press despatches from Philadelphia, the Pennsylvania Railroad is to make a sweeping abolition of free passes beginning January 1. The classes to be cut off are office holders, politicians, newspapers and everybody, "with the possible exception of the President of the United States." The only reasons given are that the spirit of the Interstate Commerce Law forbids the long established custom, and that the officers of the road deem it fitting to take this action as a result of the agitation against the giving of rebates. Philadelphia reporters who have talked with officers of the Pennsylvania say that the trunk line presidents are to meet this week and that all the other lines will take the same action as the Pennsylvania. The New York Central has already made a similar announcement.

The Attorney-General has sent instructions to every district attorney of the United States to vigorously enforce the laws against discriminations by common carriers. They are to diligently investigate all complaints received from any source, and to make investigations on their own initiative also. Whenever practicable, they must get grand juries to indict both shipper and carrier, and where the testimony of one is needed to convict the other, witnesses should be assured of immunity from prosecution. Where there is sufficient evidence, violators of the law should be indicted for conspiracy to commit an offense against the United States, based upon section 5440 of the revised statutes. The Supreme Court has held, in Clune vs. United States (159 U. S., 590, 595), that a conspiracy to commit a crime, itself punishable only by fine, may be punished by imprisonment; and where a conviction is secured, the court should be asked to punish by imprisonment and not by fine alone. It is announced in Philadelphia that under this order the Federal grand jury will be asked this week to investigate alleged illegal preferential rates on iron pipe sent to Winnipeg, and alleged illegal cartage allowances to a shipper of coffee in Philadelphia.

The Railway Mail Service.

At the close of the year [June 30, 1905] the railway mail service comprised 12,474 officers and employees, an increase in the year of 853. In the amount of ordinary mail handled there was an increase of about 5.77 per cent. as compared with the preceding year, and of 13 per cent. in registered matter. During the year 12 clerks were killed while on duty. The preceding year there were 18 regular clerks, two substitute clerks and one mail weigher killed. The number of clerks seriously injured was 125, as against 90 for last year. The number of clerks slightly injured was 386, as against 348. The arduous and hazardous duties incident to the service emphasize the desirability of some legislative action that will make provision for clerks worn out in the service and maintain the vigor and efficiency of the service by the gradual elimination of superannuated clerks.

On June 30, 1905, there were 3,064 railroad routes, the total length of which was 200,965 miles, with an annual travel of 362,645,731 miles. The expenditure in the United States was $39,833,070. The increase for the year was 4,057 miles in length of routes, 9,607,334 miles in annual travel, and $655,694 in annual rate of expenditure.

The present method of determining the rates of pay for this service is not altogether satisfactory, and while I am not yet prepared to suggest specific changes, it is believed that certain inquiries that are being instituted through departmental channels will afford data on which to base future recommendations. The plan now followed appears to furnish a somewhat uncertain basis upon which to make annual expenditures exceeding $40,000,000.—Postmaster General, Annual Report.

Interlocking on Twenty-three Roads.

The Federal Railway Signal Company, of New York, reports that the contracts received by it during six months ending Oct. 31 last for mechanical interlocking aggregated about 1,000 levers, as follows:

Name of Railroad.	Location.	Machine lever space.
Baltimore & Ohio	Niles, O.	36
Baltimore & Ohio	Wildwood, Pa.	32
Baltimore & Ohio	Ravenna, O.	52
Baltimore & Ohio	Flushing, O.	24
Baltimore & Ohio	Nova, O.	28
Baltimore & Ohio	Kent, O.	24
Baltimore & Ohio	Lowellville, O.	32
Baltimore & Ohio	Kimmel, Ind.	32
Baltimore & Ohio	Ripley, Ind.	24
Chic., Bur. & Quincy and Ill. Central	Christopher, Ill.	20
Chicago Great Western	Rodden, Ill.	12
Chicago Great Western	Winston, Ill.	8
Chic. Ter. Trans. and Chic. & Grand Tr.	Glue Island, Ill.	80
Cin., Sam. & Day. and Cin. Northern	Carlisle, O.	28
Delaware & Hudson	Oneonta, N. Y.	24
Delaware & Hudson	Oneonta, N. Y.	36
Delaware & Hudson	Delanson, N. Y.	24
Delaware & Hudson	Mineral Springs, Pa.	28
Delaware & Hudson	Moosic, Pa.	50
Delaware & Hudson	E. Glenville, Juncth, N.Y.	20
Del. & Hud. and Del. Lack. & West	Minooka, Pa.	20
Gt. Northern and Chic., St. P., M. & O.	Oakland, Neb.	40
Gt. Northern and Chic., St. P., M. & O.	Dakota City, Neb.	16
Indian Harbor & Chic., Ind. & Louisville	St. Johns, Ind.	28
Indian Harbor & Indiana, Ill. & Iowa	Schneider, Ind.	48
Indiana Harbor and Chic. & East. Ill.	Morocco, Ind.	32
Indiana Harbor and C., C., C. & St. L.	Shoff, Ind.	52
Indiana Harbor and Lake Erie & Wes.	Handy, Ind.	48
Louisvle, Henderson & St.L. and Ill. Cen.	West Point, Ky.	16
M., St. P. & S. Ste. Marie and Gt. Nor.	Warren, Minn.	16
M., St. P. & S. Ste. Marie and Gt. Nor.	Conway, N. Dak.	16
M., St. P. & S. Ste. Marie and Gt. Nor.	Ardoch, N. Dak.	20
M., St. P. & S. Ste. M. and Nor Pac.	Forest River, N. Dak.	16
Philadelphia & Reading	West Milton, Pa.	32
Philadelphia & Reading	Harrisburg, Pa.	64
Philadelphia & Reading	Ryberry Road, Pa.	16
Philadelphia & Reading	Bustleton and Somerton Turnpike, Pa.	16
Philadelphia & Reading	Crescentville, Pa.	28
Pennsylvania Lines West of Pittsburg	Urbana, O.	24
Pennsylvania Lines West of Pittsburg	Hagenbaugh, O.	24
Pennsylvania Lines West of Pittsburg	Summit, O.	24
Total		1,180

Rio Janeiro Steamers.

The Lloyd Brazilerio, which operates three lines of coastwise steamships out of Rio de Janeiro, Brazil, is being reorganized. The government will require it to run its own steamers to the United States, and this will necessitate twenty-two additional vessels, and eight smaller boats are required for river navigation. The new steamers are expected by October, 1906, and the new service is intended to be in operation by November 15 of that year.

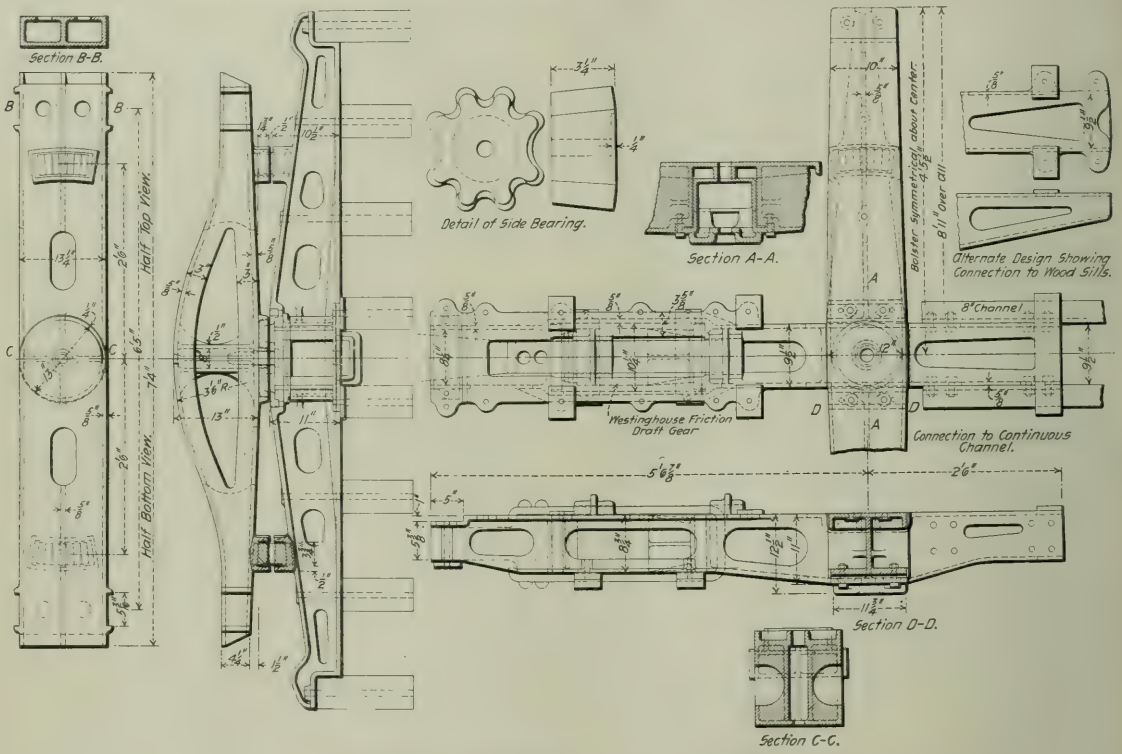
Scare Suggestions.

The railroad interests have abandoned their "information bureau," which was indefatigable in sending undesired information to newspapers in the hope of killing off the sentiment sustaining President Roosevelt in his attitude as to regulating rates. The policy of the railroads in their fight has been puerile, and has planted still deeper in some minds the belief that the opposition was very far from being in the interests of the people. This literary bureau's arguments and scare suggestions were cheap. The attempt to break up meetings of various business interests which were likely to pass resolutions favoring rate regulation was another childish way to be smart. And the appearance of railroad employees urging that the

present laws be not changed was as funny as Punch. The present movement is likely to prove just like the railroad attempt to prevent the adoption of safety-couplers and other life-saving apparatus. That splendid movement in the interests of humanity was declared an impossible and preposterous scheme, yet to-day it is saving life and property, and justifying itself right along. The railroad managers have been more scared than hurt, and apparently have feared anything that curtailed their absolute monopolistic power, the most dangerous thing for themselves, if they only knew it, of all the chances of trouble that their calling develops.—*Hartford Courant.*

Combination Draft Carrier and Body Bolster.

The accompanying drawing shows a new design of cast-steel draft-carrier and body bolster made in two pieces which interlock with each and require no bolts or rivets. The draft-beam casting has a hollow box section and extends from the end sill to a point 26 in. back of the center of the bolster. The part in front of the bolster can be modified to suit any form of draft gear or attachments and does away with wooden sills, draft lugs and bolts or rivets. In the drawing the Westinghouse friction draft gear



Combination Cast-Steel Draft Carrier and Body Bolster.

is shown applied. Back of the bolster the draft-casting can be modified to fit any sill construction, either of wood or metal. For 8-in. channel sills eight bolts are required for the attachment to each sill. Where wooden sills are used the construction shown in the detail in the upper right-hand corner of the drawing is used.

The body bolster is cast in one piece with an I section and broad flat top flange, giving it ample strength in all directions. At the center it bridges the draft casting which is put in from the bottom and interlocks with it both longitudinally and laterally. Four bolts are used for fastening the two pieces together but they are not subjected to any shear. The top center plate instead of being cast on the body bolster is cast on the under side of the draft beam.

The drawing also shows a cast-steel truck bolster and a new form of side bearing. The truck bolster is made in one casting with a box section at the ends and a deep center section, with a supporting strut. The bottom, of the side bearing boxes on both bolsters are corrugated and a cast-steel roller, with corresponding corrugations or teeth is inserted instead of the usual form of smooth roller. This roller is tapered to keep it always in proper alinement and cannot work out of the boxes.

These devices have recently been patented and are to be sold by the Pittsburg Equipment Company, 541 Wood street, Pittsburg, Pa.

South American Railroad Projects.

Guayaquil & Quito Railway.—The construction of the 245-mile railroad between Guayaquil, the principal seaport of Ecuador, and Quito, the capital of the republic, situated in the Andes at an altitude of 9,390 ft. above the sea level, is expected to be completed by the middle of next summer, after which it is proposed to continue the line 8,000 ft. down the side of the mountains to Ibarro on the border of the United States of Colombo, about 50 miles from Quito. The line is already in operation from Guayaquil to Riobamba, a distance of about 100 miles. Riobamba is a city of some 40,000 inhabitants, and is surrounded by a thickly populated and fertile country. The road is, however, built on to Ambato, which has a population of about 25,000, and is the point where trade from the Orient or interior of Ecuador concentrates. The only present entrance from the plateau and populated districts of Ecuador into the watersheds of the Amazon river is down the Palata river from Ambato, and over this route the rubber and other products are brought to the latter place. Ambato is located at an height of 8,554 ft. above the sea and is about 60 miles from Quito.

Although the Government of Ecuador has been trying for the last 50 years to get the line built, no real work was done until 1871. By 1875 about 30 miles of road were completed. Nothing further was done until 1887, when about five miles more were laid. The government caused extensive surveys to be made during the early nineties, but nothing in the way of further construction was accomplished. Meantime a large part of the road already built fell, through neglect, into a ruinous condition. From 1873 to 1894 no less than a dozen formal contracts were made between the government and private firms, both Ecuadorian and foreign, for the construction of a railroad which should connect the coast with the interior plateau, but every effort resulted in failure and financial disaster until 1898, when the government entered into a contract with Archer Harman, of New York, for the rehabilitation of the old railroad and for the construction of the line on to Quito. The Guayaquil & Quito Railway Company was formed with American and British capital in about equal proportions for the purpose of carrying out the enterprise. Mr. Harman is President of the company, and T. H. Powers-Farr is Vice-President. The directorate now includes the names of Erskine Hewitt, E. P. Holran, Charles H. Lee, S. H. Lever, E. Hope Norton, E. Dutilh-Smith, Elliott C. Smith, Robert Meade Smith, Hiram R. Steele and Arthur Turnbull, all of New York, and W. M. Beckner, of Kentucky. The total issue of $12,282,000 first mortgage 6 per cent. gold bonds of the company are secured by a first lien on the customs receipts of Ecuador (which amounted

o about $4,000,000 in 1903), and by a first mortgage on the railroad and its appurtenances; they are also guaranteed as to principal and nterest by the government.

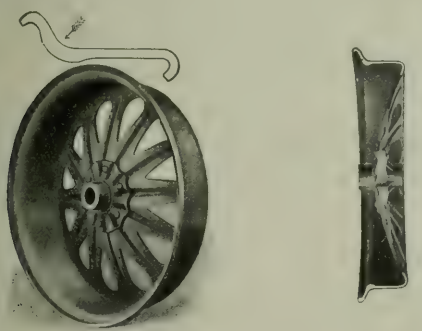
The Ecuadorian Association, Limited, was incorporated in Scotand to carry out the agreements for construction between the Ecuadorian government and the Guayaquil & Quito Railway Company. The association made a sub-contract with the J. P. McDonald Company, of New York, who built 30 miles of the 57 miles of the mountain division and partially graded the remaining 27 miles. In September, 1902, 34 miles of the mountain division were in operation. The Ecuador Company of New Jersey was then formed by Robert C. Pruyn, of Albany, N. Y., and succeeded in opening the road to public traffic to a point 115 miles distant from Guayaquil. This was done in June, 1903. Another construction company was organized in November of last year by Mr. Harman and his associates. This is the Inca Company, which is incorporated in New Jersey and has entered into a contract with the Guayaquil & Quito Railway Company to complete the building of the road to Quito, the construction of which will open up what is claimed to be one of the richest agricultural territories, now having only the most primitive transportation facilities with the outside world.

THE ECUADOR-BOLIVIA RAILROAD CONTRACT.—Several American contracting concerns are figuring on a contract about to be awarded for the construction of a 300 mile railroad, which is intended to serve as an outlet by way of Chili for the rubber, cocoa, coffee, cinchona bark, etc., grown in the interior of Bolivia. The road is to run from Anca, the most northerly port in Chili, to La Paz, located on the south end of Lake Titicaca, the highest sheet of water in the world, it being at an altitude of some 12,000 feet above sea level. The line will pass through Ancara, 15,000 odd feet above the sea. The gradient in the Andean section will be about 3.75. The gage is to be 42 in. At present La Paz, which is the principal rubber center in Bolivia, has no railroad connection with the outside world. The nearest road is at Puno, on the northwest end of Lake Titicaca, about 100 miles distant. The Puno line connects with Mollendo, a Peruvian seaport.

Among those who are to submit bids for the construction work are the New York contracting firms of J. G. White & Co. and James Stewart & Company. The British contracting firm of S. Pearson & Son, Limited, as well as German concerns are also after the contract. Tenders are to be opened at the Chilian Ministry of the Interior at Santiago, January 2.

An Improved Pressed Steel Hand Car Wheel.

An improved design of pressed steel wheel for hand and push cars is illustrated herewith. By the use of special machinery the metal is so distributed as to increase its thickness in the flange and flange throat from ⅛ to 3/16 in. The metal plate used in making the wheel being ¼ in., its thickness is almost doubled at the above-mentioned points. The plates are sheared to circular form and



Pressed Steel Hand Car Wheel.

shaped at white heat under heavy hydraulic pressure. The plates are then reheated and run through a finishing machine, which effects the distribution of metal already mentioned. The metal is compressed in all processes of manufacture of the wheel, which is rolled in finishing, thus increasing the density and hardness and tensile strength of the metal and therefore its wearing qualities.

From the finishing machine the wheels pass at red heat to another hydraulic press holding male and female dies which size the wheels and make all of them of uniform diameter and periphery. The hub and flange are pressed into place hydraulically, and the riveting is done cold under similar pressure. The dish of the center and depth of the corrugations are made as great as possible to give maximum weight-bearing qualities and a better and stronger hub fit. The wheel presents an excellent appearance.

These wheels are made by the Kalamazoo Railway Supply Company, Kalamazoo, Mich. This company was reorganized during the past year with largely increased capital, and large additions have recently been made to the plant, including the latest improved tools for the machine shop.

The Recent History of Federal Control of Railroads in the United States.*

BY W. M. ACWORTH.

(*Continued from page 178.*)

To an Englishman, who knows that his own Railroad Commission has had power for thirty years not only to say that an existing rate is wrong, but practically to say that a certain other rate ought to be substituted for it, it is a little difficult to understand the alarm which the President's proposal has excited in the American railroad world. From the point of view of the public interest it is easy to find arguments against it. That the interference of our own Commission has tended to rigidity rather than adaptation to changing circumstances; that it has kept rates up that would naturally have come down to the benefit both of the railways and their customers; that, though the interference may possibly have been necessary, on the whole it has done more good than harm—all this I for one firmly believe. But, at least, there has been here no sign of a revolutionary upheaval of the *status quo*. And, indeed, in cases such as those of the Liverpool Corn Trade Association and the Southampton Docks the Court has pretty distinctly shown that any such upheaval is in the highest degree unlikely.

At the same time there can be no doubt whatever that the great majority of the railway men of America do regard the proposals of the President with the most serious apprehension. They mistrust, not without excuse, both the competence and the impartiality of the Interstate Commerce Commission. They point out that in at least two cases—subsequently, it is true, upset by the Supreme Court—the Commission has not shrunk from decisions which would have reduced to chaos the rates over the whole what is known as Southern Territory—a territory as large, and likely in fifty years to be as populous and important as France and Germany combined. With the experience of practical railroad men they ridicule the idea of five or seven men in Washington attempting to control—you will remember that the Commission has power to act of its own motion, without waiting till a complaint is brought before it—the rate-making on 220,000 miles of line, stretching over between three and four million square miles of country, and affecting a traffic which brings in a revenue of £250,000,000 per annum. It needs at present the best energies and intelligence of an army of traffic managers and freight agents scattered all over the country to deal with the 165,000 changes of rates, which, as I have already told you are put into force in one year. How can five men in Washington assume their functions? Further, the railroad men appeal to the Constitution of the United States, which says that no man shall be deprived of his property without due process of law, and they say that the property of railroad shareholders is in effect the right to receive reasonable rates for the carriage of passengers and goods. They refuse to admit that a branch of the executive government can oust the railroads themselves from the exercise of this right.

For my own part, while fully admitting that theoretically the position of the railroad companies is a very strong one, I cannot shut my eyes to the fact that theoretically the position of the President is a very strong one, too. The great railroad magnates appear to the ordinary citizen to be able to exercise almost unfettered control of what the President calls the highways of commerce. In fact magnates, however great, are controlled by economic forces against which it would be vain for them to contend. But the public can hardly be expected to see this. Certainly our own Parliament has never shown much sign of seeing it.

How the struggle will end—and at present it is the dominant issue in American politics—no one can say. A short time back it looked as though the exposure by the railroads of the want of logic both in the President's message and in the Esch-Townsend bill would suffice to prevent any legislation at all. But since then, not only has the President's unique personal influence in the country been still further strengthened, but the scandalous disclosures in the Equitable Life case, in which one prominent railroad man is unfortunately involved, have given fresh strength to the feeling that great capitalistic organizations stand in need of better public supervision. In this country it would be safe to say that the Government would pass its bill. But the American constitution is so utterly different from ours; the balance of independent forces, which is its special feature, is so complicated in its working, that no one can foresee what the future will bring.

The most recent information that I have received is that there is some prospect of a compromise somewhat on the following lines. The Commission would be strengthened, it would cease to act as detective and prosecutor; its members would be increased in number, and their salaries made less inadequate. Power would be given

*A lecture delivered on Oct. 25, at the School of Economics, University of London.

to them, after complaint and a formal hearing, to fix a rate, which, in case of appeal by the railroads, would not go into effect until it had been approved by a court. But it is much questioned whether an Act framed on these lines would be constitutional. A court can only discharge judicial functions. Is it a judicial function to say what will be a reasonable rate next week? Further it is argued by very distinguished lawyers as follows: A court can interfere to disallow a rate made by the railroads which is so high as to be extortionate, or which creates an undue preference, for such rates are forbidden by statute. It can disallow a rate made by the Commission so low that it would amount to confiscation of the property of the railroad, for that is forbidden by the Constitution. Say that a rate of 40s. would be high enough to be extortionate, while a rate of 20s. would be so low as to be confiscatory. Between these points it is a matter of business discretion where the rate is to be fixed, and the exercise of business discretion is not constitutionally a judicial function.

In the discussion of this highly technical question it would obviously be futile for a foreigner to attempt to intervene. I have merely pointed out the difficulties that confront the President. I hope what I have said may help some of you to follow with a more understanding interest the manner in which in this coming winter he will endeavor to extricate himself from them.

German Agent for Japanese Government Railways.

The administration of the Japanese Government Railways, which has hitherto filled the bulk of its requirements for rails, bridge material, locomotives and other equipment in the United States, is reported to be negotiating with a view to place large contracts in Germany. Herr Baurat Rumschottel, formerly chief executive of the Berlin Machine Building Company, one of the largest concerns of its description in Europe, has been appointed Berlin agent for the Mikado's government lines. Herr Rumschottel is the first German to be selected for the position, hitherto Englishmen having been chosen.

The Manila and Dagupan.

The attention of the State Department has been called to the claim of the British owners of the Manila & Dagupan Railroad against the American Government. The claim amounts to about $1,500,000, and is for damages incurred during the insurrection in the Philippines, when the road was taken over by the army for military purposes. The justice of the claim has already been admitted by the United States Government, the question at issue being the amount of damages to be paid.

Cotton Rates in Texas.

In going to Galveston, the chief port of Texas, a large share of the cotton raised in the State passes through Houston, 50 miles north of Galveston, and much of it is stopped off there to be compressed. By reason of this and of the fact that Houston is itself something of a seaport, being on Buffalo Bayou, the city does a large business in cotton. To foster this Houston trade, the State Railroad Commission has made certain changes in rates. These facts are necessary to an understanding of the following editorial from the *Galveston News*, which we copy as an illustration of the beauties of state rate-making:

"The Railroad Commission of Texas is supposed to have been created for the purpose of preventing unfair discrimination in favor of one shipper or place as against another. It now stands committed to the very policy it was created to prevent. It taxes the cotton growers of Texas almost $1,000,000 a year to enable its one favored city, Houston, to continue 'in the cotton business.' For years this handicap has been put upon other cities to offset their natural advantages, and during these years Judge Reagan himself admitted the injustice of the differential in favor of Houston against other cities and against the cotton raisers.

"Until recently no commissioner who stands out for this anomaly in a State boasting a free, equal democratic policy has ever dared to let out of his lips the real purpose of the differential. Recently, on being cornered by the Beaumont *Journal*, which insists that the people of Beaumont are just as good as the people of Houston and ought to have equal privileges and similar treatment, Commissioner Colquitt let the cat out of the bag. He said in so many words: "Galveston has been appealing to the Commission to establish a straight mileage basis on cotton from all points in the State, giving Galveston the same rate which Houston enjoys. To do so would put Houston out of the cotton business, and that city would secure none of this traffic, as is evident from the experience Beaumont is now having.' * * * If it is just to leave Beaumont with the 'experience it is now having' and to leave a hundred other places with precisely similar troubles, then why is it not just to leave Houston to take her chances with the rest? If it is the duty of a Democratic Commissioner, who declaims against special privileges, to arbitrarily discount the natural advantages of other cities, and to arbitrarily, and at great cost to the people, make up for a lack of such advantages by manipulating freight rates in favor of Houston, why shouldn't he do as much for Beaumont? Isn't Beaumont Democratic?

"Commissioner Colquitt's remark about putting Houston out of the cotton business can mean only one thing: that the cotton producers of Texas are penalized to the tune of almost $1,000,000 to enable Houston to remain in the cotton business. Why not make similar efforts to keep any one of a hundred other cities in the cotton business."—*Galveston News.*

Manufacturing and Business.

The Canadian Locomotive Co. has applied to the Kingston City Council asking for an exemption of taxes for 20 years. If the exemption is granted the company proposes to increase the plant to double its present capacity.

The E. M. Dart Manufacturing Company, Providence, R. I., has received an order from the Baltimore & Ohio Railroad for Dart unions to be used on 200 locomotives now being built for that road by the American Locomotive Co.

Miss C. A. Baker, daughter of the late W. C. Baker, of New York, died on December 6. On the death of Mr. Baker, five years ago, Miss Baker took up the management of the Baker Car Heater, which she conducted most successfully until her death.

The Betts-Hayden Construction Co., of Norfolk, Va., has been incorporated with a capital of $200,000 to build docks, stations and do other construction work. The officers are: I. B. Betts, President, New York; M. C. Elliott, Secretary and Treasurer, Norfolk, Va.

An interesting exhibit at the Electrical Show, Madison Square Garden, New York, is that of the Electro-Dynamic Company, Bayonne, N. J., in which actual tests of the Moloney transformers are made. These tests show the various efficiencies of the transformers, such as low copper losses, and other interesting data.

The St. Louis Car Co., St. Louis, Mo., has recently booked large orders for its spiral journal bearings as follows: One thousand six hundred 4¼ in. x 8 in. and 3,200 5½ in. x 10 in. for the Burlington; 10,000 5½ in. x 10 in. for the Southern Pacific, and 1,600 5½ in. x 10 in. for the O., R. & N. There are also being delivered to the Pullman Company for the Burlington 8,000 5 in. x 9 in.; 200 5½ in. x 10 in. to the American Locomotive Co. for the B. & O.; and an order for 32,000 5 in. x 9 in. is being finished up for the Mo. P.

The Northern Engineering Works, crane builders, of Detroit, Mich., have been awarded the contract for the electric cranes required in the new steel casting foundry of the Monarch Coupler Co., Ltd., Detroit, Mich. There will be one 25-ton, 4-motor electric cradle crane, 50-ft. span, and one 10-ton, 4-motor standard crane, 50-ft. span. The Northern Engineering Works have also recently completed installing three electric traveling cranes in the plant of the Detroit Steel Casting Co., consisting of one 30-ton, 4-motor ladle crane, 70-ft. span, and two 10-ton, 3-motor electric cranes, 70-ft. span, and are now constructing for the same firm a 10-ton, 80-ft. electric gantry crane for yard service.

Iron and Steel.

Work has been started in the new billet and bloom mill of the Lackawanna Steel Co., Buffalo, N. Y., which will have a capacity of 40,000 tons a month.

The Alabama Steel & Wire Co., of Gadsden, and the Underwood Coal & Iron Co., of Blount County, according to reports, have beeen merged, under the name of the Southern Steel Co., of Gadsden, Ala., with a capital of $16,000,000. The officers of the new company are: Everett Schuler, President, Gadsden; George H. Schuler, Vice-President and Treasurer, Birmingham; R. D. Carver, Secretary, Birmingham. Besides these, the directors include: H. B. Schuler, Saratoga, Fla.; John Bindley, Pittsburg; C. VanCamp, Indianapolis; Moses Taylor and Robert D. VanCourtlandt, New York.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

A meeting of the general section was held on December 14, at which the following papers were read:

"The Grand River, Ontario Peninsula. Effect of Deforestation and Swamp Drainage," by W. H. Breithaupt, M. Can. Soc. C. E.

"Military Engineering," by Captain T. E. Naish, M. Can. Soc. C. E.

"An Asphalt Plant for Walks and Crossings in Small Cities," by H. B. R. Craig, M. Can. Soc. C. E.

Western Railway Club.

The December meeting will be held at the Auditorium Hotel, Chicago, Tuesday evening, December 19. A paper on "The True Perspective of the Supply Department" will be presented by Mr. Geo. G. Yeomans, Assistant to First Vice-President, Wabash Railway.

PERSONAL.

—By the change of administration in the British Government, which took effect last week, the President of the Board of Trade is Mr. David Lloyd-George.

—Mr. F. R. Moulton, Superintendent of the Iowa and Minnesota division of the Chicago & North-Western, has been on that road since 1869, when he began as brakeman. He became conductor in 1877 and Trainmaster and Assistant Superintendent in 1890.

—Mr. C. J. Bechdolt, Superintendent of the central division of the Philadelphia, Baltimore & Washington, died at his home at Media, Pa., on December 5. Mr. Bechdolt was appointed to his last office in 1891, having been Assistant Engineer of the New York division of the Pennsylvania before that time.

—Mr. O. C. Post, General Auditor of the Delaware, Lackawanna & Western, died at his home in East Orange, N. J., on December 8, at the age of 52. His first railroad service was on the Baltimore & Ohio, as a clerk, where he later became Chief Clerk of the mechanical department. Previous to his last appointment on the Lackawanna, he was for ten years General Auditor of the Minneapolis & St. Louis.

—Mr. F. M. Smith, who was recently appointed Assistant Superintendent of the Western division of the Lake Shore & Michigan Southern, entered railroad service as operator on the Franklin division of that road in 1886. He was later transferred to the claim department of that division, being put in charge of it in 1898. Five years later he was made trainmaster of the Indiana, Illinois & Iowa, later taking the same position on the Western and Michigan divisions of the Lake Shore, where he remained until his present appointment.

—Mr. W. B. Knight, who was recently appointed General Freight Agent of the Missouri Pacific, was born in 1867. His first railroad service was in 1883, as clerk in the office of the auditor of passenger accounts on the Wabash, St. Louis & Pacific. In 1888 he went to the Atchison, Topeka & Santa Fe as tariff clerk, and the next year was appointed to the same position on the Missouri Pacific. He became chief tariff clerk on the same road in 1891, being promoted in 1897 to chief clerk of the traffic department. He was made Assistant General Freight Agent in 1889, and remained there until his present appointment.

—Mr. L. J. Seargeant, director of the Grand Trunk and formerly General Manager of that road, died recently in London, at the age of 80 years. He was born in England, and entered railroad service on the South Wales Railway. He was later Superintendent of the South Wales division of the Great Western, and then became General Manager and Secretary of the South Devon. In 1874 he came to this country as Vice-President of the Chicago & Grand Trunk, and Traffic Manager of the Grand Trunk. In 1891 he was made General Manager of the Grand Trunk and President of the Chicago & Grand Trunk, where he remained until 1896. He then returned to England, remaining a director of the company until his death.

—Mr. H. H. Vaughan, Superintendent of Motive Power of the Canadian Pacific, has been appointed to the new office of Assistant to the Vice-President of that road. It is understood that Mr. Vaughan has authority over motive power, rolling stock, stores, fuel and all electrical and mechanical matters. Mr. Vaughan was born in England, graduated from Kings College, London, served an apprenticeship at the works of Naysmith, Wilson & Co., at Patricroft, and after that worked for a short time as a machinist at the Gorton Shops of the Manchester, Sheffield & Lincolnshire; also at the Nine Elms Works of the London & Southwestern. In 1891 he came to the United States and entered the shops of the Great Northern as machinist. He served as draftsman till 1894, when he was made Assistant Engineer of Tests. In 1895 he became Mechanical Engineer, and while in this position designed a number of important devices, among which is the present engineer's valve of the New York Air Brake Company. In 1898 he was appointed Mechanical Engineer of the Philadelphia & Reading, and two years later took the management of the shops and mechanical engineering department of the Q. & C. Company in Chicago. In 1902 he went to the Lake Shore & Michigan Southern as Assistant Superintendent of Motive Power. In 1904 he was appointed Superintendent of Motive Power of the Canadian Pacific. On this road Mr. Vaughan has had the difficult task of organizing a large new railroad shop, which of itself is a sufficient undertaking for the short time he has been there. This, however, is only a part of the record which he has made since he has been at Montreal, which has now placed him, while still young, in a leading position in the motive power world.

ELECTIONS AND APPOINTMENTS.

Atlanta & West Point.—M. M. Ansley has been appointed General Freight Agent of this road and of the Western of Alabama, succeeding W. E. Knox, resigned.

Baltimore & Ohio Southwestern.—J. B. Carothers, Superintendent of the Ohio division, has been transferred to the Illinois division with office at Washington, Ind., and E. R. Scoville, Superintendent of the Illinois division, has been appointed Superintendent of the Ohio division with office at Chillicothe, Ohio.

Buffalo & Susquehanna.—C. P. Clark, General Manager, has been elected also Second Vice-President.

Butte County.—A. M. Mowry has been elected Treasurer, succeeding J. K. Robinson.

Canadian Pacific.—H. H. Vaughan, Superintendent of Motive Power, has been appointed Assistant to the Vice-President, with office at Montreal.

George McL. Brown, Superintendent of Sleeping, Dining and Parlor Cars, has been appointed General Passenger Agent of the Canadian Pacific's steamship service, and G. A. Ringland has been appointed Assistant General Passenger Agent of the steamship service, both with offices at Montreal, Que.

In the rearrangement of the Sleeping, Dining and Parlor Car Department of the Western Lines, S. C. Sykes is appointed Assistant District Superintendent at Vancouver. The office of District Superintendent has been abolished. There are now sleeping and dining car agents at Winnipeg, Moose Jaw, Calgary and Cranbrook. Mr. Bell, District Superintendent for the Western Lines, reports to the Superintendent of the Department at Montreal, as heretofore. This corrects an error in the statement published in this department October 27, page 129.

Chicago, Burlington & Quincy.—J. W. Mulhern, Division Superintendent at Hannibal, Mo., has been appointed Division Superintendent at Galesburg, Ill., succeeding R. L. Porter, resigned. A. V. Brown, Superintendent of Terminals at Kansas City, succeeds Mr. Mulhern. J. P. Cummings succeeds Mr. Brown.

Jacob Kastlin, Master Mechanic at St. Joseph, Mo., has resigned. W. W. Lowell, Master Mechanic at Brookfield, Mo., succeeds Mr. Kastlin. E. W. Fitt, Assistant Superintendent of Motive Power, has been appointed Master Mechanic at Alliance, Neb., succeeding F. J. Kraemer, assigned to other duties, and the office of Assistant Superintendent of Motive Power has been abolished.

J. R. Haynes has been appointed Assistant Purchasing Agent, with office at Chicago, Ill.

Chicago, Rock Island & Pacific.—B. F. Yoakum has been elected Chairman of the executive committee, succeeding Robert Mather, resigned.

A. Hermany has been appointed Auditor of Passenger Traffic of this road, the Chicago, Rock Island & El Paso and the St. Louis, Kansas City & Colorado, succeeding D. Laughlin, resigned, with office at Chicago, Ill.

Cincinnati, Hamilton & Dayton.—T. A. Sweeney, Division Superintendent at Wellston, Ohio, has been appointed Division Superintendent at Dayton, Ohio, succeeding I. F. White, assigned to other duties. J. M. Scott, Trainmaster at Lima, Ohio, succeeds Mr. Sweeney.

Cleveland, Cincinnati, Chicago & St. Louis.—D. W. Pardee, Assistant Secretary, has been elected Secretary, succeeding E. F. Osborn, who becomes Assistant Secretary, with office at Cincinnati.

H. J. Rhein, General Passenger, Ticket and Baggage Agent of the Lake Erie & Western, has been appointed General Passenger Agent of the C., C., C. & St. L., with office at Cincinnati, Ohio. C. C. Clark, General Agent at Columbus, Ohio, has been transferred to Indianapolis, with the same title, where he assumes the duties of S. D. McLeish, Assistant General Passenger Agent, resigned. See Lake Erie & Western.

Colorado Southern, New Orleans & Pacific.—G. A. Clark, Vice-President and General Manager of the Tennessee Central, has been elected Vice-President of the C. S., N. O. & P.

Delaware & Hudson.—W. A. Moyer has been appointed Industrial Agent, with office at Albany, N. Y.

Arthur Kemper, Superintendent of Car Service, has been appointed Superintendent of Transportation. D. F. Wait, Superintendent of the Champlain division, has been appointed Superintendent of the Susquehanna division with office at Albany. A. T. Benjamin, heretofore Superintendent of the Saratoga and Susquehanna divisions, has been appointed Superintendent of the Saratoga and Champlain divisions, with office at Albany. S.

D. Curtis has been appointed Assistant Superintendent of the Champlain division, with office at Plattsburg, N. Y. D. H. Kelley, Trainmaster at Albany, has been appointed Assistant Superintendent of the Saratoga division. J. P. Wallace has been appointed Assistant Superintendent of the Susquehanna division, with office at Albany.

W. C. Ennis, Master Mechanic at Oneonta, N. Y., has been appointed Superintendent of Car Shops at Carbondale, Pa. G. S. Edmonds, Mechanical Engineer, succeeds Mr. Ennis.

Detroit, Toledo & Ironton.—F. A. Durban has been elected Vice-President, with office at Zanesville, Ohio.

Dunkirk, Allegheny Valley & Pittsburg.—See New York Central Lines.

Erie.—W. H. Willis, Inspector of Signals, has been appointed Signal Engineer, with office at Jersey City, succeeding C. H. Morrison, assigned to other duties.

G. W. Gould has been appointed Superintendent of the Employment Bureau, succeeding W. C. Hayes, transferred, with office at Jersey City.

Fort Worth & Denver City.—W. W. Miller has been appointed Division Superintendent at Childress, Tex., succeeding George Geiger, resigned. See Kansas City Southern.

Illinois Central.—This company now operates that portion of the Tennessee Central between Nashville, Tenn., and Hopkinsville, and the jurisdiction of the general officers of the Accounting, Treasury, Operating and Traffic departments has been extended over this territory.

William Smith, Jr., Assistant General Freight Agent, has been transferred from Evansville, Ind., to Nashville, Tenn.

Illinois, Iowa & Minnesota.—The office of J. C. Duffin, Secretary and General Superintendent, has been removed from Dekalb, Ill., to Rockford, Ill. C. W. Davis has been appointed Car Accountant, with office at Rockford.

Indiana Harbor.—See New York Central Lines.

Indiana, Illinois & Iowa.—See New York Central Lines.

International & Great Northern.—J. D. Trammel, Chief Engineer, has been given an indefinite leave of absence on account of the sickness of a member of his family. O. H. Crittenden has been appointed Resident Engineer at Palestine, Tex.

Interoceanic of Mexico.—F. W. Baldwin, Division Superintendent of the National of Mexico, at Acambaro, has been appointed Superintendent of Transportation of the Interoceanic of Mexico, succeeding J. H. Feehan, with office at Mexico City.

Great Northern.—H. L. Shepard has been appointed Assistant Superintendent of the Breckenridge division, with office at Breckenridge, Minn., succeeding R. C. St. John, resigned.

C. T. Walters, Master Mechanic at Minot, N. Dak., has been appointed Master Mechanic at Havre, Mont., succeeding F. M. Fryburg, resigned. A. B. Ford, Traveling Engineer, with office at Great Falls, Mont., succeeds Mr. Walters. See Montana Central.

Kansas City Southern.—George Geiger, Division Superintendent of the Fort Worth & Denver City, has been appointed Superintendent of the Southern division of the K. C. S., and also Superintendent of the Texarkana & Fort Smith, with office at Texarkana, Tex., succeeding T. E. Jarrett.

Kingston & Pembroke.—W. R. Baker, Assistant to the President of the Canadian Pacific, has been appointed Vice-President and General Manager of the K. & P., succeeding C. W. Spencer, resigned.

Lake Erie & Western.—S. D. McLeish, hitherto Assistant General Passenger Agent of the Cleveland, Cincinnati & St. Louis, has been appointed General Passenger Agent of the L. E. & W., with offices at Indianapolis, Ind. See New York Central Lines.

Long Island.—C. L. Addison, General Superintendent, has been appointed Assistant to the President, effective January 1. J. A. McCrea, hitherto Superintendent of the Pittsburg, Cincinnati, Chicago & St. Louis, at Cincinnati, succeeds Mr. Addison, with office at Long Island City.

Louisiana & Northwest.—W. R. Haynes has been appointed Superintendent, succeeding C. H. Beardsley. R. R. Joslin has been appointed Auditor, succeeding A. R. Porterfield, with office at Magnolia, Ark. The office of Car Accountant, held by C. I. Miller, has been abolished.

Macon & Birmingham.—S. F. Parrott, Acting Vice-President, has been elected Vice-President.

Millen & Southwestern.—The general offices of this company have been removed from Monte, Ga., to Graymont, Ga.

Missouri Pacific.—J. Russell, Division Superintendent at Atchison, Kan., has been appointed Superintendent of the Omaha division, with office at Omaha, Neb. G. W. Inge, Superintendent at Kansas City, has been appointed Assistant Superintendent of the Omaha division, with office at Kansas City, Kan. The Western division has been abolished.

S. P. Pryor has been appointed Purchasing Agent, with office at St. Louis. W. G. Nixon remains Purchasing Agent as heretofore.

Missouri Southern.—N. H. Davis has been appointed Auditor, with office at Chicago, Ill.

Mobile, Jackson & Kansas City.—E. S. Brooks has been appointed Purchasing Agent, with office at Mobile, Ala.

Montana.—F. T. Robertson, General Superintendent and Chief Engineer, has been appointed General Manager, with office at Helena, Mont.

Montana Central.—F. M. Fryburg, Master Mechanic of the Montana division of the Great Northern, has been appointed Master Mechanic at Great Falls, Mont., succeeding C. M. Prescott, resigned. See Great Northern.

National of Mexico.—H. L. Newton, Superintendent of Terminals at Mexico City, has been appointed Superintendent of the Pacific division, with office at Acambaro, Mex. D. R. Caffey succeeds Mr. Newton. See Interoceanic.

New York Central Lines.—D. C. Moon, General Superintendent of the Lake Shore & Michigan Southern, and J. J. Bernet, Assistant General Superintendent, have been appointed to the same offices on the Dunkirk, Allegheny Valley & Pittsburg and the Indiana, Illinois & Iowa. Mr. Moon is also General Superintendent of the Lake Erie & Western.

T. J. Cook is General Freight and Passenger Agent of the Indiana Harbor and the Indiana, Illinois & Iowa. F. G. Hopper is Assistant General Freight Agent of the Indiana Harbor.

Northern Pacific.—E. J. Pearson, Chief Engineer, has resigned. W. L. Darling, Chief Engineer of the Pacific, and recently Chief Engineer of the Chicago, Rock Island & Pacific, succeeds Mr. Pearson. See Pacific.

Pacific.—W. L. Darling, Chief Engineer, has resigned. E. J. Pearson, Chief Engineer of the Northern Pacific, succeeds Mr. Darling. See Northern Pacific.

Pacific Coast.—J. W. Smith has been elected Assistant Secretary and General Auditor, with office at Seattle, Wash. This company operates also the Columbia & Puget Sound.

Pennsylvania.—D. C. Chase has been appointed Superintendent of Steam Towing, of the United Railroads of New Jersey division.

Peoria & Pekin Terminal.—W. T. Irwin has been elected President, succeeding T. J. Miller; Guy W. Talbot, General Manager, has been also elected Vice-President; H. M. Danforth has been elected Treasurer, succeeding P. L. Saltonstall. The offices of all are at Peoria, Ill. G. F. Nevins, General Freight Agent, has been also appointed Auditor.

E. S. Walker is Master Mechanic, with office at Peoria.

Philadelphia, Baltimore & Washington.—The office of Division Superintendent at Media, Pa., made vacant by the death of C. J. Bechdolt, has been abolished and its duties will hereafter be performed by E. F. Brooks, General Superintendent.

Rio Grande Western.—John Hickey, Master Mechanic at Salt Lake City, Utah, has resigned owing to ill health. William Donald succeeds Mr. Hickey.

Salt Lake & Mercur.—J. L. Conkling, Auditor, has resigned.

Santa Fe Central.—W. C. Hagan, Secretary, has been elected also Treasurer, succeeding T. L. Clark.

Frank Zink has been appointed Acting Superintendent of Motive Power, with office at Estancia, N. Mex., succeeding G. H. Shone.

Seaboard Air Line.—Townsend Scott has been elected to the board of directors.

Southern.—This company now controls that portion of the Tennessee Central between Harriman, Tenn., and Nashville, including the Carthage and Wilder branches, and operates this part of the road as the Nashville division of the Southern. W. H. Gatchell has been appointed Superintendent of the Nashville division. H. L. Miller, Division Freight Agent at Knoxville, Tenn., has been appointed Assistant General Freight Agent, with office at that place.

Tehuantepec National.—C. Greene, Trainmaster, has been appointed Superintendent, succeeding P. H. Kilpatrick. H. P. Durham has been appointed Superintendent of Motive Power and Machinery, succeeding Louis Greaven. E. J. Ford has been appointed Car Accountant, succeeding W. H. Ware. The offices of all are at Rincon Antonio, Mex.

Tennessee & North Carolina.—J. B. Hart, Vice-President, has been elected President, succeeding J. J. Holloway, with office at Clarksburg, W. Va. Norman James succeeds Mr. Hart, with office at Baltimore Md.

Tennessee Central.—See Illinois Central, and Southern.

Texarkana & Fort Smith.—See Kansas City Southern.

Wabash.—F. H. Tristram, Assistant General Passenger Agent at Pittsburg, Pa., has been transferred to Chicago. See Wheeling & Lake Erie.

Wheeling & Lake Erie.—R. F. Kelly, who temporarily succeeded F. A. Palmer as Assistant General Freight Agent of the Wabash at Chicago, has been appointed Assistant General Freight Agent of the Wheeling & Lake Erie and the Wabash-Pittsburg Terminal at Pittsburg, Pa., succeeding F. H. Tristram, transferred.

LOCOMOTIVE BUILDING.

The Great Northern has ordered 50 locomotives from the Baldwin Works.

The Susquehanna & New York has ordered one locomotive from the Baldwin Works.

The New York, Philadelphia & Norfolk has ordered two locomotives from the Baldwin Works.

The Colorado & Southern, it is reported, will shortly close contracts for upwards of 50 locomotives.

The Wabash is asking prices on locomotives of the prairie, consolidation and six-wheel switching types.

The West Virginia Central & Pittsburg has ordered three locomotives from the Lima Locomotive Works.

The Chicago, Rock Island & Pacific, it is reported, has ordered 25 locomotives from the American Locomotive Co.

The Wisconsin Central has ordered eight saddle tank locomotives from the Davenport Locomotive Works. These locomotives will be used in construction work and are for January, 1906, delivery.

The St. Louis & San Francisco, as reported in our issue of December 8, has ordered 25 4-6-0 locomotives from the American Locomotive Co., and 20 0-6-0 locomotives from the Baldwin Works. The 4-6-0 engines will weigh 180,000 lbs., with 138,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 63 in.; working steam pressure, 200 lbs. The tender will have a capacity of 6,000 gallons of water. The 0-6-0 engines will weigh 120,000 lbs.; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in. The tender will have a capacity of 4,500 gallons of water.

The Louisiana & Arkansas has ordered two simple 10-wheel (4-6-0) locomotives from the Baldwin Locomotive Works, for January, 1906, delivery, and two second-hand locomotives from Fitz-Hugh, Luther Co. The 10-wheel locomotives will weigh 149,500 lbs., with 121,500 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 56 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 2,306 sq. ft.; 316 Tyler tubes, 2 in. in diameter and 13 ft. long; firebox, 116¾ in. long and 41⅛ in. wide; grate area, 33.3 sq. ft.; tank capacity, 5,000 gallons of water, and coal capacity, 10 tons. The special equipment includes: Westinghouse-American air-brakes, Keasbey & Mattison boiler lagging, Tower couplers, Adlake headlights, Monitor injectors, More-Jones journal bearings, Jerome piston rod packings, Ashton safety valves, Leach sanding devices, Detroit sight-feed lubricators, French springs and Crosby steam gages.

The Chicago & Eastern Illinois, as reported in our issue of December 8, has ordered 28 simple consolidation (2-8-0), five simple Atlantic (4-4-2), 19 six-wheel (0-6-0) switching and three eight-wheel (0-8-0) switching locomotives from the Baldwin Locomotive Works. The consolidation locomotives will weigh 182,000 lbs., with 162,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 55 in.; working steam pressure, 200 lbs.; tank capacity, 7,500 gallons of water, and coal capacity, 13 tons. The Atlantic locomotives will weigh 180,000 lbs., with 103,000 lbs. on the drivers; cylinders, 21 in. x 26 in.; diameter of drivers, 78 in.; working steam pressure, 200 lbs., and tank capacity, 7,500 gallons of water. Ten of the six-wheel switching locomotives will weigh 160,000 lbs.; cylinders, 20½ in. x 26 in.; diameter of drivers, 51 in., and working steam pressure, 200 lbs. The other nine six-wheel switching locomotives will weigh 142,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in. and tank capacity, 5,000 gallons of water. The eight-wheel switching locomotives will weigh 220,000 lbs.

The Vandalia, as reported in our issue of December 8, has ordered four simple Atlantic (4-4-2), five simple mogul freight (2-6-0), and three six wheel (0-6-0) switching locomotives from the American Locomotive Co., for June, 1906, delivery. The Atlantic locomotives will weigh 184,000 lbs., with 108,000 lbs. on the drivers; cylinders, 21 in. x 26 in.; diameter of drivers, 79 in.; straight boiler, with a working steam pressure of 200 lbs.; 351 tubes, 2 in. in diameter and 15 ft. 10⅞ in. long; Pennsylvania R. R. specification firebox, 96⅛ in. long and 75¼ in. wide; grate area, 50.2 sq. ft.; tank capacity, 7,500 gallons of water, and coal capacity, 24,000 lbs. The mogul locomotives will weigh 182,500 lbs., with 156,500 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 63 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 2,935 sq. ft.; 390 tubes, 2 in. in diameter and 161⅞ in. long; Pennsylvania R. R. specification firebox, 108$^{3}/_{16}$ in. x 41¾ in.; grate area, 52 sq. ft.; tank capacity, 7,500 gallons of water, and coal capacity, 26,000 lbs. The switching locomotives will weigh 144,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; straight boiler, with a working steam pressure of 180 lbs.; heating surface, 1,955.1 sq. ft.; 311 tubes, 2 in. in diameter and 131 in. long; Pennsylvania R. R. specification firebox, 108⅛ in. x 69¼ in.; grate area, 31.4 sq. ft.; tank capacity, 5,000 gallons of water, and coal capacity, 15,000 lbs. The special equipment for all includes: Westinghouse air-brakes, Pennsylvania R. R. specification axles, Alexander bell ringers, Franklin Manufacturing Co.'s boiler lagging, "Creco" or Davis brake-beams, Tower couplers, Nathan injectors and sight-feed lubricators, U. S. metallic piston rod packings for Atlantic locomotives, and Hayden piston and valve rod packings for mogul and switching locomotives, Coale's safety valves, Union Spring Co.'s springs, Latrobe driving, truck and tender wheel tires and cast-steel wheel centers.

The Lehigh Valley, as reported in our issue of December 8, has ordered 40 locomotives, as follows: Twenty 10-wheel fast freight locomotives from the American Locomotive Co.; five 10-wheel fast freight locomotives, five Pacific type passenger locomotives and 10 Mikado type slow freight locomotives from the Baldwin Works. The 10-wheel fast freight engines will weigh 199,200 lbs., with 150,200 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 68½ in.; straight, wide firebox boiler, with a working steam pressure of 205 lbs.; total heating surface, 3,269 sq. ft.; 378 charcoal iron tubes, 2 in. in diameter x 15 ft. 8 in. long; firebox, 120⅛ in. x 102 in.; grate area, 85 sq. ft. The tender will have a capacity of 7,500 gallons of water and 12 tons of coal. The Pacific type engines will weigh 220,000, with 140,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 76½ in.; straight, wide firebox boiler, with a working steam pressure of 210 lbs.; total heating surface, 3,858 sq. ft.; 311 charcoal iron tubes, 2¼ in. in diameter x 20 ft. long; firebox, 120 in. x 96 in.; grate area, 80 sq. ft. The tender will have a capacity of 6,500 gallons of water and 12 tons of coal. The Mikado locomotives will weigh 235,000 lbs., with 182,000 lbs. on drivers; cylinders, 22½ in. x 28 in.; diameter of drivers, 55½ in.; straight, wide firebox boiler, with a working steam pressure of 200 lbs.; total heating surface, 3,556 sq. ft.; 318 charcoal iron tubes, 2½ in. in diameter x 18 ft. long; firebox, 120 in. x 105¼ in.; grate area, 87.7 sq. ft. The tender will have a capacity of 8,000 gallons of water and 8½ tons of coal. The specifications for all the above engines will include: Westinghouse air brakes, Snow bell ringers, Keasbey & Mattison magnesia boiler lagging, Diamond special brake-beams, Tower all-steel couplers Glazier headlights, Hancock injectors, Magnus Metal Co.'s journal bearings, U. S. metallic piston and valve packings, Consolidated safety valves, Leach sanding devices, Detroit sight-feed lubricators, Railway Steel Spring Co.'s springs. Ashcroft steam gages, Latrobe driving, truck and tender wheel tires and cast steel wheel centers for driving wheels.

CAR BUILDING.

The Fort Smith & Western is in the market for 200 box cars.

The Texas & Pacific is building 50 combination coal and ballast cars in its own shops.

The Atchison, Topeka & Santa Fe has ordered three dining cars from the Pullman Co.

The Tacoma Eastern is figuring on the purchase of 125 flat cars of 70,000 lbs. capacity.

The Intercolonial has ordered 25 box cars of 60,000 lbs. capacity from the Rathburn Co.

The Louisiana & Arkansas has ordered two cabooses from the American Car & Foundry Co.

The Chicago City Railway, it is reported, has ordered 200 cars from the J. G. Brill Company.

The Mexican Central is reported in the market for upwards of 1,000 additional freight and box cars.

The Chicago, Indianapolis & Louisville has ordered nine passenger cars from the American Car & Foundry Company.

The Chicago & North-Western, it is reported, will shortly place orders for a large amount of additional freight equipment.

The Canadian Northern has ordered 1,000 box cars, 250 flat cars and 13 passenger cars from Rhodes, Curry & Company.

The St. Louis Southwestern, it is reported, has ordered 750 box cars, 450 flat cars and 250 stock cars from the American Car & Foundry Co.

The Virginia & Carolina Coast has ordered 275 box cars, four cabooses, nine passenger coaches, two baggage cars and three combination baggage and mail cars from the American Car & Foundry Co.

The Chattanooga Electric Railway Co., Chattanooga, Tenn., has ordered six 28-ft. cars from the St. Louis Car Co., to be mounted on St. Louis Car Co.'s trucks.

The Wabash, as reported in our issue of December 8, is asking prices on a large number of wooden box cars and steel underframe gondola cars. The wooden box cars will measure 40 ft. long and will be of 80,000 lbs. capacity. The steel cars will also be 40 ft. long, but will be of 100,000 lbs. capacity.

The Maine Central has ordered eight passenger coaches from the Pullman Co. for delivery in the spring of 1906. These cars will measure 60 ft. 5 in. over sills x 9 ft. 8 in. wide. The bodies and underframes will be of wood. It has also ordered two baggage cars from the Pullman Co. These will measure 60 ft. long x 9 ft. 9 in. wide.

The Northern Electric Co., Chico, Cal., has ordered four interurban cars from the Niles Car & Manufacturing Co., for January, 1906, delivery. These cars will weigh 70,000 lbs., and measure 56 ft. long, 9 ft. 2 in. wide and 13 ft. high, over all. The special equipment includes: Niles Car & Manufacturing Co.'s bolsters, brake-beams, brasses, door fastenings, doors and vestibules, Peckham brake-shoes, journal boxes, springs and trucks, Westinghouse air-brakes, Gould couplers, Pantasote curtain fixtures, Miner draft rigging, St. Louis enclosed arc headlights and Schoen wheels.

The Union Pacific and the Southern Pacific have ordered 600 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co., for August, 1906, delivery. These cars will weigh 38,000 lbs., and measure 39 ft. 10¾ in. long, 8 ft. 2¾ in. wide and 7 ft. 6¼ in. high, inside measurements. The special equipment includes: Simplex bolsters, National-Hollow brake-beams, Christie brake-shoes, Hewitt Manufacturing Co.'s brasses, Climax couplers, Miner tandem draft rigging, National Malleable Castings Co.'s journal boxes, Railway Steel Spring Co.'s springs, arch-bar trucks and American Car & Foundry Co.'s wheels.

The Cornwall Railroad, Lebanon, Pa., has ordered two passenger coaches and one combination passenger and baggage car from the J. G. Brill Co. for May, 1906, delivery. The passenger coaches will have a capacity for 66 persons and will measure 62 ft. long x 9 ft. 10 in. wide over all. The bodies and underframes will be of wood. The passenger and baggage car will have a capacity for 41 persons and will also measure 62 ft. long x 9 ft. 10 in. wide over all. The special equipment for these cars will include: Wooden bolsters with iron fillers, wooden brake-beams, American Brake Shoe & Foundry Co.'s brake-shoes, Westinghouse air-brakes, J. G. Brill brasses, Janney couplers, Burrow's pinch handles curtain fixtures, Pantasote curtain material, Adams & Westlake Co.'s lights and Lobdell wheels.

The Wilkes-Barre & Hazleton, as reported in our issue of December 8, has ordered 10 semi-convertible passenger cars from the Jewett Car Co., for March, 1906, delivery. These cars will weigh 40,000 lbs. approximately, and measure 40 ft. 3 in. long, 8 ft. 11 in. wide and 11 ft. 10 in. high, over all. The special equipment includes: Standard Steel Works axles, J. G. Brill Co.'s bolsters, brake-beams, dust guards and trucks, American Car & Foundry Co.'s brake-shoes, Westinghouse air-brakes, Jewett Car Co.'s couplers, door fastenings, doors, draft rigging and seats, Hartshorn spring rollers and Acme cable curtain fixtures, Pantasote curtain material, Consolidated Car Co.'s heating system, Symington journal boxes and Standard Steel Works forged rolled steel wheels. Other specialties are: That all cars will be equipped with Climax portable headlights.

The Boston & Maine has ordered 500 box cars and 1,000 drop-end gondola cars from the Laconia Car Works for March, 1906, delivery. The box cars will have a capacity of 60,000 lbs. and will weigh 32,900 lbs. They will be 36 ft. long x 8 ft. 6 in. wide x 8 ft. high, all inside dimensions. The bodies and underframes will be of wood. The gondola cars will have a capacity of 60,000 lbs. and will weigh 26,800 lbs. They will measure 34 ft. long x 8 ft. 1 in. wide x 3 ft. high, all inside dimensions. The bodies and underframes will be of wood. The special equipment for both classes includes: Hammond wrought-iron axles, 4¼ in. x 8 in. journals, pressed steel bolsters, simplex brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, Gould couplers, Miner tandem draft rigging, Murphy roofs, Crucible Steel Co.'s springs, pressed steel trucks (pedestal type), and 33-in., 600-lbs. Laconia Car Co.'s cast-iron wheels.

BRIDGE BUILDING.

Arkansas.—A bill has been introduced in both Houses of Congress authorizing the Rock Island, Arkansas & Louisiana Railroad to build bridges over the Ouachita river, and other navigable rivers in Arkansas.

Evarts, S. Dak.—The Chicago, Milwaukee & St. Paul, it is said, has given a contract to Kansas City parties for building a railroad bridge over the Missouri river at this place on its proposed extension to the West.

Knoxville, Tenn.—Plans are being made for building a viaduct over the railroad tracks at Asylum avenue. The proposed structure will cost about $35,000 and will be similar to the Clinch avenue viaduct now nearing completion, which cost $80,000.

Lyndon, Kan.—Bids are wanted January 2 by the County Commissioners for building steel bridges in Osage County as follows: One 102 ft. long, one 42 ft. long and two each 100 ft. long; all with 14-ft. roadway on stone abutments. John W. Yeoman is County Clerk.

New York, N. Y.—The Board of Estimate and Apportionment has approved the plans for the new Hendrik Hudson memorial bridge to be built at Spuyten Duyvil, and has appropriated $1,000,000 for the preliminary work. The estimated cost of the entire structure will be $2,025,000, and it is to be completed in time for the proposed anniversary celebration in 1909.

Oregon.—Bills were introduced on December 6 in both Houses of Congress authorizing the Portland & Seattle Railway to build a bridge over the Columbia river.

Salem, Mass.—Essex County Commissioners have voted to ask bids for putting up a new bridge over Danvers river connecting Salem with West Beverly, estimated to cost $100,000; also for a bridge over Squam river at Gloucester to cast about $55,000.

Troy, N. Y.—Washington and Saratoga Counties will pay a share of the cost of building a bridge over the Hudson river at Sandy Hill to cost about $60,000.

Washington, D. C.—The bill authorizing a Memorial bridge over the Potomac river between Washington and Ashington, Va., was introduced in the House of Representatives December 6. The bill has been before Congress for several sessions.

Wilson, N. C.—Bids are wanted December 18 by the Board of County Commissioners for building a steel bridge to consist of two spans each 80 ft. long with a 16-ft. roadway over Moccasin river, in Wilson County. John W. Hays, 3 South Adams street, Petersburg, Va., is the engineer who will furnish information.

Yankton, S. Dak.—In the U. S. Senate on December 7 a bill was introduced authorizing the Winnipeg, Yankton & Gulf Railroad Co. to build a combined railroad and highway bridge over the Missouri river, at Yankton.

Other Structures.

Baltimore, Md.—The Baltimore & Ohio has given a contract to the McLean Contracting Co. for building a large dock at Locust Point. The new structure will be practically a duplicate of pier No. 5 recently built for the North German Lloyd Co., and will be 975 ft. long by 165 ft. wide, with two decks carrying two tracks each.

Birmingham, Ala.—A recent fire at the shops of the Tennessee Coal & Iron & Railroad Co. caused a loss of about $20,000.

Bloomington, Ill.—A contract, it is said, has been given by the Cleveland, Cincinnati, Chicago & St. Louis to W. C. Carr & Son at $25,0000 for building its passenger station here.

Buffalo, N. Y.—The shops of the Union Dry Dock Co. and the Erie transfer and freight house, 1,500 ft. long, on the north side of Ganson street, were destroyed by fire December 8; loss about $130,000.

Charlottetown, P. E. I.—Bids are wanted by D. Pottinger, General Manager of the Intercolonial Railway, Moncton, N. B., December 26, for building a stone passenger station at Charlottetown.

Hoboken, N. J.—The Delaware, Lackawanna & Western has let a contract for putting up its new terminal station to the Snare-Triest Co., of New York.

Norfolk, Va.—Application will soon be made by the Norfolk & Western for permission to build a steel coal pier at Lambeth Point at a cost of between $300,000 and $400,000.

Schenectady, N. Y.—The Schenectady Railway Co. has under consideration the building of new machine shops adjoining its Mc-

Clellan street car barn. The proposed structure will be of brick, 100 ft. by 200 ft.

WICHITA, KAN.—The Missouri Pacific has bought about 25 acres of land on the northern boundary of the city to be used as a site for its new shops, which are to take the place of those in the southern section of the town. The plans include a 28-stall roundhouse, on which work is to be commenced at once.

WILMINGTON, DEL.—Revised plans of the new Pennsylvania station to be built at Front and French streets have been completed. The proposed structure will be of brick 193 ft. x 167 ft.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

CANADIAN NORTHERN.—An officer of this company is reported as saying that the $6,000,000 borrowed by President Mackenzie in England will be used for building the Hudson's Bay branch from Erwood to Fort Churchill, on Hudson's Bay. Contracts for ties are now being let at Erwood. Surveys have been completed and work will be commenced as early in the spring as possible.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CHICAGO & NORTH-WESTERN.—This company has filed application for permission to build an extension from Lakewood northeast in Oconto County, Wis., a distance of six miles.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—This company, which recently gave a contract to W. J. Oliver & Co., of Knoxville, Tenn., to double track 12 miles of its road from Pineknot, Ky., to Flat Rock, has given an additional contract to the same party to double track the line from Pineknot south to Helenwood, Tenn., a distance of 18 miles. (December 1, p. 175.)

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Bids are wanted by William M. Duane, Superintendent at Cincinnati, Ohio, December 28, for double track work and grade reduction on the St. Louis division betwen Indianapolis and Delmar, Ind. The work includes the excavation of 1,370,000 cu. yds., and building a double track roadbed, and relocating the line between Delmar and Lena, which requires the removal of 2,275,000 cu. yds. of earth; also for double tracking the roadbed and relocating the line on the Cincinnati division between Middletown and Miamisburg. This calls for the excavation of 600,000 cu. yds.

COLUMBUS & ERIE (ERIE).—Contracts have been given by this company for building its proposed road from Lakewood, N. Y., at the south end of Chautauqua lake, west to Columbus, Pa., 20 miles. The first section, from Lakewood to Niobe, Pa., will be built by Burke Bros., of Scranton, Pa., and the remainder of the road from Niobe to Columbus, by R. C. Hunt, of New York. The sections are of about equal length. The new line will be double track and will furnish a low-grade line for main line trains. The cost of the work will be about $500,000. (See Erie, Sept. 29, p. 103.)

DEEPWATER.—See Tidewater below.

DETROIT TERMINAL.—Under this name a company has been incorporated in Michigan, with a capital stock of $2,000,000, to build a belt road outside and around the city of Detroit, the entire length of the proposed line being about 25 miles. It will follow closely the city line, and will connect with all steam and electric roads running into the city, and is expected to open up much new territory for manufacturing industries. The directors are: Joseph H. Berry, Col. Frank J. Hecker, Charles B. Warren, William G. Smith, William B. Cady and Alfred Hopper, all of Detroit.

ERIE.—See Columbus & Erie above.

FLORIDA WEST SHORE (S. A. L.).—A contract, it is said, has been given by this company to C. H. Davis, of Manatee, Fla., for building an extension from its southern terminus at Fruitville, south to the end of Gasparilla Island, at Boca Grande Inlet, and to Charlotte Harbor, a distance of about 50 miles. It is expected to have the work completed by July of next year.

HARRIMAN LINES.—The *Wall Street Journal*, quoting the Director of Maintenance and Operation of the Harriman Lines, gives a statement of a total of 863 miles of branches and extensions planned by the various companies. Of this total the Union Pacific has 201, the Oregon Short Line 140, the Oregon Railroad & Navigation Co. 135, and the Southern Pacific 387 miles. Details of the new lines, most of which have been already mentioned in the *Railroad Gazette*, will be found under the names of the separate companies.

MANISTEE & GRAND RAPIDS.—This company has completed an extension of its line to Marion, Osceola County, connecting the Ann Arbor Railroad at that point with the Grand Rapids & Indiana Railroad at Tustin, and with Lake Michigan at Manistee.

MEXICAN ROADS.—A concession has been granted by the Mexican Government to Rafael Davila and Salvadore Gardenas Pena, of Monterey, to build a railroad from Allende in the State of Coahuila north to Zaragoza, about 15 miles. The proposed line will connect at Allende with the International. The terms of the concession require that the road shall be completed and in operation within two years.

NEW YORK-PHILADELPHIA (ELECTRIC).—This company is said to be asking bids for building nine miles of electric railroad from Milltown, N. J., to a point south of Metuchen, for which contracts will shortly be let. This company is the holding corporation of the consolidated street railway lines between Camden and Jersey City, and it proposes to build an air line to be operated by electric power from Elizabeth to Camden by way of Trenton. The first three miles of the new road from Elizabeth west are nearing completion. Contracts for the section from Metuchen to New Brunswick will be let as soon as the second section is under way.

OKLAHOMA CITY, DENVER & GULF.—Incorporation has been granted this company in Oklahoma with a capital of $19,425,000 to build a railroad from Shreveport, La., through Texas; the Choctaw, Chickasha and Seminole Nations in Indian Territory, and through Pottawatomie, Cleveland, Oklahoma, Canadian, Logan, Kingfisher, Blaine, Custer, Dewey, Woods, Day, Woodward and Beaver Counties in Oklahoma; thence to Denver, about 777 miles. The directors include: C. G. Jones, J. L. Wilken, E. Overholser, G. W. Carlc and H. J. Edwards, all of Oklahoma City.

OMAHA & SOUTHWESTERN.—See Union Pacific.

OREGON RAILROAD & NAVIGATION.—The following two branches cover the 135 miles of new line to be built, referred to under the heading Harriman Lines:

(1) A branch from Elgin, Ore., to Joseph, Ore., 63 miles, grading on which has just begun. This is to develop the Wallowa Valley, now a stock raising country, but rich in agricultural possibilities.

(2) A line from Riparia, Wash., to Lewiston, Idaho, 72 miles, now being graded. This will be used jointly by the Northern Pacific, which in turn will build on to Grangeville, Idaho, 50 or 60 miles from Lewiston, its line being used jointly by the O. R. R. & N. The latter line will be built next spring, giving a through line from Riparia to Grangeville, a fine wheat country. There is nothing competitive about this building, the Harriman line builds half, the Hill line the other half, and they both will use the whole jointly.

OREGON SHORT LINE.—The 140 miles of new branches and feeders mentioned under the heading Harriman Lines consists of the following:

(1) An extension under the name of the St. Anthony Railroad, from Marysville, Idaho, to Dwelles Inn on the western boundary line of Yellowstone Park, 75 miles up the Henry Fork of the Snake river. The 65-mile stage ride from Monida to Dwelles, near the lower Geyser Basin, will thus be eliminated. To Marysville the new line will run through an agricultural section and beyond is a heavy timber country. The line to Marysville will be completed by Dec. 15.

(2) A line from Garland, Utah, to Malad City, Idaho, 30 miles, through an agricultural section in Utah and southern Idaho. There is a large beet sugar plant at Garland.

(3) Thirty-five additional miles of spurs in southern Idaho and northern Utah to the beet fields. The longest of these spurs is from Logan, Utah.

ST. ANTHONY.—See Oregon Short Line.

SAN FRANCISCO, IDAHO & MONTANA.—An officer writes that the route of this proposed road is from Butte, Mont., southwest through Salmon City, Boise, and Caldwell, Idaho, and Mason City, Nev. (Old Camp McDurmit), thence to Winnemucca, Nev., with an extension from Mason City west to the northern part of California Valley. Track laying will commence early next year. Contracts for part of the grading are let and others are being let. The section between Boise and Winnemucca runs through practically desert prairie lands, except the Boise basin and the Owyhee range on the boundary of Idaho and Oregon, where the grade will be 1.6 per cent. The balance of the section will be 0.6 per cent. The work includes a steel bridge over the Snake river. It is the plan to build 210 miles from Boise to Winnemucca by January, 1907. William Peyton Mason, 4 Elks Building, Minneapolis, Minn., is President, and C. E. Bryant, Boise, Idaho, is Chief Engineer. (November 24, p. 167.)

SEABOARD AIR LINE.—See Florida West Shore above.

SONORA (So. P.).—According to the *Jalisco Times*, this company announces that the concession granted to it by the Mexican Government for its proposed line from Guaymas to Guanajuato is as follows: The company is to receive $10,000 (U. S. currency) a mile. The total amount shall not exceed $7,500,000, or enough to cover 750 miles. The line will be about that length and the payments will be made in government bonds and in cash, to be distributed over a period of ten years. During the first 15 years, the government agrees not to allow the building of a parallel track within a zone extending about 205 miles on either side of the proposed road. For the first ten years, the company will be permitted to import

free of duty all material for construction, machinery for its shops, engines and cars. The Mexican Government also provides, in order to encourage exports, that railroad rates shall be 50 per cent. less on this class of goods when the shipping distance is 156 miles or over. About 50 engineers are now at work making surveys for this line. (November 3, p. 144.)

SOUTHERN PACIFIC.—The 387 miles of new branches and feeders described under Harriman Lines as to be built by the Southern Pacific, include the following:

(1) A line from Drain, Ore., on the San Francisco-Portland line, midway between Eugene and Roseburg, westerly down the valley of the Umpqua, thence southerly to Coos Bay, on the Pacific Coast, 82 miles. This line has just been begun, and is to be completed in 1906. It runs through a timber and agricultural country.

(2) A line from Natron, Ore., up one of the forks of the Willamette across the Cascades, south to Klamath Lake in southern Oregon, where the government is to open a wide area by irrigation. This line will also develop a fine timber section and will be 152 miles long.

(3) Extension 16 miles long from Hazen, Nevada, on the main line, southeasterly, into the heart of the irrigated country. The entire country round Carson Lake in Nevada will have water next year from the government's Carson project. It is now a sage brush desert.

(4) A line 15 miles long from Santa Cruz, running up from the ocean coast 15 miles on the Pacific coast, to proposed large cement works. As a result of government irrigation plans and private operations, there is more demand for cement now in California than three large factories can supply.

(5) A line through lower California in the irrigated districts, south of the boundary line and back to Yuma on the main line, making on the main line a loop of 70 miles, of which 40 or 45 miles are completed.

(6) Under the name of the Cananea, Yaqui River & Pacific, in Mexico, a 52-mile line has been surveyed from Batamotal near Guaymas on the Gulf of California, southeasterly to the valley of the Yaqui. This also is a rich agricultural country, but eventually the new line will serve many mines in the foothills of the Sierra Madre mountain. This line is part of the Southern Pacific concession in Mexico. The Greene properties are in northern Sonora, and it is not improbable that Harriman and Greene interests later on will find a way of connecting.

See Sonora above.

TIDEWATER.—An officer writes that contracts have been let for building the Tidewater and Deepwater Railways, as follows: Section A: From Southern Railway crossing near Hurt, Va., westerly 20 miles, to J. G. White & Co., 43 Exchange Place, New York. Section B: From Meherrin, Va., easterly 22 miles, to A. & C. Wright & Co., and W. R. Bonsal & Co., Hamlet, N. C. Section D-2: From Brookneal easterly 6½ miles, to Butler Bros. Construction Co., 1170 Broadway, New York. Section E: From Brookneal westerly 20 miles, to Carpenter, Frazier, Boxley & Co., Clifton Forge, Va. Section F: From Southern Railway crossing near Hurt, Va., easterly 32 miles, to Lane Bros. Co., Esmont, Va. Section G: From Roanoke easterly 23 miles, to D. A. Langhorne & Co., Alderson, W. Va. Sections H, I, J, K, L: From Roanoke to Bluestone River, 112 miles, to MacArthur Bros. Co. and Arthur F. MacArthur, Chicago, Ill. Work will be commenced at once and the entire road completed for operation December 1, 1907. (December 8, p. 184.)

UNION PACIFIC.—The 201 miles of new construction mentioned under Harriman Lines include the following:

(1) The Omaha cut-off, which is being built under the name of the Omaha & Southwestern from South Omaha, Neb., to Lane, 11.5 miles. The existing line is 20.43 miles long. Estimated cost $2,000,000. Substitutes light for very heavy grades, and double for single track.

(2) A line being built from Hershey on the main line near North Platte, Neb., up the valley of the North Platte to Northport, 150 miles, through the corn belt.

(3) An extension from Topeka on the Kansas City main line northwesterly to Onaga, Kan., 40 miles, through an agricultural section. This line connects at Onaga with another Union Pacific line to Kansas City.

(4) Double tracking 100 miles in southern Wyoming and in spots where the coal traffic is heavy, and also 70 miles from Kansas City to Topeka. The latter strip has been in progress some time but is about completed. Work on the other 100 miles has just begun.

VANCOUVER, VICTORIA & EASTERN.—The grading contracts let to the sub-contractors by J. W. Stewart, who has the work on this road, from Seims, Shields & Co., are in the form of stations of 100 ft. each, the following being the names of the contractors and their stations from Midway, B. C., to the international boundary: Burns & Jordan, 259 stations; Johnson & Anderson, 97 stations, including 350-ft. tunnel; Johnson & Welch, 142 stations; D. J. Brown, 58 stations; D. A. Rankin, 62 stations; Boie Bros. & Moran, 66 stations; George Chew, 104 stations; Burns & Jordan, 96 stations, including 400-ft. tunnel; Johnson & Welch, 82 stations; T. J. Gallagher, 123 stations; E. A. Carleton, 65 stations; P. S. Hughes, 144 stations; Gorman & Pierce, 124 stations. The total distance from Midway to the boundary is 30 miles, the length of the line south of the line is 47 miles, and from the point where it again enters Canada to the Keremous, 17 miles, and from Keremous to Princeton, 48 miles. Plans are now being made to ask for bids for the line between Keremous and Princeton. Passenger trains will soon run over the branch from Curlew to Midway, the line having been completed. James H. Kennedy is Chief Engineer, with headquarters at Midway, B. C.

WESTERN PACIFIC.—An officer writes that this company has let contracts for building 359 miles and has 11 miles under construction in California, and has also let contracts for 110 additional miles in Utah, divided as follows: From Oakland, Cal., to the California-Nevada state line, 370 miles, and from near Salt Lake City, Utah, to a point near the Utah-Nevada line, 110 miles. The contractors are: The Utah Construction Co., of Ogden, Utah, 110 miles in Utah and 174 miles in California; E. B. & A. L. Stone, of Oakland, Cal., 185 miles in California. The company is also making surveys from the Utah-Nevada state line to the Nevada-California line, 429 miles.

WICHITA MOUNTAIN TRACTION.—Incorporation has been granted a company under this name, with $250,000 capital, to build an electric railroad from Roosevelt, Okla. Ter., east, traversing Kiowa, Comanche and Caddo Counties, to Apache, a distance of 50 miles. The incorporators include: W. R. McKnight, E. A. McCoulter, C. L. Johnson and Guy H. Parker, of Roosevelt, and John A. McKeene, of Hobart. The office of the company will be at Hobart.

RAILROAD CORPORATION NEWS.

CINCINNATI, HAMILTON & DAYTON.—Two committees have been formed to protect the holdings of security owners. The first is for the $8,500,000 4 per cent. refunding gold bonds of 1954. This committee consists of J. N. Wallace, Frederick Strauss and Mark T. Cox. J. N. Wallace is a member of the second committee which represents the holders of the $15,000,000 4½ per cent. collateral trust notes of 1908. (See Pere Marquette.)

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY.—Spencer Trask & Co. and N. W. Harris & Co., New York, have jointly purchased $2,000,000 refunding and extension mortgage 4½ per cent. gold bonds of 1931 of this company, which owns 103 miles of road and controls all the gas and electric lighting companies of Milwaukee. The total authorized issue of these bonds is $20,000,000 of which $8,000,000 is reserved to retire the following bonds: $500,000 West Side Street Railway 5 per cent. bonds of 1909; $6,500,000 Milwaukee Electric Railway & Light Co. consolidated 5 per cent. bonds of 1926; $1,000,000 Milwaukee City Railway first mortgage 5 per cent. bonds of 1908. Of the remaining $10,000,000, $9,000,000 is reserved in the treasury of the company until January 1, 1907, when it may be issued at the rate of $1,000,000 a year for extensions and improvements.

NEWARK PASSENGER RAILWAY.—N. W. Harris & Co., New York, are offering $400,000 first consolidated mortgage 5 per cent. gold bonds of this company. The total amount authorized is $6,000,000. The company operates 83 miles of road in and about Newark, N. J., and its entire $6,000,000 capital stock is owned by the Consolidated Traction Co., which guarantees the above-mentioned bonds. The mortgage securing this issue now constitutes a first lien on the property.

NEW YORK CENTRAL & HUDSON RIVER.—It is reported that the Andrews syndicate and this company have bought the $6,500,000 common stock of the Rochester Railway & Light Co., at $125 a share. The light company controls the Rochester Railway Co., which operates 146 miles of road in and about Rochester, N. Y.

NORTHERN SECURITIES.—A dividend of 5 per cent. on the $3,954,000 "stubs" has been declared, payable on January 10, to holders of record of December 22.

PERE MARQUETTE.—A shareholders' protective committee has been formed to protect the interests of the holders of the common and preferred stock of this company. Nathaniel Thayer is chairman. It is said that the Pere Marquette shareholders have the most to fear in the present receivership. The Cincinnati, Hamilton & Dayton, on March 1, 1905, guaranteed 4 per cent. dividends on the $12,000,000 Pere Marquette preferred and 5 per cent. on the $14,145,500 common stock, and the present C., H. & D. receivership may break this guarantee.

SEABOARD AIR LINE.—This company has made an equipment mortgage to Blair & Co. for $1,279,460 to provide for 15 locomotives and 1,015 cars, to be built by various companies.

UNION PACIFIC.—The convertible bonds now outstanding amount to $19,233,000, and the outstanding common stock is $176,796,900.

GENERAL NEWS SECTION

NOTES.

The Louisville & Nashville is preparing to plant 250,000 catalpa trees at Bay St. Louis, Miss., and Carneys, Ala.

Senator Millard, of Nebraska, has retired from the Senate Committee on Interstate Commerce, and Senator W. M. Crane, of Massachusetts, has been appointed in his place.

The New York Central is preparing to adopt green for proceed and yellow for caution as the night indications in fixed signals. The Hudson and the Harlem divisions will be changed first.

According to a Chicago press despatch, the messengers of the United States Express Company, running to and from that city, are now required to practice in a school of pistol marksmanship four times a month.

The Toledo, Bowling Green & Southern Traction Company proposes to put in a large number of short side tracks between Toledo and Findlay for the purpose of promoting the grain traffic. The company intends to accommodate all of the farmers along its line.

The Atlantic Coast Line and the Armour Car Lines have assured the Truckers' Association at Wilmington, N. C., that for the next strawberry season 2,000 refrigerator cars will be furnished, and that four-fifths of these will be 40-ft. cars. The railroad also promises improved motive power.

The Wabash has announced that it will carry corn from the Missouri River to the Atlantic Seaboard for export at 19 cents per 100 lbs. This rate is to stand until January 1. It is made to meet the 28½-cent rate through to Liverpool recently made by the Chicago, Milwaukee & St. Paul.

On Monday of this week the Chicago & North-Western and the Chicago Great Western announced a rate on export corn of 8¼ cents from Missouri river points to Chicago. This rate is made to compete with the reductions by other lines recently announced, and expires December 31.

According to a Chicago Press despatch the Rock Island road has given orders to its freight agents to decline packing-house products at Missouri River points, the officers of the company having concluded that on account of the high speed and the other expensive elements of this service, the interest of the road requires that it use its facilities for other classes of freight.

On the night of December 16 the North Coast Limited express train of the Northern Pacific was stopped by robbers 15 miles west of North Yakima, Wash., and the express car was blown open with dynamite. The express and mail cars were first moved forward a half mile away from the rest of the train and the passengers were not molested. It is said that the robbers secured but very little money.

The shipments of potatoes over the Bangor & Aroostook Railroad during the month of November amounted to 716,511 bushels; and total crop of the year to date, 2,358,098 bushels, or an increase of 390,559 bushels over the same period last year. The Aroostook County shippers have large contracts for delivery of seed potatoes in January and February, a large proportion going to Texas and other Southern States.

The action of Governor Toole, of Montana, in vetoing the Railroad Commission Bill, passed by the Legislature of that State at its last session, is not to be allowed to settle the matter. The "Montana Rate Association" has been organized at Helena and is going to ask the Governor to call an extra session. The Association also proposes to go before the Interstate Commerce Commission with complaints of discrimination on interstate business.

Press despatches of December 15 and 16 report indictments for violation of the freight rate laws at Philadelphia, Chicago and Kansas City. At Philadelphia the Eastern Agent of the Mutual Transit Company, the company itself and the local agent, the agent of the Great Northern Railway and several shippers were indicted for giving or accepting rebates on shipments of iron pipe to Winnipeg, and on other articles. The National Essence for Coffee Company secured immunity from prosecution by voluntarily surrendering books and papers. At Chicago, the Chicago & Alton Railway and two of its former officers, John N. Faithorn, Vice-President, and F. A. Wann, General Freight Agent, were indicted for paying illegal rebates to Schwarzschild & Sulzberger; also for giving free transportation to employees of that firm. At Kansas City indictments were returned against George H. Crosby, of the Burlington, L. B. Taggart, his chief clerk, the Chicago, Milwaukee & St. Paul Railway Company, and a number of shippers. The Alton Road and its two officers were indicted here on the same charges as in Chicago. Among the shippers indicted were the Armour, the Swift and the Cudahy Packing Companies and Nelson Morris.

Bids for Philippine Railroads.

The bids were recently opened at the Insular Bureau of the War Department for concessionary grants to be made by the Philippine government for the construction of railroads in the Philippine Islands, as provided by act of Congress. The proposed lines aggregate 1,235 miles. Lines are to be built on the Islands of Luzon, Panay, Negros, Cebu, Leyte and Samar. Speyer & Co., of New York, offered to build about 425 miles on the island of Luzon without government guarantee of bonds. This offer was made in connection with the existing Manila Railway Company, Limited, which now has in operation over 200 miles of railroad in Luzon. Speyer & Co., in connection with their bid, asked for concessions under which to build branches of the existing Manila & Dagupan Railway, and if their bid is accepted it probably will result in the operation under one management of 633 miles of railroad on the island of Luzon. Morris McMicken, G. Gresskens, G. Poncin, Jacob Furth and E. C. Hughes, of Seattle, offered to build 100 miles of railroad in southern Luzon. Kean, Van Cortland & Co., J. G. White & Co., Charles M. Swift, with whom are associated Cornelius Vanderbilt, R. T. Wilson & Co., and the international Banking Corporation, offered to build 100 miles on the island of Panay, 100 miles on the island of Negros, and 95 miles on the island of Cebu under a 4 per cent. guarantee for 30 years on 95 per cent. of the cost of construction. Their bid stated that the construction would be done by J. G. White & Co.

Cuba Eastern Extension.

The Cuba Eastern Railroad, which now operates about 30 miles of road in the province of Santiago de Cuba, is planning an extension from its northern terminus, San Pre, westerly through the La Maya valley to San Luis, about 40 miles. This is a rich sugar district, and the new line will broaden the traffic of the road, now mainly timber. A large sum is to be spent in developing the agricultural possibilities of the new territory. This will include the building of about 30 miles of narrow gage tramway for carrying sugar cane to the mills. Much of the grading on the extension has already been finished, and the company is now in the market for 80-lb. rails and about 2,000 tons of bridge material, as well as for cars and locomotives. The maximum grade on the new line is to be 2 per cent., and it is hoped to have the line in operation within the next few months. The President of the company is H. W. Bennett, of New York. A. V. Sims, Guantanamo, Cuba, is Chief Engineer and General Manager. The New York offices of the company, including those of Mr. De Zayas, the Purchasing Agent, are at 79 Wall street.

Relief for the Train-Accident Record.

The football season is closed and the record of casualties, as tabulated by the *Tribune*, shows a list of 18 killed and 159 injured. The hunting season in Wisconsin and Michigan is closed, and the casualty list shows 26 killed and 55 wounded, some of whom will not recover. The complete record of casualties since July shows 70 killed and 89 wounded. The automobile season is a continuous one. In the principal cities of the United States these machines have killed, since the year began, 66 persons and nine in smaller places, and injured 463 persons in cities and 46 in villages, a total of 75 killed and 509 injured in 11 months. The killing of these 157 persons by the three agents of destruction mentioned is sheer and culpable waste of life. Modern civilization is now so complex and exacting that a considerable loss of human life is inevitable. There must be a certain number of persons drowned, burned, killed by railroad and steamboat disasters, explosions, mine accidents, lightning, cyclones, storms and electricity. There will be several thousand of them this year. Their loss must be accepted as one of the debts we pay to the constantly changing methods of civiliza-

tion, and it will grow larger from year to year as life and transportation and business grow more complex and their problems of operation more difficult and dangerous.—*Chicago Tribune.*

New York Rapid Transit Commission.

At a recent meeting of the Chamber of Commerce of New York, the Chamber presented to each member of the Rapid Transit Commission a gold medal, commemorating the service of these gentlemen to the city in building the Subway. The members of the Commission are: Messrs. Alexander E. Orr, Morris K. Jesup, John Claflin, Woodbury Langdon, Seth Low, John H. Starin, and Charles Stewart Smith.

Cabinet for Train News Agent's Stock.

Mr. Albert Headley, General Foreman of the car department of the Duluth & Iron Range, has put into effect a plan to utilize the space which had been occupied by Baker heaters in the company's smoking cars, these heaters having been displaced. It was prompted by the custom of news agents of using one or two seats in the smoking car for storing and exhibiting their stocks. Mr. Headley builds in the heater space a cabinet 5 ft. high with a railing around the top, which is finished outside to correspond with the car interior. Suitable shelving is placed within the cabinet, which, as the plan shows, is divided between the door and the cabinet proper. The position and dimensions of the cabinet are such as to make use of the space conveniently and to the best advantage. Besides making available for the use of passengers the seats formerly taken up by the news agent, the seat adjoining the cabinet is added. The cabinet enables the news agent to take care of his stock in much better shape than formerly.

Chicago Tunnels.

At a recent meeting of the directors of the Illinois Tunnel Company, A. J. Earling, President of the Chicago, Milwaukee & St. Paul, was elected Chairman of the Executive Committee.

Wyckoff's Water-Proof Steam Pipe Covering.

The accompanying illustrations show the general design of the Wyckoff's water-proof steam pipe coverings used for both underground and exposed steam and hot water pipes. This covering is constructed of eight thoroughly seasoned white pine staves, one inch thick. These staves are joined, as shown, and are wound with heavy galvanized steel wire and wrapped with two layers of heavy corrugated paper. Another casing of one inch white pine jointed staves, wound with galvanized steel wire, is placed over the first covering, as shown, thus making two casings of wood, each one inch thick, with a non-conductive lining of corrugated paper between.

The corrugated paper forms an air chamber between each layer of wood and paper, thus adding to the covering's non-conductive qualities. For underground use, the covering is completely coated on the outside with asphaltum pitch. When used overhead it is furnished painted on the outside with black asphaltum paint. The covering is made in lengths of from 4 to 8 ft. The lengths are connected by tenon and socket joints. In putting it over the pipes it requires simply to be driven together.

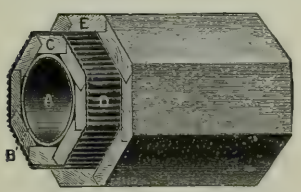
Where the pipes are in place and cannot be disconnected for the purpose of sliding the covering on, a patent covering opened, as shown in Fig. 2, is furnished; to prevent the wood from charring when the covering is used on high pressure steam pipes, the covering is lined with tin and two layers of asbesots paper, as shown in Fig. 1.

The Wyckoff Co. also make water-proof wood stave covering as a substitute for the solid log. This pipe is made of seasoned white pine staves, two inches thick, carefully selected, free from sap and other imperfections, jointed together, wound with steel hoop and coated with asphaltum.

This covering is also made in lengths of from 4 ft. to 8 ft., each connected by a socket joint. It can be put together easily and properly by any ordinary laborer.

Fig. 3 shows the wood stave covering wound with steel hoop and coated with asphaltum cement, with a portion of the cement removed to show the steel hoop with which the pipe is wound.

These pipe coverings are made by A. W. Wyckoff & Son Co., Elmira, N. Y.



A—Tin Lining. B—Asbestos. C—Wood. D—Corrugated Paper. E—Wood. F Asphaltum Coating.

Fig. 1—Wyckoff's Steam Pipe Covering.

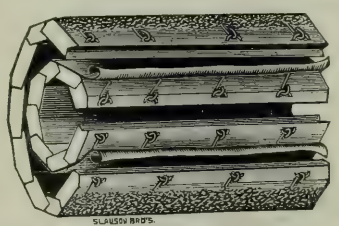


Fig. 2—Wyckoff's Steam Pipe Covering.

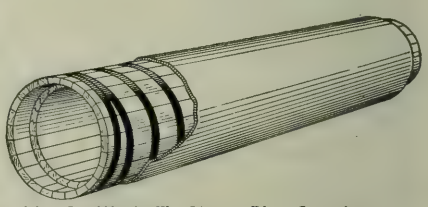


Fig. 3—Wyckoff's Steam Pipe Covering.

The Consolidated Steam Coupler.

The accompanying illustration shows the Consolidated Car-Heating Company's new type of steam hose coupler. With the exception of the automatic lock, the coupler has but two parts, the coupler head and the gasket. The gasket slides into place in a machined groove and is firmly locked in place by slightly bending the light steel lug formed on it. No springs are required to hold the gasket in place and there is no obstruction in the steam passage. It has a full 1½-in. opening and is interchangeable with smaller sizes of couplers. When used with couplers having an opening less than 1⅜ in. in diameter it is fitted with a slightly smaller gasket.

A New Steam Hose Coupler.

An automatic lock is applied which exerts a downward pressure of about 35 lbs. on the wing of each coupler. This holds the gaskets tightly together at all times and prevents uncoupling on sharp curves while permitting automatic uncoupling without damage to the hose in case the train parts. The curved lugs and hooks of the couplers are milled on special machines.

Panama Canal Appropriation.

The bill making a short time appropriation for the expenses of the Panama Canal, which called for $16,500,000 and was amended in the House to read $11,000,000, has been passed by the Senate, the Upper House agreeing to the lower figure.

Don't Let the Officers Do All the Work.

Mr. C. E. Lee, assistant general manager of the Boston & Maine, addressing a brotherhood meeting in Boston recently, said:

"The time has come when labor cannot say to the employer, 'We must have an increase in wages because we want it.' Nor can employers say, 'You can't have it, because I won't give it to you.' I never expect to see an era of universal peace between labor and the employer, but I do believe that the time has come when the employer and employee can get together and tell what they do desire of each other. While I believe in labor organizations, they never can take the place of hard work to secure advancement. * * * Any organization that is worth joining is worth backing up. Attend the meetings and don't let the officers do all the work. Don't be too critical of the committees that wait on the management. It is one of the meanest things to elect a committee and then kick about its work. The stronger they are the better they suit me. * * *"

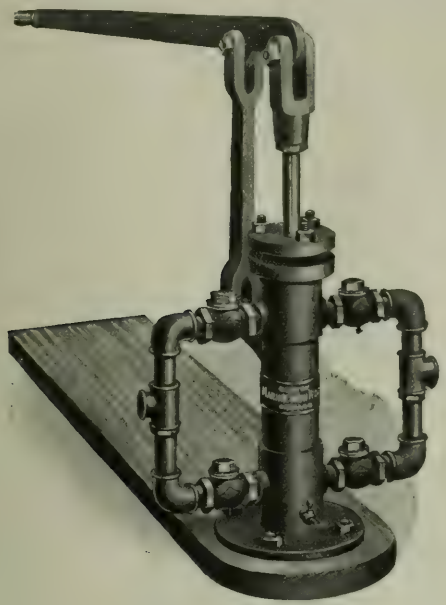
Collision on the "Harlem Line."

In a collision of two northbound trains at converging tracks at 104th street and Fourth avenue, New York City, on Tuesday evening last, one passenger was killed and 30 were injured, all of the victims being in one car of train No. 222 of the New York, New Haven & Hartford. The two trains, both filled with suburban passengers, had left the Grand Central station, three miles south of the point of collision, at about the same time; the New Haven train on track No. 4, and the other, a Poughkeepsie local of the New York Central & Hudson River, on track No. 3. At 110th street a preceding train on track No. 4 had been delayed and the signalman had therefore set the crossover track to turn the New Haven train from track 4 to track 3. The engineman of the Poughkeepsie train appears to

have disregarded the signals which should have stopped him before he reached the crossover, and his engine struck the side of the New Haven train, overturning one car. The signals are high semaphores on a bracket post, at the left of the tracks, this part of the road being operated "left-handed."

A Boiler Test Pump.

A pump for making hydrostatic tests on boilers, pipes, etc., is shown in the accompanying illustration. It is double-acting, enabling one man to pump against 500 lbs. pressure. It has a 5-in.



Hydrostatic Test Pump.

stroke, 1-in. suction and ¾-in. discharge. The lever handle is forged, also the fulcrum and the knuckle connection. The cylinder is semi-steel and the piston is of bronze. For inspectors' or yard use the base shown in the illustration is most convenient. For fastening down in a permanent position a square base is furnished. The pumps are subjected to a rigid test before shipment. They are made by the Marine Iron Works, Chicago.

Disastrous Fire at Twenty-Third Street Ferry.

The new ferry-house of the Delaware, Lackawanna & Western at West Twenty-third street, New York City, was completely destroyed by fire on Wednesday last, and the similar structure of the Central of New Jersey, adjoining it on the south, which also was new, had its interior gutted. Gangs of painters were at work beneath the Lackawanna ferry-house, and it is believed that the fire started among their materials. The ferry-houses of the Erie and of the Pennsylvania, adjoining that of the Lackawanna on the north, were threatened, but were saved.

"The Public is Satisfied."

A certain western railroad which has not yet been "reorganized" by Wall street is still owned and operated by the blunt-spoken old lumberman who built it. Last year, after a particularly severe accident upon it, the agent for an automatic block signal called and tried to get a contract. The old lumberman examined the device attentively and finally said: "Wal, I reckon it is a pretty machine. I like to sit here and see it work myself, it's so all-fired sure. But come to using it on my road—now, young feller, I've been running a railroad some longer'n you, and I'll tell you something. Accidents is bound to happen about once in so often, no matter what you do. I've got three brakemen in jail now, and I've vowed to hang the next one, and the public is pretty well satisfied. But what satisfaction is it going to be to any one if I go to work and hang an old automatic machine?"—*Youth's Companion.*

Manufacturing and Business.

Falls hollow iron has been specified for the staybolts of a number of locomotives recently ordered from the Baldwin Locomotive Works by the Seoul-Fusan Railroad.

The Mark Flather Planer Co., Nashua, N. H., has received an order for a 38-in. x 16-ft. frog and switch planer for the Kingston shops of the Delaware, Lackawanna & Western.

The Miller-Collins Company, Contracting Engineers, 1133 Broadway, New York, has been awarded the contract for the designing and erection of a new foundry building at Long Island City, for the Union Ballast Co., New York. This building will be built on pile foundations, with concrete block walls, structural steel frame, plank and composition roof. Work will be started at once. The Miller-Collins Company are in the market for prices on cement, sand, piles, lumber, sash, doors, window frames, roofing, structural steel, etc.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society December 20, a paper on "The Inspection of Treatment for the Protection of Timber by the Injection of Creosote Oil," by H. R. Stanford, was presented. This paper was printed in the "*Proceedings*" for November, 1905.

Franklin Institute.

At a stated meeting of the Institute held December 20, there was a paper on "Hydraulic Mining in British Columbia and Alaska," with illustrations, by Howard W. DuBois, Mining Engineer, Philadelphia. At a meeting of the Sections held December 21, the program included a paper on "Electro-Chemical Calculations," by Dr. Joseph W. Richards, of Lehigh University, Bethlehem, Pa.

St. Louis Railway Club.

The December meeting of this club took the shape of the annual Christmas tree entertainment. It was held on the 9th, and consisted of music, vaudeville, and various humorous specialties. If the show was as funny as the program, it must have been highly entertaining; for the bill has a laugh in every line.

The Railway Signal Association.

Secretary H. S. Balliet, New York City, announces that the next meeting of this Association will be held at the Grand Union Hotel, New York City, January 9. The following papers will be presented:

Signaling on the East Bengal State Railway, by George K. Rogers, of Calcutta.

The care of storage batteries, by H. W. Lewis (Lehigh Valley).

Preliminary report on installation and maintenance of storage batteries, by I. S. Raymer, Chairman of the committee.

Line Wire, by F. F. Fowle, of the American Telephone & Telegraph Co.

Rubber Covered Wire will be brought up for discussion, with particular reference to the feasibility of a system for inspection. An amendment to the Constitution and one to the By-Laws will be voted on.

PERSONAL.

—Mr. Franklin K. Lane, who is to succeed Hon. J. W. Fifer on the Interstate Commerce Commission, is a lawyer in San Francisco. He is a prominent Democrat and took an active part in the reorganization of that party, resulting in the successful reform movement in San Francisco. Mr. Lane has also had newspaper experience, having been with the *San Francisco Chronicle* and at one time editor of the *Tacoma News.*

F. K. Lane.

—Mr. J. C. Lincoln, recently appointed Assistant Freight Traffic Manager of the Missouri Pacific, has spent nearly all of his railroad life on that road. In 1876, he was clerk in the Car Service department, and later went into the Superintendent's office. He then went to the St. Joseph & Denver as clerk in the General Freight and Passenger department. In 1883, he returned to the Missouri Pacific as commercial agent. He was appointed Assistant General Freight Agent in 1890 and First Assistant General Freight Agent in 1897. Two years later he was appointed General Freight Agent, where he has been until his present appointment.

Mr. W. J. Spicer, who died recently at his home in Detroit, was born in England in 1832 and went to Canada at the age of 21. After serving for several years as a freight agent on the Great Western, he became, in 1861, Superintendent of that road. In 1884, he was appointed General Manager of the Grand Trunk lines west of the Detroit and St. Clair rivers, remaining there for about ten years. He then retired from active service, but continued as director of the Grand Trunk.

—Mr. J. A. Shepherd, who was recently appointed Superintendent of the Maryland division of the Western Maryland, entered railroad service in 1892 as an assistant agent on the Wabash. He served at various offices for four years, and then was made despatcher at Decatur, Ill. In 1898 he was appointed assistant chief despatcher. In 1902, he was appointed chief despatcher, but the next year went to the Western Maryland as Superintendent of Transportation of that road and of the West Virginia Central & Pittsburg.

—Mr. Charles B. Peck, Manager of the Texas Car Service Association and President of the National Association of Car Service Managers, died at Houston, Texas, on December 10. He was born in 1840, and at the age of 15 began railroad service in an office of the Milwaukee & Mississippi. He became station agent of the Milwaukee & Prairie du Chien (now the Chicago, Milwaukee & St. Paul), and in 1867 became station agent of the Leavenworth, Lawrence & Galveston. He was promoted to be General Freight Agent and then General Superintendent of that company and later became General Manager of the Chicago & Grand Trunk. He left this office to become Vice-President and General Manager of the Atlantic & Danville, and in 1892 was appointed General Manager of the San Antonio & Aransas Pass.

—Mr. Ira A. McCormack, who is now General Superintendent of the Electric Division of the New York Central & Hudson River, was born in 1859. In 1872, he entered railroad service as a telegraph operator on the Pittsburg & Connellsville, and the next year went to the Pittsburg, Fort Wayne & Chicago, where he remained for 13 years as brakeman, conductor, freight and ticket agent and yardmaster. He then became yardmaster on the West Shore, and in 1888 trainmaster on the same road. In 1891, he went to the Pittsburg & Lake Erie as trainmaster at Pittsburg, but soon after took a similar position on the New York Central. He then went to Chicago to install automatic signals on the Chicago & North-Western and the Illinois Central, and later to the Lake Shore & Michigan Southern as trainmaster. In 1895 he became General Superintendent of the Brooklyn Rapid Transit, and in 1899 Vice-President of the Syracuse Rapid Transit. From here he went to Cleveland as General Manager of the Cleveland Electric Street Railway, and in 1902 returned to the New York Central as Assistant Manager of the Grand Central Station. He was promoted to the position of Manager of the "Grand Central Station and Harlem Line," which title is now changed to his present one.

I. A. McCormack.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—J. F. Scott has been appointed Assistant Secretary at Topeka, Kan., and A. O. Wellman, Assistant Treasurer at the same place, relieving E. Wilder, Secretary and Treasurer, who is in ill health.

Baltimore, Chesapeake & Atlantic.—C. E. Pugh, Second Vice-President of the Pennsylvania, has been elected President and Director of the B., C. & A. and the Maryland, Delaware & Virginia, succeeding S. M. Prevost.

Canadian Pacific.—J. B. Elliott, Master Mechanic at Montreal, Que., has been appointed General Master Mechanic of the lines east of Fort William, with office at Angus Shops, Montreal.

Chicago Great Western.—J. E. Chisholm, Master Mechanic at Oelwein, Iowa, has been appointed General Master Mechanic, with office at that place.

Cleveland, Akron & Columbus.—See Pennsylvania Lines West.

Colorado & Southern.—J. M. Herbert, Vice-President and General Manager, has been elected First Vice-President. A. D. Parker, Vice-President in charge of the auditing department, has been elected Second Vice-President in charge of operating, traffic and auditing. J. H. Young, General Superintendent, has been appointed General Manager, succeeding Mr. Herbert, with office at Denver, Colo.

W. A. Webb has been appointed Assistant to the Second Vice-President, with office at Denver, Colo.

Delaware, Lackawanna & Western.—G. E. Hustis, Auditor of Disbursements of the Michigan Central, has been appointed General Auditor of the D., L. & W., with office at New York, succeeding O. C. Post, deceased.

Grand Trunk.—N. C. Rothschild has been elected a director, succeeding L. J. Seargeant, deceased.

Great Northern.—G. T. Slade, General Superintendent, has returned from a long leave of absence. H. A. Kennedy, Acting General Superintendent, resumes his duties as Assistant General Superintendent, with office at Spokane, Wash. J. H. O'Neill, Acting Assistant General Superintendent, returns to Whitefish, Mont., as Superintendent.

Lehigh & New England.—Daniel Hardy, General Superintendent, has resigned to go into private business, effective Jan. 1, 1906.

Maryland, Delaware & Virginia.—See Baltimore, Chesapeake & Atlantic.

Michigan Central.—N. B. Ackley has been appointed Auditor of Disbursements, with office at Detroit, Mich., succeeding G. E. Hustis, resigned. See Delaware, Lackawanna & Western.

Midland Valley.—See Philippine Roads.

Missouri Pacific.—M. C. Markham, Assistant to the President of the Western Pacific, has been appointed Assistant to Vice-President C. S. Clarke of the Missouri Pacific, effective January 1, and his duties will be those of director of traffic.

National Lines of Mexico.—See Tehuantepec National.

Pennsylvania.—A. B. Clark, Supervisor at Pittsburg, Pa., has been appointed Assistant Engineer at Renovo, Pa., succeeding D. R. Mehaffey, transferred to the office of the Chief Engineer of Maintenance of Way.

Pennsylvania Lines West.—R. C. Barnard, Superintendent of the Cleveland, Akron & Columbus, has been appointed Superintendent of the Cincinnati division of the Pennsylvania Lines West, succeeding J. A. McCrea, resigned, to go to the Long Island. W. B. Wood, Superintendent at Richmond, Ind., succeeds Mr. Barnard. N. Neff, Engineer of Maintenance of Way at Chicago, succeeds Mr. Wood. All these appointments are to take effect January 1.

Philippine Roads.—F. A. Molitor, Chief Engineer of the Midland Valley, has been appointed, by the Secretary of War, Supervisor of Railroads in the Philippines.

Tehuantepec National.—W. B. Ryan, Traffic Manager of all the roads comprised in the National Lines of Mexico, has resigned, effective Jan. 1, 1906, but remains General Traffic Manager of the Tehuantepec National.

Western Pacific.—See Missouri Pacific.

White Pass & Yukon.—A. B. Newell, Vice-President and General Manager, has resigned. A. L. Berdoe, Comptroller, succeeds Mr. Newell as General Manager, with offices at Vancouver, B. C., and Skaguay, Alaska.

LOCOMOTIVE BUILDING.

The Great Northern has ordered 85 locomotives from the Baldwin Works.

The Raleigh & Pamlico Sound, it is reported, has ordered two locomotives.

The Mexican Central, it is reported, will shortly order a number of locomotives.

The Minneapolis & St. Louis, it is reported, has ordered two locomotives from the American Locomotive Co.

The Virginia Coal, Iron & Coke Company has ordered two saddle tank locomotives from the Davenport Locomotive Works.

The McCall Ferry Power Company, New York, has ordered five four-wheel saddle tank, standard-gage, construction locomotives from the Davenport Locomotive Works.

The Northern Pacific, it is reported, is figuring on 25 locomotives. These are in addition to the 80 locomotives which were recently reported as ordered from the American Locomotive Co.

The Chicago, Burlington & Quincy has ordered 15 simple Pacific (4-6-2) locomotives from the Baldwin Locomotive Works. These locomotives will weigh 222,000 lbs., with 150,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 74 in.; radial stay boiler, with a working steam pressure of 200 lbs.; heating surface, 3,773 sq. ft.; 305 tubes, 2¼ in. in diameter and 20 ft. long; fire-

box, 9 ft. ⅛ in. long and 6 ft. ¼ in. wide; grate area, 54.25 sq. ft.; tank capacity, 8,000 gallons of water, and coal capacity, 13 tons.

The Susquehanna & New York, as reported in our issue of December 15, has ordered one simple consolidation locomotive from the Baldwin Locomotive Works. This locomotive will weigh 215,000 lbs., with 125,000 lbs. on drivers; cylinders, 21 in. x 24 in.; diameter of drivers, 46 in.; wagon top boiler, with a working steam pressure of 190 lbs.; 306 tubes; firebox, 95 in. x 42 in. The tender will have a capacity for 4,500 gallons of water and five tons of coal. The special equipment will include: Westinghouse air-brakes, Monitor injectors, metallic piston and valve rod packing and pneumatic sanding devices.

The Texas & Pacific is building three simple switching locomotives at its Marshall, Tex., shops. These locomotives will weigh 39 tons; cylinders, 17 in. x 24 in.; diameter of drivers, 44 in.; straight boiler, with a working steam pressure of 150 lbs.; heating surface, 1,145 sq. ft.; 148 tubes, 2½ in. in diameter and 13½ ft. long; firebox, 5 ft. 2 in. long and 2 ft. 10 in. wide; grate area, 15 sq. ft.; tank capacity, 2,500 gallons of water, and coal capacity, 4½ tons. The special equipment includes: Westinghouse air-brakes, Sterlingworth brake-beams, Tower couplers, Detroit injectors, U. S. metallic piston and valve rod packings, Coale safety valves, Nathan sight-feed lubricators, Union Spring & Manufacturing Co.'s springs, and Crosby steam gages.

The Canadian Pacific is building at its Angus shops six Pacific (4-6-2) locomotives and 10 switching (0-6-0) locomotives, for November and December, 1905, and January, 1906, delivery. The Pacific locomotives will weigh 215,000 lbs., with 140,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 69 in.; radial stayed wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 3,122 sq. ft.; 209 Mannesmann & Canadian Pacific special tubes, 2¼ in. in diameter and 20 ft. long, and 22 superheater tubes, 5 in. in diameter and 20 ft. long; Canadian Pacific special firebox, 102⅛ in. x 70 in.; grate area, 49.7 sq. ft.; tank capacity, 5,000 imperial gallons of water, and coal capacity, 10 tons. The switching locomotives will weigh 126,000 lbs.; cylinders, 18 in. x 26 in.; diameter of drivers, 52 in.; radial stayed wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 1,544 sq. ft.; 234 Canadian Pacific special tubes, 2 in. in diameter and 11 ft. 5⅞ in. long; Canadian Pacific special steel firebox, 96⅜ in. x 42¾ in.; grate area, 29 sq. ft.; tank capacity, 3,500 imperial gallons of water, and coal capacity four tons. The special equipment for both includes: Westinghouse air-brakes, Krupp and open hearth steel axles, "Little Giant" bell ringers for Pacific locomotives, magnesia and plastic boiler lagging, Simplex brake-beams, Canadian Pacific standard brake-shoes, Washburn pilot and Tower tender couplers, Pyle-National headlights and Hancock injectors for Pacific locomotives, Canadian Pacific standard journal bearings, U. S. metillac piston and valve rod packings, "World" brand safety valves, Leach double sanding devices, Richardson sight-feed lubricators for Pacific locomotives, and Detroit sight-feed lubricators for switching locomotives, Crucible springs, Star steam gages, Krupp crucible driving wheel tires and Krupp open hearth truck and tender wheel tires for Pacific locomotives.

CAR BUILDING.

The Southern is reported to be in the market for 10,000 freight cars.

The Coal & Coke has ordered 100 cars from the Standard Steel Car Co.

The Asheville Electric Company has ordered two cars from the J. G. Brill Co.

The Chicago & Alton, it is reported, is in the market for 200 refrigerator cars.

The Halifax & Southwestern has ordered 50 flat cars from Rhodes, Curry & Co.

The Lake Shore & Michigan Southern is to build 25 passenger cars at its own shops.

The Philadelphia & Reading, it is reported, is in the market for 1,000 gondola cars.

The Solvay Process Company has ordered 60 freight cars from the Middletown Car Works.

The Toledo, St. Louis & Western, it is reported, is in the market for a large number of box cars.

The Buffalo, Rochester & Pittsburg has ordered 200 steel cars of 100,000 lbs. capacity from the Standard Steel Car Co.

The Wisconsin & Michigan, as reported in our issue of December 1, has ordered 200 ore cars of 100,000 lbs. capacity from Barney & Smith.

The Philadelphia & Reading, as reported in our issue of December 15, has ordered 900 gondola cars from the Middletown Car Works.

The Cincinnati, Milford & Loveland Traction, Milford, Ohio, has ordered two cars from the Cincinnati Car Co.

The Cuba Eastern has ordered 40 freight cars of 60,000 lbs. capacity and five passenger coaches from the American Car & Foundry Co.

The Aurora, Elgin & Southern, it is reported, is in the market for 13 passenger cars and has ordered one milk car from the Jewett Car Co.

The Great Northern, it is reported, has ordered 10 sleeping cars from the Pullman Co. and 68 passenger cars from Barney & Smith and the American Car & Foundry Co.

The St. Louis Construction & Equipment Company is contemplating the purchase of a number of freight cars, including about 1,000 coal cars of 100,000 lbs. capacity.

The Chicago & Milwaukee Electric has ordered 10 coaches from the Jewett Car Co., 10 parlor cars from the Pullman Co., and will probably be in the market for additional equipment soon.

The Butte, Anaconda & Pacific has ordered 100 steel hopper ore cars of 100,000 lbs. capacity from the Standard Steel Car Co., for January, 1906, delivery. These cars will be 25 ft. 10 in. long, 9 ft. 5⅜ in. wide and 8 ft. 9 in. high, inside measurements.

The New York, New Haven & Hartford, it is reported, has ordered 41 coaches, 15 combination passenger and smoking cars, 20 baggage cars, four combination baggage and mail cars and 20 carriage cars from Osgood, Bradley & Sons, and five sleeping cars from the Pullman Co.

The Southern, as reported in our issue of December 15, has ordered 7,500 box cars of 60,000 lbs. capacity and 2,500 steel gondola cars of 100,000 lbs. capacity as follows: One thousand two hundred and fifty box cars from the Western Steel Car & Foundry Co., 1,750 box cars from the American Car & Foundry Co., 3,000 box cars from the Mt. Vernon Car Manufacturing Co., 1,500 box cars from the Lenoir Car Works, 600 steel gondola cars from the Standard Steel Car Co., and 1,000 steel hopper gondola cars from the American Car & Foundry Co.

The Texas & Pacific, as reported in our issue of December 15, is building 50 Rodger ballast Hart convertible cars of 80,000 lbs. capacity at its Marshall, Tex., shops, for December delivery. These cars will weigh 36,500 lbs., and measure 34 ft. long, 10 ft. 2 in. wide and 9 ft. high, over all. The special equipment includes: Common Sense bolsters and trucks, Sterlingworth brake-beams, Westinghouse air-brakes, Tower couplers, International draft rigging, Union Spring & Manufacturing Co.'s springs and Marshall Car Wheel & Foundry Co.'s wheels.

The Chicago, Indianapolis & Louisville, as reported in our issue of December 15, has ordered one combination car, three first-class coaches and five excursion cars from the American Car & Foundry Co. The combination car is for February, 1906, delivery, the first-class coaches are for April, 1906, delivery, and the excursion cars are for May, 1906, delivery. The combination and excursion cars are 75 ft. long, the first-class coaches are 70 ft. long, and all cars are 8 ft. 10 in. wide, inside measurements. The special equipment for all includes: National-Hollow brake-beams, "Brown" brake-shoes, Westinghouse air-brakes, National couplers, Dayton Supply Co.'s curtain fixtures, Pantasote curtain material, Harrison dust guards, Consolidated heating system, Symington journal boxes, Pintsch gas light, Sessions platforms, Pittsburg Spring & Steel Co.'s springs, Pullman vestibules and Paige steel tired wheels. Other specialties are: Vendor Co.'s automatic ventilators.

The Delaware, Lackawanna & Western, as reported in our issue of December 1, has ordered 500 double hopper bottom steel cars of 80,000 lbs. capacity, 500 steel frame gondola cars of 80,000 lbs. capacity, 18 milk cars of 55,000 lbs. capacity, 10 express cars, and two broad vestibule coaches from Barney & Smith and 15 suburban coaches and three combination passenger and baggage cars from the American Car & Foundry Co. All cars are for May and June, 1906, delivery. The double hopper bottom steel cars will weigh about 36,000 lbs., and measure 33 ft. 6½ in. long, 10 ft. wide and 10 ft. 3⅜ in. high, over all. The steel frame gondola cars will weigh about 37,000 lbs., and measure 44 ft. 3¼ in. long, 9 ft. 11½ in. wide and 7 ft. 5⅜ in. high, over all. The milk cars will weigh 73,000 lbs., and measure 55 ft. 3½ in. long, 10 ft. 2½ in. wide and 13 ft. 1 in. high, over all. The express cars will weigh about 76,000 lbs., and measure 63 ft. 6½ in. long, 10 ft. ¼ in. wide and 14 ft. ½ in. high, over all. The vestibule coaches will weigh about 82,000 lbs., and measure 68 ft. 10 in. long, 10 ft. wide and 14 ft. 7½ in. high, over all. The suburban coaches will weigh about 78,000 lbs., and measure 59 ft. long, 8 ft. 10½ in. wide and 9 ft. 6½ in. high, inside measurements. The combination passenger and baggage cars will be 54 ft. 2½ in. long, 8 ft. 10½ in. wide and

ft. 6½ in. high, inside measurements. The special equipment for l includes: Simplex bolsters, Buffalo brake-beams and Lappin eel back brake-shoes for double hopper bottom and steel frame ondola cars, Long-Streeter steel back brake-shoes for the balance, estinghouse air-brakes, Magnus Metal Co.'s brasses, Gould coup-rs, Forsyth automatic curtain fixtures and Pantasote curtain ma-rial for vestibule, suburban and combination cars, Dunham doors r double hopper bottom cars, Miner draft rigging, and Pullman urnal boxes for milk, express, vestibule, suburban and combina-on cars, Woodman journal boxes for double hopper bottom and ame gondola cars, Pintsch gas light for express cars, Commercial etylene light for vestibule, suburban and combination cars, Amer-an Car & Foundry Co.'s steel platforms for suburban and com-nation cars, Barney & Smith seats for vestibule coaches, Simplex ailway Appliance Co.'s springs, Barber arch-bar trucks for double opper and steel frame gondola cars, Pullman broad vestibules r vestibule coaches, and Boies wheels for milk, express, vestibule, burban and combination cars.

BRIDGE BUILDING.

Anaconda, Mont.—An agreement, it is said, has been reached etween the city officials and the Butte, Anaconda & Pacific to intly build a steel bridge over Nevada avenue. The city's share the cost will be $10,000.

Arkansas.—The bill authorizing the Rock Island, Arkansas & ouisiana to build bridges over the Ouachita river and other navi-able rivers in Arkansas has been passed by both houses of Con-ress. (December 15, p. 192.)

Barrie, Ont.—A bridge is to be built over the Harlem river outh of Bradford by Sincoe County Council; also a bridge over he Sturgeon river east of Vasey.

Dominion City, Man.—A combined railroad and highway bridge to be built over the Red river at Morris. It is reported that the anadian Northern will put up the structure if this government grees to allow it a subsidy.

Jacquet River, N. B.—Surveys have been completed by the Pro-ncial Public Works department for building a stone and steel idge over the Jacquet river here to cost $15,000.

Jefferson City, Tenn.—A contract has been given to J. T. Mon-ay for building a bridge for the Southern Railway at this place. he contract for building several others on the line of the Southern n the east end of the Knoxville division has also been let to the ame party.

Lexington, Neb.—Bids are wanted January 10 by R. S. Thorn-on, County Clerk, for building all the bridges that may be needed n Dawson county during 1906.

Pittsburg, Pa.—A contract has been given to William B. Scaife Sons Co. for building a new trestle over Lowrey's run for the ittsburg Railways Co. The proposed structure will be 455 ft. long, arying from 30 ft. to 101 ft. in height, with girder spans from 5 ft. to 90 ft. each.

St. Louis, Mo.—Plans have been filed by the St. Louis, Kansas ity & Colorado for building a number of bridges over Olive street oad, North and South road and Hanley road in St. Louis county n its proposed cut-off under construction from Olivet to the inner elt line of the Terminal road.

Salem, Mass.—Bids are wanted January 4 by the Commis-ioners of Essex county for building the substructure and the uperstructure of a rolling lift bridge over the new canal on West-rn avenue in Gloucester. Bids are also wanted on the same date or building a bridge over the Danvers river between Salem and Beverly. James P. Hale is Assistant Clerk.

San Francisco, Cal.—Plans are being made to put up a steel iaduct about 1,000 ft. long to carry the electric street railroad racks over the Southern Pacific yards at Channel street.

Van Buren, Ark.—A bill was introduced in the House of Repre-entatives December 13, authorizing a bridge over the Arkansas river t or near Van Buren, Ark.

Vancouver, Wash.—On December 13, both houses of Congress assed a bill authorizing the Portland & Seattle to build a bridge ver the Columbia river. Construction must commence within one ear, and the bridge be completed in three years from the date of pproval of the act.

Other Structures.

Moncton, N. B.—The Intercolonial, it is said, is planning to ut up new locomotive shops at a cost of about $500,000.

New York, N. Y.—The New York Central & Hudson River has iled plans with the Bureau of Buildings for the second of its series f new buildings in connection with the new Grand Central station. The proposed building will have a frontage of 224 ft. on Lexington avenue, and be 275 ft. deep, and will cover the site of the "Grand Central Palace." The new building will be occupied by the branch U. S. postoffice and for the terminal offices of the company, but will first be used as a temporary station until the main building fronting on Forty-second street is completed. The cost of this structure will be about $1,000,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Athens & Jefferson City (Gainesville Midland).—A contract has been given by this company to Gwathmey & Mackall, of Norfolk, for building its proposed road.

Atlantic City & Shore (Electric).—This company has been formed to operate with electric power the line of the West Jersey & Seashore between Camden, N. J., and Atlantic City by way of Newfield. The line from Newfield to Atlantic City, which is single track, is to be double tracked at once. An account of the plans for electrification is given on page 594 of this issue.

Baltimore & Ohio.—At a recent meeting of the board of directors it was decided to four-track the line from Pittsburg, Pa., to Connellsville, a distance of 58 miles. The movement of coal and coke over this section is very heavy.

Beaumont, Sour Lake & Western.—This road, which is building an extension from Sour Lake west to Houston, Tex., a distance of 65 miles, is reported to have let the contract for building 56 miles from Sour Lake to Humble. (October 6, p. 111.)

Brandon, Saskatchewan & Hudson's Bay.—This company has completed track laying on its proposed road from Devil's Lake, N. Dak., to the international boundary. Work is to be pushed on the balance of the road to Hudson's Bay, and if the weather permits, grading will be continued all winter. (November 24, p. 166.)

Bronx, Yonkers & White Plains (Electric).—Incorporation has been granted this company in New York, with a capital of $110,000. to build an electric railroad 11 miles long, from the borough of the Bronx, New York City, to White Plains and to Yonkers. The directors include: John H. Matthews, C. H. West, George Matthews and M. H. Wood, all of New York City.

Brookville & Mahoning (Pittsburg, Shawmut & Northern).—Announcement has been made that contracts are to be let this month for extending this road from its northern terminus for a distance of 21 miles. The work includes the excavation of about 500,000 cu. yds. and building 200,000 cu. yds. of embankment, 20,000 cu. yds. of bridge, culvert and masonry work, and 1,000 tons of steel bridges and viaducts. The road is projected as extension of the Pittsburg, Shawmut & Northern toward Pittsburg, south from Hydes, in Elk County, Pa., to Freeport, in Armstrong County, 103 miles. Some of the grading work has been under way since last spring. About 15 miles on the west bank of the Allegheny, between Freeport and East Brady, are graded, and work is in progress at this end.

Buffalo, Taylorsville & State Line.—A charter has been granted a company under this name in Pennsylvania to build a railroad along Buffalo creek from Taylorstown, Washington County, to the West Virginia state line near Broom's station, where connection will be made with the railroad which is partially built from Wellsburg to Tate's Run. The company is being financed by Pittsburg and Claysville capitalists. At Taylorstown, connection will be made with the Baltimore & Ohio. The promoters of the proposed road have large coal fields along Buffalo creek.

California Midland.—An officer writes that contracts are to be let next month for building this proposed railroad, which is to be equipped for both steam and electricity, from Marysville, Yuba County, Cal., through Grass Valley to Auburn. The maximum grade will be 2.5 per cent. The work includes the building of three bridges. John Martin is President, and C. A. Trow, Chief Engineer, of Sacramento, Cal. (November 24, p. 166.)

Canadian Pacific.—This company, it is said, will lay new tracks on its line from Lethbridge to Kootenay Landing, a distance of 200 miles. New bridges will also be put in, the track reballasted and other improvements made.

Chicago, Lake Shore & South Bend (Electric).—Contracts have been given by this company for building its proposed road to connect Chicago with Cleveland and Cincinnati. To complete the Cleveland line there remains to be built a line between Fort Wayne and Warsaw, Ind., and plans now under way call for the completion of this branch within a year. Connection between Cincinnati and Chicago will be made over the Western Ohio and the Cincinnati, Dayton & Toledo. Edwin Hanna, J. B. Hanna and other Cleveland capitalists are interested.

Cleveland, Cincinnati, Chicago & St. Louis.—Bids are wanted

January 1, 1906, by W. M. Duane, Cincinnati, Ohio, Superintendent of Construction, for grading on the St. Louis division of this road between Indianapolis, Ind., and Lena. The work includes the excavation of 4,000,000 cu. yds. of earth. Bids are also wanted for work on the Cincinnati division between Middletown, Ohio, and Miamisburg, which calls for the excavation of 600,000 cu. yds. of earth, as mentioned on advertising page 22 of this issue.

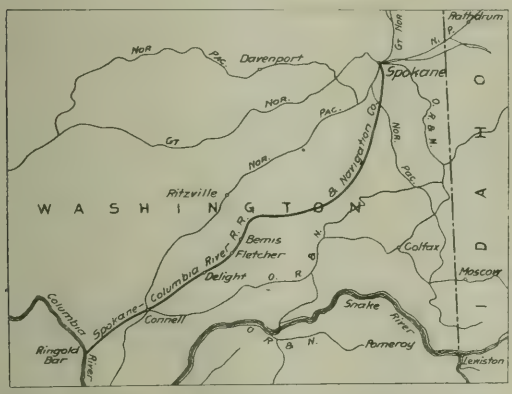
Work has been commenced by this company straightening its roadbed and reducing grade on the Cairo division near Swango Hill, and on the removal of heavy grades at Swango. The work covers a distance of five miles.

CRITTENDEN RAILROAD.—This company, which has a capital of $275,000, and is owned by the Crittendon Lumber Company, has completed 15 miles of railroad from Earle, Ark., on the St. Louis, Iron Mountain & Southern, to Heath, on the Rock Island-Frisco System.

DUNLAP & REDSTONE.—A charter has been granted a company under this name in Pennsylvania with a capital of $200,000, to build a railroad for a distance of about 10 miles, to open up coke fields controlled by W. J. Rainey in Menallen and Redstone townships, Fayette County.

GAINESVILLE MIDLAND.—See Athens & Jefferson City above.

SPOKANE-COLUMBIA RIVER RAILROAD & NAVIGATION.—An officer writes that grading work is under way on this proposed road from Spokane, Wash., southwest to Ringold Bar, on the Columbia river, where water connection will be made to Portland. The contract calls for the completion of 63 miles of the line by May 1, 1906, and an additional 85 miles by December 1, 1906. The line will run through a fine wheat growing section, and is expected to be in operation by next autumn. Track laying will be begun about January 15 by the Eldenbell Construction Co., 42 Broadway, New York, who have the contract. Additional contracts for grading and bridge work have been let to M. P. Zindorf, of Connell, Wash. The work will be very light. William F. Kyle is President, and W. S. Foster, Chief Engineer, both of 112 Wall street, Spokane, Wash. (November 24, p. 167.)



Spokane-Columbia River Railroad & Navigation Company.

GREEN BAY, OSHKOSH, MADISON & SOUTHWESTERN.—An officer writes that grading has been commenced on 15 miles of the line from Shawano, Wis., northwest of its proposed road to run from Madison, Wis., to North Crandon, on the Minneapolis, St. Paul & Sault Ste. Marie, a distance of 220 miles. The contractors are McDonell, O'Connor & Co., of Grand Rapids, Mich. W. K. Rideau is President; Leander Choate, Vice-President; R. H. Edwards, Secretary and Treasurer, and C. H. Hartley, General Manager, all of Oshkosh, Wis. (November 24, p. 166.)

KANSAS CITY, MEXICO & ORIENT.—Profiles and maps of the final survey have been submitted by this company to the Mexican Government for approval for its line through the Sierre Madres in the western portion of Mexico. The maximum grade will be 2½ per cent., and the greatest curvature 8° degrees. According to the survey, the road will run for several miles along the brink of a gorge 6,000 ft. deep and a mile wide. There remains about 200 miles of road through the mountains yet to be constructed to connect the Pacific coast with the interior. (October 20, p. 126.)

KNOXVILLE & MARYVILLE (ELECTRIC).—An officer writes that contracts will be let within 30 days by this company for building its proposed electric road from Knoxville south through Vestal, Rockford and Scottsville to Maryville, a distance of 16 miles. The work includes the building of one steel or concrete bridge. W. S. Nash of Knoxville is President, and Smith & Steele are agents for the company.

OKLAHOMA & TEXAS.—An agreement has been made by this company with the town of Lindsay, Ind. T., granting the company 10 miles of right of way through that town. (September 22, p. 95.)

PENNSYLVANIA.—See Pennsylvania & Newark below.

PENNSYLVANIA & NEWARK.—This company has been incorporated in New Jersey by Pennsylvania Railroad interests, with a capital of $500,000 to build a railroad from Trenton northeast to Newark, paralleling the present line of the Pennsylvania between those two points. The new road will provide an additional double-track line to be used for freight to relieve the existing line. The incorporators are: A. J. Cassatt, William A. Patton, Samuel Rea, T. D. Cuyler, W. H. Barnes, Henry Tatnall and F. L. Sheppard.

PITTSBURG, SHAWMUT & NORTHERN.—See Brookville & Mahoning above.

PORTLAND & BRUNSWICK (ELECTRIC).—Application has been made by this company which operates an electric line from Brunswick to Yarmouth in Maine, to build an extension of its road through Yarmouth, Falmouth and Cumberland, Me., connecting with Portland, a distance of 12 miles. E. J. Lawrence, A. B. Page, S. A. Nye, A. F. Gerald and C. W. Davis, of Waterville, Me., are interested.

RICHMOND & CHESAPEAKE BAY (ELECTRIC).—Contracts have been let by this company to Phillips & Alport, of Richmond, Va., for building its proposed extension from Brook Turnpike to Hungary road, and to H. H. George, also of Richmond, to build the balance of its proposed road to Ashland, Va. (December 8, p. 184.)

ROGERS SOUTHWESTERN.—This company, which was incorporated last year, is being financed by capitalists of Rogers, Benton County, Ark., and has completed surveys and secured rights of way for building its proposed road from that place southwest to Springtown, a distance of 20 miles. W. R. Felker, of Rogers, is interested.

SOUTH & WESTERN.—This company, it is reported, will soon let contracts for building an additional 200 miles of its proposed road in Virginia and North Carolina. The work will probably be done between Clinchport, Va., and Kingsport, Tenn., and between Spruce Pine, N. C., and Marion, N. C. Work is now under way by the Carolina Construction Co., which was organized by George L. Carter, President of the S. & W., in North Carolina, and it is said that this company may get the entire contract. Other contracts have been let to Walton & Wilson and J. E. Rode & Co. for 50 miles between Kingsport and Erwin, but work has not yet been begun.

UNION PACIFIC.—Articles of incorporation have been filed by this company in Nebraska to build an extension of its Cedar Rapids branch from the northern terminus at Spalding, Neb., northeast for a distance of 150 miles into South Dakota. The proposed line will cross the Chicago & North-Western's Wyoming line.

VIRGINIA & CAROLINA COAST.—The contract has been let to J. G. White & Co., of New York, by this company for building its proposed road from Mackey's Ferry, N. C., through Columbia, thence over Pamlico river by ferry, through Bayboro and over the Neuse river to Beaufort, N. C., a distance of about 113 miles. The work, which will be very light, is now under way. The officers of the company are: R. T. Goodell, President; F. E. Dewey, General Manager, and A. N. Bullitt, Chief Engineer, all of Norfolk, Va.

WABASH.—Official announcement has been made that contracts will shortly be let for building a connecting link between the Wabash and the Union Railroad at Pittsburg. The completion of this link will enable the Wabash to secure some of the freight from the Pittsburg mills, which it has long desired.

WESTERN PACIFIC.—About 2,400 men are at work on the grading of this road between San Francisco and the Nevada state line, and several thousands more would be employed if they could be had. Eighteen miles of the old Tesla coal road are utilized in approaching Stockton. The Utah Construction Co., which has all of the work between Oroville and the Nevada line, is pushing the work on the approaches of the 6,000-ft. tunnel at the summit, and on the 7,300-ft. tunnel at Spring Garden, where the road crosses from Spring Garden Creek to the middle fork of the Feather river. The boring of the tunnels will soon be begun. The following description of the route from Oakland, Cal., to Salt Lake has been given out by officials of the company in San Francisco. The route leaves the company's terminals at Oakland by way of Third street, following the general route of the Southern Pacific as far as Niles. Like the Southern Pacific it enters the Niles Canyon, but on the opposite side of Alameda creek from that occupied by the S. P. The high country in the eastern end of Alameda County is avoided by a 4,000-ft. tunnel that is to enter the hills from a point in Niles Canyon, keeping the grades down to 1 per cent. From the east portal of the Niles Canyon tunnel the route extends to Livermore and then to a connection with the Alameda & San Joaquin Rail-

road, which is to afford the Western Pacific an entrance into Stockton. On the Alameda & San Joaquin a number of curves and gradients are to be corrected. From Stockton to Sacramento, the route lies between the track of the Southern Pacific Company and the Sacramento river. Just how the road will enter Sacramento has not been definitely decided upon. Between Sacramento and Oroville, the new road will lie between the tracks of the Southern Pacific and the Sacramento river, and north of Oroville the road will closely follow the north fork of the Feather river for a considerable distance, and then swing southeasterly to Beckwith Pass, leaving Quincy, the county seat of Plumas county, a few miles to the south and west. Two tunnels, each about 7,000 ft. long, will enable the Western Pacific to keep within maximum grade of 1 per cent. in its climb over the Sierra. Through the Beckwith Pass the new road will parallel for a considerable distance the tracks of the Sierra Valley Railway. Then the road will make a sharp bend to the northeast, passing to the northward of Pyramid Lake, and from that point will shoot straight for Winnemucca. From Winnemucca to Wells it will closely follow the tracks of the Southern Pacific, and from Wells the road will take the straightest possible course to the southern end of Great Salt Lake. In Salt Lake City it will reach the terminals of the Rio Grande Western. Thirty construction camps have been located at various points along the line of the road by the contractors. The entire line from Oakland to Salt Lake, with the exception of that portion of the route that lies in the state of Nevada, is now under contract. No contracts will be given for the work in Nevada for some time to come.

West Jersey & Seashore.—See Atlantic City & Shore.

RAILROAD CORPORATION NEWS.

Alabama Great Southern.—The shareholders will vote on Dec. 29, on a proposition to liquidate the Alabama Great Southern Railway, Limited, which is an English holding company for the railroad. As the Southern Railway now holds the majority of the outstanding stock of the English company, it has been decided that there is no reason for its further existence. The proposition is to exchange shares of Alabama Great Southern Railroad Company stock at par for the shares of the English company.

Boston, Revere Beach & Lynn.—This company, a narrow gage road from Lynn to Boston, with 17 miles of line, has declared a semi-annual dividend of 2 per cent. on its $850,000 capital stock. The annual rate last year was 2 per cent.

Canadian Pacific.—The sales of land by this company during the month of November were the largest during any fall month in the history of the company, the total being 202,667 acres for $1,075,165, as compared with the sale in the same month last year of 26,032 acres for $112,843.

Chicago, Cincinnati & Louisville.—See Cincinnati, Hamilton & Dayton.

Chicago, Rock Island & Pacific.—This company has declared a quarterly dividend of 1½ per cent. on its $74,842,600 capital stock outstanding. During the year 1904 the annual rate was 8¼ per cent., and this year 2 per cent. was paid in January, 2 per cent. in April and 2¼ per cent. in October.

Cincinnati, Hamilton & Dayton.—In the application for a receivership the amount of the floating debt of this company, as of Dec. 1, is given as $6,625,000. The following transactions are mentioned as most seriously damaging the solvency of the C., H. & D.: The purchase of 110,000 shares of the common stock of the Pere Marquette by the C., H. & D. at 125; the tripartite agreement between the Pere Marquette, the C., H. & D. and the Toledo Railway & Terminal Co., under which the last named company was leased at a high rental and $3,500,000 of bonds guaranteed; the agreement by which the C., H. & D. became liable for one-half of $3,500,000 bonds issued to buy the Chicago, Cincinnati & Louisville, and also for one-half of the interest on the $6,000,000 prior liens of the C., C. & L.

It is expected that receiver's certificates will be issued shortly to pay the January interest on the bonds and notes of the company. This interest amounts to $855,520, and in addition there will fall due at the same time $70,000 interest on the joint collateral notes issued for the purchase of the C., C. & L., and $289,382 in dividends on Pere Marquette stock, which constitutes a rental under the lease of that road, making in all $1,214,902 falling due on Jan. 1, 1906.

The *Boston News Bureau* has given out the following statement obtained from former owners of the C., C. & L.: "The syndicate which built the C., C. & L. was approached in the summer of 1904 by interests representing the Pere Marquette, with a view to purchase. Negotiations culminated on July 5 in a sale of all the stock of the C., C. & L. to the Pere Marquette. The Pere Marquette paid for this stock $3,500,000 in 4 per cent. ten-year collateral trust bonds, secured on the $4,206,000 stock of the C., C. & L. The bonds are Pere Marquette bonds. The syndicate agreed to deliver the C., C. & L. to the Pere Marquette free of all floating debt, and with bonds at $25,000 a mile including equipment. It was stipulated that, while the road would be delivered immediately for operation, control of the directorate would not pass until the collateral trust bonds were also endorsed by the C., H. & D. The bonds endorsed by the C., H. & D. have not yet been delivered and the original syndicate controls the directorate of the C., C. & L. and holds the executive offices. The C., C. & L. is laid with 70-lb. and 85-lb. rails. It has its own terminals in Cincinnati. It had a contract for terminals on the Chicago Terminal, but the line lacked a connection of nine miles when the road was sold. Under the arrangement for sale, the nine-mile connection was to be built by the new owners with money provided by the sellers, and on deposit in a Boston trust company. That connection has never been built. The money is still on deposit in Boston. No commission was paid to United States Mortgage & Trust Co. or anyone else. . . . The trade was concluded some days before the C., H. & D. bought the Pere Marquette."

Denver & Rio Grande.—The New York Stock Exchange has listed $1,312,700 additional preferred stock. The proceeds of this issue were used as follows: $1,200,000 were exchanged for $750,000 Utah Fuel bonds and $450,000 cash; $112,700 were exchanged for $902,200 Rio Grande Southern stock.

Massachusetts Electric.—This company paid no dividends during 1905 on its $20,557,400 preferred stock. Last year 4 per cent. was paid. The reasons given are the large sums taken from the surplus for reconstruction, and the expectation of further deductions for the same reason. The gross earnings of the company during the year ended September 30th were $6,734,127, an increase of $353,264. The net earnings were $2,277,824, an increase of $376,482; and the surplus was $734,310, an increase of $295,594.

Mexican Central.—The New York Stock Exchange has listed $11,613,200 additional common stock of this company. Of this issue $160,000 is to retire old income bonds; $625,000 to refund the bonds and floating debt of the Chihuahua & Pacific; $5,000,000 in exchange for 50,000 shares of Mexican Pacific; $328,200 for income bonds not exchanged; $1,999,000 to be issued for Mexican Pacific stock for par; $1,000 for 10 shares of the latter company under agreement from private owners, $1,000,000 to Ladenburg, Thalman & Co., and Hallgarten & Co., for funds advanced for new construction, and $2,500,000 to the Atlantic Construction Company.

Mohawk Valley Company.—A company of this name was incorporated in New York State in February with capital stock of $100,000 and authority to build railroads, to organize other corporations and to buy, hold and dispose of stocks and bonds of other corporations. The incorporators and first directors were all connected with the New York Central, and included William A. Greer, Assistant Treasurer, and Landreth H. King, Registrar of Contracts, of that company. It was believed at the time that the Mohawk Valley Company was to be a holding company for electric railway properties in which the New York Central and Delaware & Hudson are interested. On December 16, the Mohawk Valley Company, whose headquarters are at Utica, N. Y., filed a certificate of increase of its capital stock to $10,000,000. This certificate was signed by Horace E. Andrews, of Cleveland, Ohio, who, in connection with the New York Central, has been acquiring various electric railway properties in the central part of New York State. Edward L. Rossiter, Treasurer of the New York Central, as Treasurer of the Mohawk Valley Company, certified on the certificate that Mr. Andrews is the owner of all its capital stock. Whether the increase in the capital stock is for the purpose of taking over the Schenectady Railway, which is owned jointly by the New York Central and Delaware & Hudson, or some other of the electric railroad properties bought by the Andrews-Vanderbilt syndicate, or is made in connection with the electrification of parts of the West Shore Railroad has not as yet been announced.

Pere Marquette.—See Cincinnati, Hamilton & Dayton.

Philippine Roads.—See page 195 of this issue.

Pittsburg, Youngstown & Ashtabula.—The shareholders will vote on Jan. 8 on a proposition to consolidate this 125-mile road with the Newcastle & Beaver Valley, 15 miles long.

Southern.—See Alabama Great Southern.

United Traction & Electric Company.—N. W. Harris & Co., of New York, are offering $500,000 first mortgage 5 per cent. gold bonds of 1933 of the United Traction & Electric Company, which owns the entire street railway system of Providence, R. I., and neighboring towns, amounting to about 345 miles of road.

GENERAL NEWS SECTION

NOTES.

A bill will be introduced in the Canadian Parliament at the next session, and undoubtedly will be passed, to pension the old employees of the Intercolonial (Government) Railroad. There are about 300 men on the road who will probably be retired. Mr. Emmerson, with engaging frankness, says that it will not be necessary to fill the vacated positions.

It is announced that the new through train between St. Louis and the City of Mexico, which is to be put in service January 16, is to run through in about 55 hours, a somewhat shorter time than was named in the first announcement. This train will run twice a week each way, and will carry only sleeping car passengers. It runs over the St. Louis, Iron Mountain & Southern, the Texas & Pacific, the International & Great Northern and the National Railroad of Mexico.

The principal railroads of the State of Washington, after a conference with the State Railroad Commissioners, have decided to restore, with some alterations, the joint through freight rates which were abolished some time ago. The new agreement includes Tacoma and all non-competitive territory on the Oregon Railroad & Navigation Company's line. The new rates will also cover live stock, hay, grain, coal and other articles not before included. The newspapers say that the new rates show substantial reductions on many articles between eastern Washington and the cities on Puget Sound, and that the decision to adopt these rates is a victory for the Railroad Commission.

Shipments of Iron Ore in 1905.

The *Marine Review* estimates the total ore shipments by lake during 1905 as 33,476,904 tons, which is 12,250,313 tons in excess of the movement of last year. To these figures is yet to be added the all-rail movement which will probably exceed 500,000 tons, so that the total movement of ore from the Lake Superior mines during 1905 will be 34,000,000 tons. The 1905 movement is, therefore, over 6,000,000 tons greater than the movement of 1902, and is the record breaking movement on the great lakes. Of this great movement the Oliver Iron Mining Co. shipped 18,779,374 tons. Shipments during December aggregate 405,060 tons, an increase of 38,689 tons over the movement of the corresponding month last year. The shipments by months during the year have been as follows: April, 1,195,173 tons; May, 4,619,431 tons; June, 4,999,451 tons; July, 5,224,619 tons; August, 5,009,382 tons; September, 4,425,550 tons; October, 4,257,009 tons; November, 3,341,229 tons; December, 405,060 tons.

Following were the shipments by ports during the month of December and during the full season, with comparative data for the previous year:

	December		Season	
Port.	1904.	1905.	1904.	1905.
Escanaba	137,344	131,553	3,644,267	5,307,938
Gladstone	.....	.....	480	.....
Marquette	40,416	52,578	1,907,301	2,977,828
Ashland	18,422	25,224	2,288,400	3,485,344
Superior	37,926	75,151	4,169,990	5,118,385
Duluth	75,599	39,853	4,649,611	8,807,559
Two Harbors	56,670	80,701	4,566,542	7,779,850
Total	366,371	405,060	21,226,591	33,476,904
Increase for 1905		38,689		12,250,313

Standard Locomotives for India.

The British Engineering Standards Committee has just issued a revised edition of its report on standard locomotives for Indian railroads, embodying some slight changes in detail which have been suggested by experience of the standard engines already built according to its specifications. The designs provide for five engines, two for the broad 5 ft. 6 in. gage and three for the narrow meter gage. The former comprise a passenger engine of the American or 4-4-0 type and a goods engine of the six-coupled 0-6-0 type, and the latter a 4-6-0 passenger engine, a mixed traffic or goods engine of the same type, and a goods engine of the 4-8-0 or Mastodon type. The two broad gage engines are identical in regard to their boilers, as indeed they are in every other respect, except so far as differences are involved by the different sizes and arrangement of the wheels. The total heating surface is 1,349.5 sq. ft., with a grate area of 25.3 sq. ft.; the steam pressure is 180 lbs., and the cylinders have a diameter of 18½ in. with a stroke of 26 in. But the passenger engine has driving wheels of 6 ft. 2 in. diameter, including 3 in. tires, while those of the goods engine are of 5 ft. 1½ in. diameter, also including 3 in. tires, and the total weight in working order, exclusive of tender, is 51 tons for the former and 48 tons for the latter. The weight on the axle of each pair of driving wheels is 16.25 tons in each case except that of the rear axle of the goods engine, on which it is 15.5 tons. The tenders are the same for both engines; they are carried on six wheels, weigh 39.5 tons in working order, and have a capacity for fuel of 7½ tons and for water of 3,000 gallons. For the three meter gage engines the boilers again are all the same, having Belpaire fireboxes, with a heating surface of 1,062 sq. ft., a grate area of 16 sq. ft., and a working pressure of 180 lbs. The stroke is 22 in. in each case, but the diameter of the cylinders is 15½ in. for the passenger engine, 15 in. for the mixed traffic engine, and 16 in. for the goods engine. The diameters of the driving wheels are 4 ft. 9 in., 4 ft., and 3 ft. 7 in., all the tires being 2½ in. The engines weigh in working order 33.70 tons, 33.30 tons, and 39.50 tons, the weight on each driving axle being 8.7 tons, 8.6 tons, and 8 tons. The six-wheeled tenders for these engines weigh 22.95 tons, and hold four tons of fuel with 2,000 gallons of water.

In its original report the committee pointed out that these designs, especially as regards the broad-gage, only provided for engines and tenders of the type which it was thought would prove most useful at the present time on the majority of Indian railroads; but it intimated its opinion that it would be found necessary to design other types for heavy passenger and goods work, as well as for special use in hilly country and for shunting purposes. The justness of this opinion has since been demonstrated by a request from the Secretary of State for India that the committee will consider the advisability of standardizing three types of broad-gage locomotives of a heavier type—a request which is now receiving attention.

Mr. Prouty Decides in Favor of the Railroad.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the case of Artz against the Seaboard Air Line. It appears that the carrier's passenger fare from Fernandina, Fla., to Savannah, Ga., 124 miles, is $5, or about 4 cents per mile, while a rate of 3 cents per mile is fixed by state authority for fares within the states of Florida and Georgia. The carrier's line between Savannah and Fernandina or Jacksonville is more expensive to maintain than other parts of its system, and the freight traffic is light and the local passenger traffic insignificant. A reduction of this interstate passenger fare would not contribute to the development of the section or increase materially the passenger business of the line. Reducing the fare to 3 cents per mile would render the earnings of this part of the system less than the average upon the whole system and less than the average in that part of the country of other roads.

The Commission holds that ordinarily the through interstate passenger fare should not exceed the sum of local fares, but there is no specific requirement in the regulating statute to that effect and the only question for determination is whether the fare complained of is unreasonable. It is held that upon all the circumstances the fare in question cannot be deemed excessive and the complaint is therefore dismissed.

Took Him at His Word.

Paul Morton, at a convention of railroad men, said of the railroad hog:

"I wish that all these men could be treated as a certain Marylander once was. The Marylander boarded a train with two armloads of bundles. He sat down, and piled his bundles beside him. Then he opened a paper and began to read in great comfort. The car by degrees grew crowded. At last the only vacant seat was the bundle-filled one beside the Marylander. Though several passengers hesitated beside this seat, looking at the Marylander wistfully, he made no sign. He would rather let the people stand than remove his goods. Finally someone summoned the conductor. He hurried in and said:

"'Take down those bundles, please, at once. Don't you see, sir, that there are ladies standing all about you?'

"The Marylander was a perfect example of the railroad hog. He said in a blustering tone:

"'What is the matter with you? Those bundles don't belong to me. They belong to a man in the smoker.'

"'All right,' said the conductor. 'I'll pile them up here, then, till he comes.' And he put the bundles in the rack overhead, and gave the vacant seat to a lady.

"The Marylander laughed because he had not had to move his bundles himself; but, when he came to get off, he did not laugh so heartily. As he was gathering his precious pile together, the conductor hurried to him and said sternly:

"'Don't touch those packages, sir. They belong to a gentleman in the smoking car.'

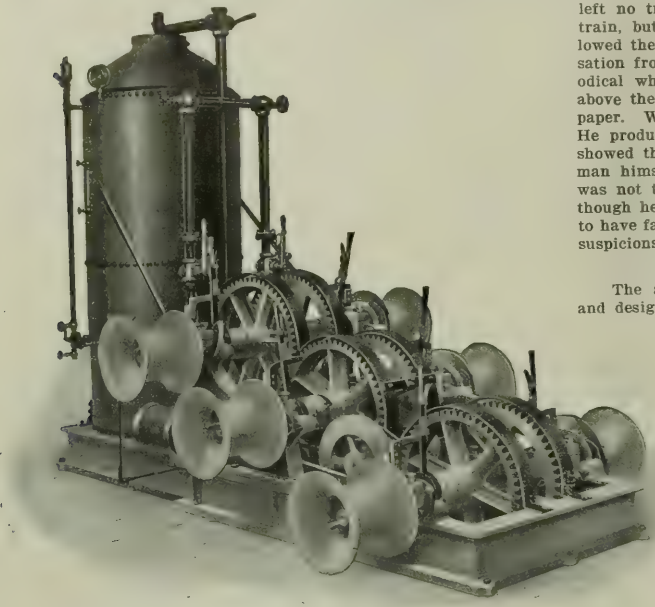
"'Ah, what's the matter with you?' snarled the other. 'They belong to me.'

"'You said they didn't,' answered the conductor, 'and I am going to take you at your word. The only way you can get them is to come and identify them at our main office to-morrow.'"—*Express Gazette.*

Lidgerwood Improved Erecting Engine.

The accompanying illustration shows the latest type of Lidgerwood hoisting engine, made by the Lidgerwood Manufacturing Co., New York. This engine is specially designed and largely used in bridge erection work as well as in the construction of iron buildings. It is equipped with winches or spools instead of drums on account of the large amount of rope usually to be wound in this class of work, and the fact that with the winch or spool the quantity that can be taken care of is practically unlimited.

The spools are all keyed fast to the shafts, which are independent and supported by a central bearing. Each spool-shaft has its own gear running loose on the shaft, and fitted with a jaw clutch. The jaw clutches are of the Lidgerwood improved spiral type, and can



Lidgerwood Improved Erecting Engine.

be thrown in at any position by small hand levers which have thumb-latches, engaging with notches on the quadrants, so that when the clutches are thrown in they cannot come out, and when thrown out there is no danger of their accidentally becoming engaged. The spools being independent enables the engine to be operated to great advantage in bridge erection, as several members of a truss or girder can be hoisted and held in position while they are being bolted or riveted. By having several men at the engine these members can be hoisted simultaneously, the number hoisted being limited only by the hoisting capacity of the engine and the number of spools. By making fast to each end of a long and heavy girder, and by hoisting first on one end and then on the other, a much greater weight can be handled than by means of a drum hoist. The tackle can also be multiplied as much as desired, since any amount of rope can be wound on the spools. This engine is especially well proportioned for the severe character of hoisting duty it has to perform. The bed-plate is in one piece, and is widened in front so that the working parts of the engine are all inside of the side frames. This leaves the winches clear so they can be operated without danger to the man handling the lines. The shaft bearings are wide, and the shafts are of the best hammered steel and unusually large, to withstand the strain due to handling heavy weights on the overhanging spools. The gearing is extra strong and heavy, and the engine can be operated from either side. An important element in the success of this engine lies in the form of the spool, which is especially adapted to the class of work for which the engine is designed to be used. When desired the engine can be equipped so as to be self-propelling in either direction.

Pensions on the New York Central.

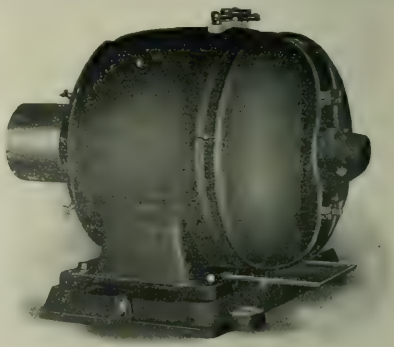
The directors of the New York Central and of the railroads allied with it have decided to pension their old employees, and a committee has been appointed to prepare a plan. An age limit will be established, and there will be regulations for the retirement of the superannuated, similar to those now in force on a number of other roads. The members of the committee are Vice-Presidents W. C. Brown and John Carstensen, General Superintendent Deems of the Mechanical Department, and the General Managers of the four principal roads in the New York Central system—Messrs. A. H. Smith, W. H. Marshall, R. H. L'Hommedieu and C. E. Schaff. Before long this committee will make its report, establishing the rules and regulations, and naming the date when pension allowances will begin.

Chicago Outclassed.

A suit brought against the Taff Vale Railway for compensation for injuries has revealed an example of nerve for which it is difficult to find a parallel; that of a man who deliberately lay in front of a train and had his legs cut off. The plaintiff claimed that the jolt of a train threw him against a door, which opened and allowed him to fall across the track. The train passed over both his legs, which had to be amputated. The company produced evidence which left no trace of doubt that the plaintiff had not traveled by the train, but had deliberately placed his legs on the tracks and allowed the train to run over them for the sake of getting compensation from the company and £500 from the proprietors of a periodical which offers that sum to any reader who loses both legs above the ankles in a railway accident while in possession of the paper. When the plaintiff was found he was perfectly conscious. He produced three pocket handkerchiefs, tied them together and showed the man who found him how to make a tourniquet. The man himself properly adjusted the bandage. The fact that there was not the slightest mark on either his body or his clothes, although he weighs 210 pounds, and the train from which he claims to have fallen was traveling at the rate of 30 miles an hour, aroused suspicions and inquiries followed.—*London Press Despatch.*

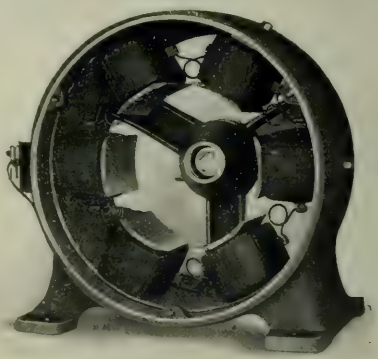
The Sprague Type D Direct Current Motor.

The accompanying illustrations show the general appearance and design of the new type D motor made by the Sprague Electric



The Sprague Enclosed D 4-Pole Motor.

Company, New York. These motors are made in nine different sizes of frames, ranging from 10 h.p. to 90 h.p. for standard slow speeds, and from 15 h.p. to 105 h.p. for standard moderate speeds. They are fitted with either shunt, series or compound wound field



Yoke of the Sprague Type D 6-Pole Motor.

windings for use on 115, 230 or 500-volt d.c. circuits. They are made entirely enclosed, semi-enclosed and open. The small sizes are bipolar, but from 20 h.p. up they are multipolar.

Stay-Bolt Iron for the Harriman Lines.

The Bethlehem Steel Company has been awarded the contract for furnishing stay-bolt and boiler brace iron to all of the Harriman lines in such quantities as may be required during the year

1906. The Union Pacific, Oregon Short Line, Oregon Railroad & Navigation Co., Southern Pacific and the Chicago & Alton are to be supplied under this contract. The Bethlehem Steel Company has recently erected a new mill for making high-grade stay-bolt iron, and is furnishing it in large quantities to many of the largest railroads in the United States and Mexico.

New Dining Cars on the London & North-Western.

The London & North-Western has recently introduced on its lines some dining cars of the American type with movable individual seats which are an innovation in British practice. In the usual

Interior of London & North-Western Dining Cars.

types of British dining cars the seats are fixed and heavily cushioned, much after the style of the seats in the compartments. The new cars are 65 ft. 6 in. long over body and 69 ft. 6 in. long over buffers. The width over eaves is 9 ft., and the height from rail to top of roof is 8 ft. 7 in. They are mounted on two six-wheel trucks, having a wheel-base of 11 ft. 6 in. The cars were built at the Wolverton Works from the designs of Mr. C. A. Park, Carriage Superintendent of the London & North-Western.

Bids for Philippine Railroads Rejected.

All the bids recently submitted for concessionary contracts or grants for the construction of railroads in the Philippine Islands were rejected by the Bureau of Insular Affairs, because the bidders did not conform to the strict specifications called for in the proposal. The Bureau will advertise for new proposals to be opened January 20. The terms will be modified.

Manufacturing and Business.

H. B. Underwood & Co., makers of special tools for railroad repair shops, Philadelphia, Pa., are distributing their 1906 calendar, and will be glad to send a copy to any one interested.

The Bettendorf Axle Company, New York, has received an order from the Southern Railway Co. for 30,000 bolsters and 1,000 cast-steel trucks. This, we believe, is the largest single order ever placed for bolsters.

The Midland Navigation Company of Canada is to have built at Collingwood a lake steamer to be 450 ft. long and with capacity to carry 9,000 tons of grain. This will be the largest Canadian steamer on the lakes.

The November and December issue of *The Obermayer Bulletin* foundry information is being distributed by The S. Obermayer Co., Chicago. It contains a number of articles on foundry practice and management, as well as its usual amount of light reading matter.

The Telegraph Signal Company has filed a certificate of incorporation with the Secretary of State at Albany, N. Y.; capital, $100,000. The company proposes to make an electrical device for enabling a train despatcher to arouse inattentive operators at stations along the line, and to remove difficulties due to accidental grounding of a wire at way stations. Among the directors are John McGarvey, Superintendent of the Buffalo, Rochester & Pittsburg Railway at Rochester, N. Y., and James G. Halleran, of Oswego, N. Y. The inventor of the device is S. A. Wright, of Morton, N. Y.

The American Blower Company, of Detroit, is furnishing mechanical draft apparatus for the Huntsville (Alabama) Railway, Light & Power Company; the New York, Susquehanna & Western Railway Company at Rochelle Park, N. J.; the C., B. & Q. Railway Company at St. Paul and Chicago; the Lackawanna Coal Company at Olyphant, Pa., and the Lehigh Coal & Navigation Company at Lansford, Pa. It is also furnishing heating apparatus for some of the Pennsylvania Railroad Company's new shops at Allegheny; for the Lincoln ark shops of the B., R. & P. Railway at Rochester; Kingsland, New Jersey, shops of the Delaware, Lackawanna & Western, and for the Schenectady Works of the American Locomotive Company.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—D. F. Kirkland, Superintendent at Waycross, Ga., has resigned.

Canadian Northern.—W. A. Brown, Superintendent at Port Arthur, Ont., has been appointed General Superintendent, with office at Winnipeg, Man.

Canadian Pacific.—W. S. Painter has been appointed Architect, with office at Montreal.

Chicago, Burlington & Quincy.—F. E. Kennedy has been appointed Master Mechanic at McCook, Neb., succeeding R. B. Archibald, resigned.

Colorado & Southern.—J. H. Bradbury, Assistant General Auditor, has been elected General Auditor, with office at Denver, Colo., succeeding A. D. Parker, promoted. J. S. MacKie has been elected Secretary and Treasurer, succeeding H. Bronner, who remains on the executive committee.

Lehigh & Hudson.—M. Rutherford, General Freight and Passenger Agent, has been elected Vice-President and General Manager. H. G. Pierson succeeds Mr. Rutherford.

Louisville & Atlantic.—R. N. Hudson, Roadmaster and Chief Engineer of the Louisville, Henderson & St. Louis, has been appointed General Manager of the L. & A., effective January 1.

Louisville & Nashville.—F. Kesler, Acting Assistant Superintendent at Birmingham, Ala., and previously Trainmaster, has been appointed Assistant Superintendent, succeeding E. J. Haylow, deceased.

Louisiana & Northwest.—J. J. Nelson has been elected President, with office at St. Louis, succeeding C. O. Ferguson. H. C. Brown, Manager, has been elected Vice-President, with office at Magnolia, Ark., succeeding J. O. Richardson. Mr. Richardson has been elected Secretary, with office at Homer, La., succeeding A. R. Porterfield.

Missouri & Illinois Bridge & Belt.—William Graham, Superintendent, has resigned. Arthur Hamilton succeeds Mr. Graham, with office at Alton, Ill.

W. L. Bedison, Auditor, has resigned.

Missouri, Kansas & Texas of Texas.—C. H. Scott, Trainmaster at Smithville, has been appointed Superintendent at Greenville, Tex., succeeding W. E. Williams, resigned to go to the Missouri, Kansas & Texas.

New York, Westchester & Boston.—F. H. Bull has been elected Vice-President and a Director.

Pullman.—F. E. Rice, District Superintendent at St. Paul, has been appointed Manager of the Western division, with office at Chicago.

Southern.—M. M. Richey, Assistant General Superintendent at Birmingham, Ala., has resigned.

J. W. McCay, formerly Roadmaster on the Evansville & Princeton Traction, has been appointed Superintendent of the Evansville, Rockport and Cannelton branches of the Southern.

Union Pacific.—W. R. Kelly, General Solicitor, has resigned, effective January 1.

Wabash.—F. E. Signer, Manager of the Lehigh & Wabash Despatch, has been appointed Assistant General Freight Agent of the Wabash, with office at St. Louis, effective January 1. He will be in charge of all the fast freight business done by the Wabash lines.

LOCOMOTIVE BUILDING.

The Nevada Consolidated Copper Company has ordered three 8-in. x 14-in. standard gage mining locomotives from the H. K. Porter Co.

The Sierra Railway Company, of California, has ordered two 10-in. x 16-in. oil burning locomotives of 30-in. gage from the H. K. Porter Co.

The Cuba Eastern is reported in the market for two 90,000-lb. mogul locomotives and one 60,000-lb. switching locomotive. Mr. De Zayas is Purchasing Agent, Orient Building, 79 Wall street, New York.

The Kilpatrick Bros. & Collins Contracting Company, Omaha,

Neb., has ordered three 10-in. x 16-in. 36-in. gage contractors locomotives of 36,000 lbs. each, and two 14-in. x 20 in. standard gage locomotives of 68,000 lbs. each from the H. K. Porter Co.

The Minneapolis & St. Louis, as reported in our issue of December 1, has ordered eight simple mogul (2-6-0) locomotives from the Schenectady Works of the American Locomotive Co., and two switching locomotives from the Baldwin Locomotive Works, instead of from the American Locomotive Co., as reported in our issue of December 22. The mogul locomotives will weigh 140,000 lbs., with 118,950 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 64 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; 316 Otis steel tubes, 2 in. in diameter and 147 in. long; Otis steel firebox, 96½ in. x 62 in.; and tank capacity, 7,000 gallons of water. The special equipment includes: "She" bell ringers and sanding devices, Franklin boiler lagging, Simplex brake-beams, Street-Perfecto brake-shoes, Wabash headlights, Monitor and Ohio injectors, Damascus journal bearings, Jerome's piston and valve rod packings, Ashton safety valves and steam gages, Nathan sight-feed lubricators, A. French Spring Co.'s springs, Taafel's steam heat equipment, Midvale driving wheel tires, and Boies truck and tender wheel tires.

The Mobile & Ohio has ordered 10 simple ten-wheel locomotives from the Baldwin Co. These locomotives will weigh 170,000 lbs., with 130,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 62 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,944 sq. ft.; 361 Detroit seamless steel tubes, 2 in. in diameter and 15 ft. long; Otis firebox, 120⅝ in. x 41⅛ in.; grate area, 34 sq. ft.; tank capacity, 7,000 gallons of water, and coal capacity, 15 tons. The special equipment includes: Westinghouse air-brakes, Western bell ringers, Manville boiler lagging, Damascus brake-beams, Streeter brake-shoes on tender, Gould couplers, Pyle and Dressel headlights, Ohio injectors, Ajax journal bearings, U. S. metallic piston and valve rod packing, Consolidated safety valves, Leach sanding devices, Chicago sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, Ashcroft steam gages, Latrobe driving, truck and tender wheel tires, also Paige steel-tired engine and tender truck wheels, Miner tandem draft gear on tender, Elvin driving box lubricator, Bordo blow-off cocks, Brewer fire door opening device, and Scully-Gallagher tender bolsters.

CAR BUILDING.

The Raleigh & Pamlico Sound, it is reported, has ordered 500 cars.

The Chicago, Burlington & Quincy is in the market for 1,000 box cars.

The East Carolina, it is reported, is in the market for one passenger coach.

The Zanesville & Crooksville has ordered one express car from the Jewett Car Co.

The Zanesville & Southeastern has ordered one express car from the Jewett Car Co.

The Minneapolis & St. Louis has ordered one cafe observation car from the Pullman Co.

The Rogers & Southwestern is figuring on new equipment. Address J. E. Felker, Rogers, Ark.

The Evansville & Terre Haute has ordered 1,500 coal cars from the American Car & Foundry Co.

The Aurora, Elgin & Chicago Ry. Co., Chicago, has ordered one express car from the Jewett Car Co.

The National Packing Company, Chicago, will shortly be in the market for a number of beef cars.

The Quebec Central is considering the purchase of 20 stock and refrigerator cars and six passenger cars.

The Tidewater, it is reported, will shortly be in the market for upwards of 1,200 additional freight cars.

The Chicago Great Western, it is reported, will probably build 200 box cars in its own shops early in 1906.

The St. Louis, Rocky Mountain & Pacific is figuring on the purchase of two combination cars and one coach.

The Interborough Rapid Transit, New York, is figuring on material for 10 passenger cars to be built at its own shops.

The New York Central has ordered 50 passenger coaches, 30 baggage cars, and four cafe cars from the Pullman Co.

The Boston & Worcester (Electric), it is reported, will shortly ask bids on a number of semi-convertible cars 52 ft. long.

The Buffalo, Rochester & Pittsburg will shortly be in the market for additional equipment to that reported in our issue of December 8.

The Northern Pacific has ordered 10 dining cars, 11 tourist sleeping cars, 15 baggage cars, and 30 passenger coaches from Barney & Smith.

The Boston & Maine has ordered 1,000 box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co. and 500 box cars from the Pullman Co.

The Cuba Eastern is reported in the market for 80 box cars of 60,000 lbs. capacity and seven passenger cars. Mr. De Zayas is Purchasing Agent, Orient Building, 79 Wall street, New York.

The Buffalo, Rochester & Pittsburg has ordered ten 66-ft. passenger cars and two 66-ft. combination passenger and baggage cars from the Pullman Co. These cars are for May, 1906, delivery, and will be equipped with wide vestibules.

The General Chemical Company, New York, has ordered 20 tank cars of 6,600 gallons capacity from the Bettendorf Axle Co. The special equipment will include Bettendorf cast-steel trucks and I-beam bolsters, Griffin wheels, Westinghouse brakes, Monarch brake-beams, Climax couplers and Camel journal bearings.

The Chicago, Rock Island & Pacific has ordered from the American Car & Foundry Co. 3,000 box cars, 250 dump cars, about 1,000 stock cars, 10 cabooses, 22 coaches, six combination mail and baggage cars, six combination baggage and passenger cars, seven baggage cars, and five buffet and five postal cars. It is also reported that this company will shortly order two dining cars.

The Intercolonial, as reported in our issue of December 15, has ordered 25 box cars from the Rathbun Co. These cars will have a capacity of 60,000 lbs. and will weigh 34,800 lbs. They will measure 36 ft. long x 8 ft. 6 in. wide x 8 ft. high inside. The bodies and underframes will be of wood. The special equipment will include: Simplex bolsters and brake-beams, Christie brake-shoes, Westinghouse air-brakes, Dunham door fittings, Chicago doors, Miner tandem draft rigging, Harrison dust guards, Chicago roofs and Simplex trucks.

The Denver, Northwestern & Pacific, as reported in a previous issue, has ordered two combination cars and six passenger coaches from the Pullman Co. The combination cars will have a capacity for seating 20 persons and the coaches for 70. The cars will measure 60 ft. long over sills, 9 ft. 8 in. wide and 6 ft. 10 in. high. The special equipment will include: Pullman axles, double cast-steel bolsters, Diamond special brake-beams, Streeter steel-back brake-shoes, Westinghouse brakes, Magnus Metal Co.'s brasses, National couplers, Westinghouse draft rigging, Martin steam heating system, Pintsch light, Pullman springs and Paige wheels.

The Tacoma Eastern, as reported in our issue of December 15, is building at its own shops 50 flat cars and one observation car. The flat cars will have a capacity of 80,000 lbs., and will weigh 27,500 lbs. They will measure 41 ft. long x 8 ft. 6 in. wide inside. The bodies and underframes will be of wood. The special equipment will include: American cast-steel bolsters, Sterlingworth brake-beams, Westinghouse brakes, Tower couplers, twin spring draft rigging, American steel trucks and Griffin wheels. The observation car will weigh 68,000 lbs., and will measure 65 ft. long x 10 ft. wide x 14 ft. high, all inside dimensions. The special equipment will include: Sterlingworth brake-beams, Westinghouse brakes, Tower couplers, Forsyth curtain fixtures, Pantasote curtain material, Adams & Westlake door fastenings, Monitor roofs, six-wheel trucks and Griffin wheels.

The Mobile & Ohio, as reported in our issue of December 1, has ordered 900 box cars of 60,000 lbs. capacity, 2,000 gondolas of 80,000 lbs. capacity, and 100 furniture cars from the American Car & Foundry Co. All of these cars are to be delivered within 60 days. The box cars will weigh approximately 3,400 lbs., and measure 36 ft. long x 8 ft. 6 in. wide x 8 ft. high; inside measurements. The gondolas will weigh 3,400 lbs., and measure 37 ft. 1½ in. long x 9 ft. 8 in. wide x 3 ft. 9 in. high, all inside measurements. The furniture cars will be 45 ft. 2½ in. long, 8 ft. 6 in. wide and 9 ft. high, all inside measurements. The special equipment includes: Scully-Gallagher bolsters, Damascus brake-beams, Westinghouse air-brakes, Jones doors for box and furniture cars, Miner draft rigging, Patterson-Sargent paint, Chicago roofs for box and furniture cars, Pittsburg Spring & Steel Co.'s springs and arch-bar trucks.

BRIDGE BUILDING.

Edmonton, Alberta.—An official writes that the Department of Public Works of the Province of Alberta will build a bridge over Bow marsh and the Bow river, opposite Calgary. Contracts for the superstructure have been let to the Canadian Bridge Co., of Walker-

ville, Ont. It will be a combined highway and street car bridge 540 ft. long and cost about $50,000.

MOBILE, ALA.—Bills were introduced in the United States Senate Dec. 14 and in the House of Representatives Dec. 15, authorizing the Mobile Railway & Dock Company to build and maintain a bridge or viaduct across the water between the end of Cedar Point and Dauphin Island.

NOME, ALASKA.—On Dec. 19 a bill was introduced in the U. S. Senate authorizing a free bridge across the Snake river at Nome, Alaska.

PENNSYLVANIA.—A bill was introduced in the House of Representatives Dec. 19 authorizing the Fayette Bridge Company to build a bridge across the Monongahela river from a point in the Borough of Brownsville, Fayette County, to a point in the Borough of West Brownsville, Washington County, Pennsylvania.

ST. PAUL, MINN.—A bill has been introduced in the House of Representatives authorizing a bridge across the Mississippi river between the military reservation at Fort Snelling and St. Paul, Minn.

TEXAS.—In the U. S. Senate on Dec. 18 a bill was introduced authorizing the Jasper & Eastern Ry. Co. to build and operate a railroad bridge across the Sabine river in the states of Louisiana and Texas.

WENATCHEE, WASH.—A steel bridge will be built over the Columbia river at this place. Work is to be commenced as soon as material can be delivered. The Wenatchee Development Co. and the Wenatchee Canal Co. will furnish $100,000, and the citizens of Wenatchee the remaining $20,000. The bridge will carry an inverted syphon connected with the present pipe line and ditch system. Water will be furnished for the irrigation of 20,000 acres of land on the east side of the Columbia.

YANKTON, S. DAK.—On Dec. 19 the U. S. Senate passed a bill extending the time for commencing construction of a bridge across the Missouri river by the Yankton, Norfolk & Southern Ry. Co., to March 9, 1907.

Other Structures.

ANNAPOLIS, MD.—Bids were opened at the Navy Department, Washington, D. C., last week for the construction of the foundation for the first building for the experiment station at the Naval Academy for the use of the Bureau of Steam Engineering. Two bids were received, one from the Noel Construction Company, of Baltimore, Md., at $76,000, and one from the Latta & Terry Construction Company, of Camden, N. J., at $68,990.

INDIANAPOLIS, IND.—The board of directors of the Cleveland, Cincinnati, Chicago & St. Louis, it is said, has authorized the building of extensive shops here.

MCKEESPORT, PA.—The Pittsburg & Lake Erie has started work on a large roundhouse to cost, with other improvements, about $200,000.

SAN FRANCISCO, CAL.—The Ocean Shore Railroad is planning to put up a large steel frame and brick building on Mission street between Eleventh and Twelfth streets, the lower floor of which will be used as the main passenger terminal of its new electric line running to Santa Cruz, a distance of 83 miles.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BEAUFORT & WESTERN.—An officer writes that this company has given a contract to the General Contracting & Engineering Co., 15 Whitehall street, New York, for building its proposed line from Morehead City, N. C., east to Beaufort, a distance of three miles.

BRANDON, SASKATCHEWAN & HUDSON BAY.—An officer writes that this company, which was recently incorporated, was granted a charter to build a railroad from the international boundary to Brandon and that it let a contract in September for building the entire line. The road has now been completed for several miles. When completed, the line will connect with the Great Northern at St. Johns, N. B. The offices of the company are at Brandon, Man., and the directors include: K. Campbell, A. S. Frazer, Charles Whited and others, of Brandon.

CHESTERFIELD & LANCASTER.—An officer writes that a contract has been given by this company to O. H. Page & Son, of Cheraw, S. C., for building its road from Ruby, S. C., west to Lynches river, a distance of 18 miles.

CINCINNATI, BLUFFTON & CHICAGO.—An officer writes that this company is planning to build extensions from Huntington, Ind., northeast to Bluffton, and from Portland southeast to Union City. The aggregate length of the lines will be 45 miles. (See Construction Record.)

DELAWARE, LACKAWANNA & WESTERN.—This company, it is said, will build a cut-off across Warren County, N. J., 25 miles long. The proposed line will start at Washington and run to the Water Gap. Such a line will be shorter than the main line, and eliminate a number of curves.

DES MOINES & MISSOURI.—This company, which is being financed by George Fernald & Co., bankers, of Boston, has secured rights of way for its proposed line from Des Moines, Iowa, south to Seymour, a distance of 80 miles. The proposed road will run through part of Warren County, the west half of Marion County, and through Lucas and Wayne Counties to Seymour, where connection will be made with the Chicago & Kansas City division of the Chicago, Milwaukee & St. Paul. The road will penetrate large coal fields, part of which are under option to George G. Wright, Clark M. Garver and others, of Des Moines.

DULUTH, SOUTH SHORE & ATLANTIC.—According to reports, this company's line will be extended from the head of Lake Superior west to Thief River Falls, a distance of 200 miles, where connection is to be made with the new line of the Minneapolis, St. Paul & Sault Ste. Marie from Thief River Falls, to Kenmare, N. Dak. The proposed line will run through rich agricultural territory, and will parallel the Great Northern for part of the distance.

GAINESVILLE MIDLAND.—An officer writes that this company has given a contract to the Gwathmey & Mackall Engineering Co., of Norfolk, Va., for building an extension from Jefferson, Ga., southwest to Athens, a distance of 18 miles. The company is also, with its own forces, changing the present line from Gainesville to Jefferson, a distance of 23 miles, from narrow to standard gage. (October 27, p. 134.)

KANSAS, OKLAHOMA, TEXAS & GULF.—An officer writes that this company, which was incorporated last year, has done nothing towards building its proposed line. Surveys are being made and rights of way are being secured. Construction work is to be commenced at Granite, Okla. T., in February, 1906, and will be continued for 35 miles west to the Eggleston Industrial Company's works. The company will build a spur about three miles long at Granite, and expects to have the work completed in six months. Thomas L. Eggleston, of Granite, Okla. T., is President. (See Construction Record.)

KETTLE VALLEY.—Surveys are being made by this company to build a line from Bannock City, 12 miles from Grand Forks, B. C., to Franklin Camp, a distance of 40 miles.

KINGSTON & PEMBROKE.—This company, an officer writes, proposes to build a line from Sharbot Lake, Ont., northeast to Carleton Junction, on the Canadian Pacific, a distance of 40 miles. (See Construction Record.)

LOUISVILLE & NORTHERN RAILWAY & LIGHT.—This company, which has a capital of $5,000,000, it is said, has begun the work of building a system of electric lines in southern Indiana to connect with Louisville or with the line of the Louisville & Southern Indiana Traction. The first section to be built will be from Jeffersonville to Sellersburg, a distance of 12 miles, and this will be followed by lines to Corydon, French Lick, West Baden and other lines in the southern portion of the state. The incorporators are officials of the Chicago company which bought the public utilities of New Albany and Jeffersonville.

MIDLAND OF MANITOBA.—An officer writes that this company, which was granted a provincial charter to build a railroad from Portage la Prairie southwest to the United States boundary line, will probably build its line through Gretna, Man. Contracts for building several miles near Portage la Prairie have been let and grading is under way on this section. The offices of the company are at Portage la Prairie, and the directors include: James Fisher, of Winnipeg; Edward Brown and Charles Anderson, of Portage la Prairie.

MOREHEAD & NORTH FORK.—An officer writes that this company, which was recently incorporated in New Jersey, is to build a railroad from Morehead, Ky., west to north fork of Licking river, a distance of about 14 miles. Contracts have not yet been let. The work includes the boring of one tunnel. E. W. Hass, of Clearfield, Pa., is Chief Engineer. (December 1, p. 176.)

NICOLA, KAMLOOPS & SIMILKAMEEN COAL & RAILWAY.—An officer writes that work was commenced last June on this proposed road from Spence's Bridge, B. C., on the Canadian Pacific southeast for a distance of 40 miles to the coal mines, and that 75 per cent. of the grading is completed. Track laying has been commenced. The work on the first 15 miles was very heavy, being along the face of a steep rocky bluff. On the remainder of the road, 25 miles, the work is light. The maximum grade is 1 per cent. The line rises continuously from Spence's Bridge to its terminal at the coal mines, where the elevation is about 1,200 ft. The maximum curvature is 12 degrees. There will be nine Howe truss bridges on masonry abutments and one tunnel about 400 ft. long. Loss, MacDonnell &

Co. are the contractors. A. J. Cambie, of Spence's Bridge, is Chief Engineer.

North Coast.—This company, it is said, has completed surveys for its proposed road, which is to run from Seattle, Wash., to Wallula. The survey follows the Cowlitz Valley southeast of Tacoma and runs up the valley through Cowlitz Pass and along the Teiton river to North Yakima. From that point it has not yet been determined which survey will be adopted.

Northern Electric Company.—To the 26 miles of standard gage road in course of construction by this company, from Chico to Oroville, Cal., will be added lines from Marysville to Meridian, and from Yuba City to Live Oak. The street railway line at Marysville has been bought, and will be rebuilt at once as an electric road. The new articles of incorporation filed by the Northern Electric, give Reno, Nev., as the principal place of business. The capital stock has been increased from $3,000,000 to $6,000,000. Henry A. Butters is president of the company and F. A. Ross superintendent.

Seattle & Eastern.—Articles of incorporation have been filed by a company under this name in Washington, with a capital of $4,000,000, to operate railroads in any state and in any county in the state of Washington. W. H. Goldson, E. C. Gill and M. E. Heavey, of Seattle, and John McQuaid, of Issaquash, are incorporators.

Southern Pacific.—Surveys, it is said, are being made by this company for its proposed extension from Arnaudville north to Port Barrie, 12 miles, and from Lafayette northeast to Baton Rouge, 52 miles, all in Louisiana. The Baton Rouge extension crosses the Atchafalaya at a swampy point, and a large number of trestles will have to be built.

Worcester & Providence (Electric).—This company, which has been incorporated in Rhode Island to build a street railroad through North Providence, Smithfield, North Smithfield and Burrillville, will file a map showing the location of its proposed road the first of next year. The officers are: F. C. Hinds, of Boston, President; F. W. Tillinghast, Providence, Vice-President; Charles H. Wilson, Boston, Secretary and Treasurer.

Youngstown & Ohio River.—Incorporation has been granted a company under this name in Ohio, with a capital of $10,000 to build a railroad connecting Youngstown with the Ohio river. The southern terminus will be at East Liverpool, and a branch is to be built to Salem. G. W. Hill, M. P. Goodman, C. H. Holland and others are incorporators. The office of the company will be at Leetonia, Ohio.

RAILROAD CORPORATION NEWS.

Alaska Central.—This company has filed a mortgage to the Western Trust & Savings Bank, of Chicago, trustee, securing an issue of $30,000,000 5 per cent. bonds, part of the issue to be used for refunding.

Atchison, Topeka & Santa Fe.—This company has bought for a sum said to be $17,312,400 the Southern California, which owns 478 miles of road. The Atchison already owned all the common stock and nearly all of the preferred.

Aurora, Elgin & Chicago (Electric).—It is reported that this company will be consolidated with the Elgin, Aurora & Southern Traction, which is controlled by the same interests. The A., E. & C. operates 57 miles of road between Chicago, Elgin and Aurora, and has $3,000,000 common stock, $1,500,000 6 per cent. cumulative preferred stock, and $3,000,000 first mortgage 5 per cent. bonds of 1941 outstanding. The E., A. & S. T. operates 72 miles of road between Carpentersville, Ill., Elgin, Aurora, Bristol and other towns, and has $2,000,000 stock and $2,000,000 bonds outstanding. It is said that the capital stock of the new company will consist of $3,000,000 common and $3,000,000 preferred stock, and also that the preferred stock of the A., E. & C. will receive a stock bonus of 20 per cent. and have its 18 per cent. of back dividends paid.

Chicago & North-Western.—This company has bought from the Chicago Railway Terminal Elevator Co. the Galena elevator, in Chicago, having a capacity of 700,000 bushels, for $398,000.

Chicago, Milwaukee & St. Paul of Montana.—This company has been organized in Montana with $2,000,000 capital stock as a subsidiary of the Chicago, Milwaukee & St. Paul.

Cincinnati, Hamilton & Dayton.—The receiver has announced that he will ask authority from the court to pay the interest on the following bonds, borrowing what money may be necessary: C., H. & D. second mortgage gold bonds of January 1, 1887; C., H. & D. refunding mortgage bonds of July 1, 1904; Dayton & Michigan Consolidated mortgage bonds of January 1, 1881; Indiana, Decatur & Western first mortgage bonds of November 1, 1895; Cincinnati, Ind. & W. refunding mortgage bonds of December 1, 1902; Pere Marquette collateral trust indenture bonds of January 1, 1903; Pere Marquette Consolidated mortgage bonds of January 2, 1901; Pere Marquette refunding mortgage bonds of January 2, 1905; Flint & Pere Marquette (Toledo Div.) first mortgage bonds of July 1, 1897; Grand Rapids, Kalamazoo & Southeastern Railroad first mortgage bonds of October 1, 1897.

The Board of Directors has taken action toward the annulment of the C., H. & D.'s lease of the Pere Marquette.

Duluth, Virginia & Rainy Lake.—This company has changed its name to the Duluth, Rainy Lake & Winnipeg.

Detroit, Toledo & Ironton.—The report for the year ending June 30th, representing two months' operation by this company and the preceding ten months' operation of the road under the old name of Detroit Southern, shows gross earnings of $1,468,299, a decrease of $20,639; and net earnings of $153,695, a decrease of $46,154. The gross earnings for the four months ending October 31st were $1,319,153 and net earnings $428,733. The approximate gross earnings for November were $377,000. During these five months the company has not taken advantage of its trackage agreement with the C., H. & D., by which it secured an entrance into Toledo.

Interborough Rapid Transit.—This company, controlling all the elevated and subway lines of Manhattan, is, according to a plan under consideration, to be consolidated with the Metropolitan Street (surface) Railway and the Metropolitan Securities Company. The $35,000,000 capital stock outstanding of the Interborough Rapid Transit is to be exchanged one share for two, for 4½ per cent. collateral stock of a new holding company. The $52,000,000 common stock outstanding of the Metropolitan Street Railway will be exchanged for 100 per cent. 5 per cent. cumulative preferred stock and 50 per cent common stock of the new holding company. The $30,000,000 capital stock of the Metropolitan Securities Company, which has been paid up only to the extent of $50 per share, will be exchanged for 85 per cent. common stock of the new holding company after $25 per share additional has been paid in. A syndicate has been formed to underwrite the entire issue of common stock of the new company, but it has not yet been determined at what price this is to be underwritten. The syndicate, it is said, will include Kuhn, Loeb & Co., August Belmont & Co., J. P. Morgan & Co., and others. The capital stock of the new company will, according to the above terms, consist of $52,000,000 preferred and $83,000,000 common. It is said that $17,000,000 more additional common stock will be authorized. There will be $70,000,000 4½ per cent. collateral trust bonds.

Kansas City Southern.—The directors of this company have voted to issue $5,100,000 5 per cent. six-year notes to be offered 95, to common and preferred stockholders to the extent of per cent. of their holdings; and a meeting of the stockholders has been called for February 1 to authorize the issue. As the notes should sell at par, the "rights" of stockholders are worth about 50 cents a share.

Metropolitan Street Railway.—See Interborough Rapid Transit

New York, Ontario & Western.—This company has purchased through the Scranton Coal Co. the coal property of the Black Diamond Co. at Simpson, Pa. These coal deposits are estimated at about 1,000,000 tons.

North Coast.—This company, which was incorporated last September to build an electric or steam road into the Yakima Valley, Wash., has filed amended articles of incorporation increasing its capital stock from $1,000,000 to $25,000,000. A director is quoted as saying that a $25,000,000 bond issue has been arranged for. He refuses to tell with what larger system this company is affiliated, but the Northern Pacific has been mentioned in this connection.

Rutland.—A dividend of 1½ per cent. on the $9,057,600 preferred stock has been declared. This is the first dividend on this stock declared since 1903, when 1 per cent. was paid. In 1892 to 1902 the dividend varied from 1 per cent. to 4 per cent. The surplus available for dividends on this stock in 1904 amounted to 1.6 per cent., and this year was about 1.7 per cent.

Seaboard Air Line.—The Ruhstrat committee, which was formed to protect the interests of the minority stockholders soon after the promulgation of the Ryan-Blair plan for reorganization, has sold the shares of preferred and common stock pooled with it for about $68,000 to Middendorf, Williams & Co., of Baltimore, and John L. Williams & Sons, of Richmond. The price paid were $55 per share of preferred and $35 per share of common, amounting in all to about $2,600,000.

Southern.—This company has leased the Transylvania, which runs 42 miles of road from Hendersonville, N. C., to Lake Toxaway.

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